

Roman Bank, Spalding

Flood Risk and Drainage Impact Assessment

Extra Care Accommodation

For Sea Island Developments (Spalding) Ltd

Date: *8 December 2022*

Doc ref: *P22-311-ZZ-XX-HYD-RP-C-9000*

DOCUMENT CONTROL SHEET

Issued by	Hydrock 3E Limited 2 Esh Plaza, Sir Bobby Robson Way, Great Park, Newcastle Upon Tyne, NE13 9BA	Office contact Tel: +44 (0)191 230 2993
Client	Sea Island Developments (Spalding) Ltd	
Project name	Roman Bank, Spalding	
Title	Flood Risk and Drainage Impact Assessment	
Doc ref	P22-311-ZZ-XX-HYD-RP-C-9000	
Project no.	P22-311	
Status	S2	
Date	08/12/2022	

Document Production Record		
Issue Number	P01	Name
Prepared by		Gary Spence
Checked by		Andy Wallace
Approved by		Martin Pearse

Document Revision Record			
Issue Number	Status	Date	Revision Details
P01	S2	08/12/2022	First Issue – For Comment

Hydrock 3E Limited has prepared this report in accordance with the instructions of the above named client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

CONTENTS

1. INTRODUCTION 1
2. SITE DESCRIPTION 2
2.1 Location 2
2.2 Topography 2
2.3 Ground Conditions 2
2.4 Proposed Development 2
3. EXISTING WATERCOURSE AND DRAINAGE 3
3.1 Existing Watercourses 3
3.2 Existing Positive Drainage Networks 3
4. FLOOD ZONE AND RISK TO THE PROPOSED DEVELOPMENT 4
4.1 Fluvial and Sea Flooding 4
4.2 Flood Map for Planning 4
4.3 Historic Flooding 5
4.4 Surface Water Flooding 6
4.5 Flooding from Artificial sources 7
4.6 Ground water flooding 7
4.7 Sewer Flooding 7
5. SURFACE WATER AND FOUL DRAINAGE 8
5.1 Existing Surface Water 8
5.2 Proposed Surface Water 8
5.3 Surface Water Discharge Rate 8
5.4 Surface Water Treatment 9
5.5 Surface Water Attenuation 10
5.6 Surface Water Maintenance 10
5.7 Surface Water Exceedance Flows 10
5.8 Foul Water Drainage 11
6. CONCLUSIONS AND RECOMMENDATIONS 12

Appendices

Appendix A Site Location Plan

Appendix B Proposed Development Layout

Appendix C Anglian Water Sewer Records

Appendix D Environment Agency Correspondence

Appendix E Proposed Levels Plan

Appendix F Proposed Drainage Layouts

Appendix G Proposed Drainage Calcs

Appendix H Proposed Drainage Maintenance Plan

Appendix I Proposed Flood Depth Plan

1. INTRODUCTION

1.1 This report has been commissioned by Sea Island Developments to examine the flood risk and drainage issues associated with the proposed construction for extra care accommodation at Roman Bank, Spalding.

1.2 The objective of this assessment is to identify any potential risk of flooding to the proposed development and any risk to the adjacent properties as a result of development. This will be undertaken in accordance with the requirements of the National Planning Policy Framework (NPPF) and its associated Technical Guidance. It will also assess the surface and foul water drainage proposals to ensure the development does not increase the risk of flooding elsewhere.

1.3 This report is based on the following information;

- Environment Agency (EA) online flood maps
- The South East Lincolnshire Council Strategic flood risk assessment (SFRA)
- Phase I Geo-environmental Assessment undertaken by Hydrock 3E
- Anglian Water Sewer Records

1.4 This report presents the factual information available during the time of appraisal, interpretation of the data obtained and recommendations relevant to the scope of works. It has been assumed in the production of this report that the site is to be developed for extra care accommodation.

1.5 This report has been prepared for the sole use of Sea Island Developments and their appointed design team. No other third party may rely upon or reproduce the contents of this report without the written approval of Hydrock 3e. If any unauthorised third party comes into the possession of this report, they rely on it entirely at their own risk and Hydrock 3e do not owe them any Duty of Care or Skill.

2. SITE DESCRIPTION

2.1 Location

The site, centred on National Grid Reference 525731, 323810 is located around 21km to the south west of Boston city centre and around 35km south east of Grantham. The site is approximately 0.43 Hectares (Ha) in size and is currently a heavily vegetated green field.

The proposed site location plan is included in Appendix A.

2.2 Topography

A topographical survey has not been carried out at this time and levels have been assessed using information readily available online.

The western boundary of the site has an embankment running its entire length, the top of the embankment situated on the boundary sits at around 5.400mAOD with a highest level of 5.700mAOD located in the south west corner with the ground falling into the site down to levels as low as 3.400mAOD towards the north west corner of the site.

Beyond the embankment to western boundary the is the River Welland, the level of the watercourse are yet to be surveyed and it is estimate that the base of the watercourse will be around 3.00mAOD.

The adjacent public road, Roman Bank, runs along the length of the eastern boundary with levels falling from south to north ranging between 4.40mAOD and 4.00mAOD. Levels from the road then fall into the site.

A proposed levels plan, showing the existing boundary levels is contained within Appendix E.

2.3 Ground Conditions

A Phase I Geo-environmental Assessment has been undertaken by Hydrock 3E which notes that from published geological plans made ground is not recorded below the site. However, given the construction and demolition of a series of developments have occurred on the site historically, it is considered some made ground will likely be present associated with this.

Geological plans record the site as being underlain by Tidal Flat Deposits. From nearby historical BGS borehole records, superficial deposits comprising medium dense silty sand, with occasional shallow clay bands are noted in the general area to a depth of at least 10m.

2.4 Proposed Development

The proposed development layouts are shown in Appendix B. The drawing shows the proposal to construct extra care accommodation with an underground basement car park and associated hard and soft landscaping.

3. EXISTING WATERCOURSE AND DRAINAGE

3.1 Existing Watercourses

The nearest named watercourse to the site is the river Welland located directly to the west of the site running adjacent to the boundary, flowing from south to north.

The Coronation Channel merges into the river Welland 0.42km north east of the site, flowing from the south east in a north western direction before meeting the river.

A watercourse named Vernatts Drain is situated 0.62km North west of the site, flowing from south west to north east for around 7km where it eventually merges into the River Welland near the Surfleet Sluice, adjacent to the point where the river Glen also meets the river Welland.

The Fulney Lock is located around 300m north east of the site where the River meets the Coronation Channel.



Figure 1 : Existing Water Course Map

3.2 Existing Positive Drainage Networks

A copy of the Anglian Water public sewer map has been obtained and is provided within Appendix C.

The records show a 150mm foul sewer is located within the southern section of the site to provide an existing connection into the main public foul sewer within the road.

There are no surface water sewers within the vicinity of the site.

An unknown manhole is shown to be located within the site near the eastern boundary, this manhole is to be investigated further to confirm its current use.

4. FLOOD ZONE AND RISK TO THE PROPOSED DEVELOPMENT

The site has been assessed for flood risk based on information from online EA Flood Map for Planning and Long term Flood Risk Mapping.

All sources of flooding have been reviewed including fluvial, sea, surface water, groundwater, sewer and artificial sources.

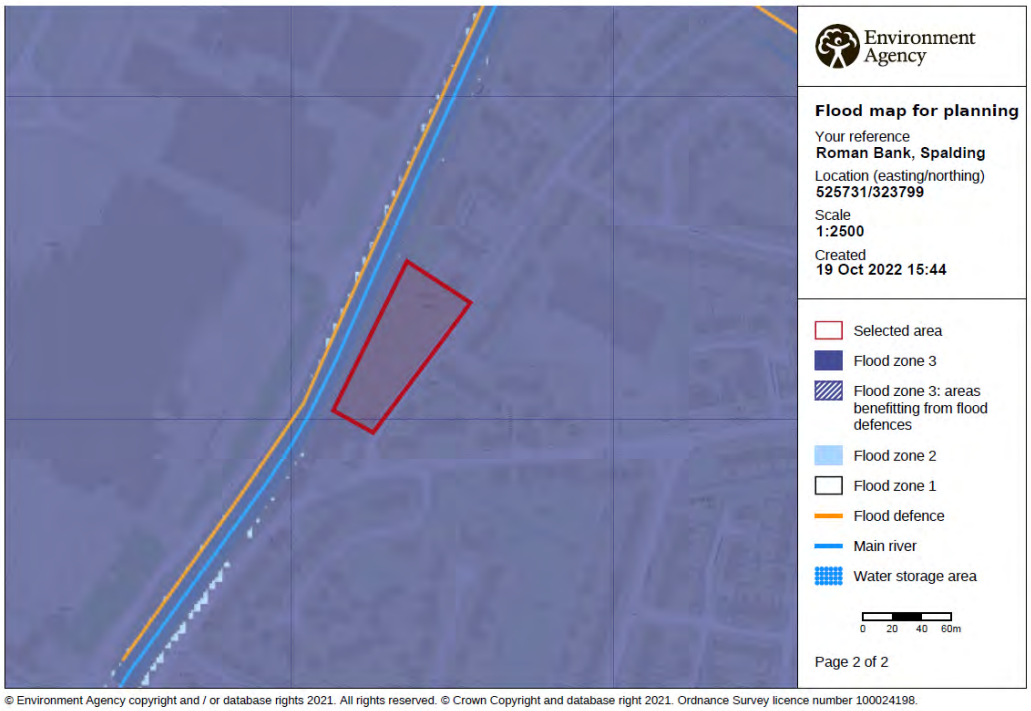
4.1 Fluvial and Sea Flooding

The EA Flood Zones refer to the probability of river and sea flooding. The mapping does not take account of the possible impacts of climate change, or the presence of flood defences. Flood Zone definitions are set out in the National Planning Policy Framework (NPPF) as the following:

- Flood Zone 1: Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- Flood Zone 2: Land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
- Flood Zone 3: Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

4.2 Flood Map for Planning

The EA Flood Map for Planning shows the site to be wholly located within Flood Zone 3. The site is therefore considered to be at high probability of river flooding based on the EA online flood maps. An extract of the flood map can be found below.



© Environment Agency copyright and / or database rights 2021. All rights reserved. © Crown Copyright and database right 2021. Ordnance Survey licence number 100024198.

The Environment Agency have been contacted to provide their flood risk assessment data for the site and this can be found in Appendix D.

Modelled flood levels for the River Welland have been obtained from the EA which show the worst case river flood level in the area of the site to be 4.68mAOD during the 1in100yr+20%CC Storm event.

The EA data does not provide a value for the 1in100yr+40%CC storm event, however it does provide a value for the 1in1000yr+20%CC storm event which is also recorded as 4.68mAOD.

It is therefore considered that we can assume the flood level of the 1in100yr+40%CC is also 4.68mAOD.

The western boundary of the site, adjacent to the River Welland, currently sits at a lowest level of around 5.270mAOD and it is therefore expected that the river embankment adjacent to the site would not be breached by the river flooding.

From the current online 'Guidance for Flood Risk and Coastal Change' and in reference to the 'Flood Zone and flood risk tables' the proposed development is noted to be located in flood zone 3a ' High probability' from Table 1. From the Flood risk vulnerability classification in Table 2 the site is classified as a 'More vulnerable, development.

The Flood risk vulnerability and flood zone compatibility Table 3 shows that the proposed development will require an exception test to be undertaken. This will need to be satisfied to enable development within this flood zone. This assessment is to be undertaken by others and is not considered further in this report.

The EA have stated that the tidal limit of the River Welland is located 270m north east of the site, at the Fulney Lock. A copy of the response can be found in Appendix D.

However, the South Holland Council SFRA contains details of potential flood depths for the entire Spalding area during an extreme tidal event from the Coronation Channel. The extent of which includes the proposed site boundary and indicates that the site would be subject to flood depths of between 1-2m.

A proposed flood depth plan has been provided in Appendix I which is based on a maximum flood level of 5.35mAOD, this has been set by taking the maximum 2m depth from the SFRA information and adding this to the lowest existing ground level of 3.35mAOD.

The plan demonstrates that the ground floor level has been set at 5.35mAOD and will therefore provide a safe haven for residents should flood depths reach the maximum 2m depth. Residents would reside here until the flood water drained and a safe evacuation route was available.

4.3 Historic Flooding

The EA response within Appendix D has stated that they have no records of historic flooding of the site, however they are in the process of investigating a potential flood that has occurred. This means their response may be subject to change following the conclusion of the ongoing investigation.

4.4 Surface Water Flooding

Surface water flooding occurs when the amount of rainfall exceeds the drainage or infiltration capacity of the surface it falls upon. Surface water runoff can coalesce into surface water flow pathways, especially in urban areas where there is a large proportion of impermeable ground surface due to development, as it flows towards a drainage system or watercourse. Surface water can also pond within areas with inadequate drainage.

The Environment Agency has worked together with Lead Local Flood Authorities who deal with surface water flooding to produce Updated Flood Map for Surface Water mapping which places areas at risk of flooding from surface water into the following categories:

- High risk: The area has a chance of flooding of greater than 1 in 30 (3.3%) each year.
- Medium risk: The area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%) each year.
- Low risk: The area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%) each year.
- Very low risk: The area has a chance of flooding of less than 1 in 1000 (0.1%) each year.

An extract of the Flood Map for Surface Water mapping is shown within Figure 2.

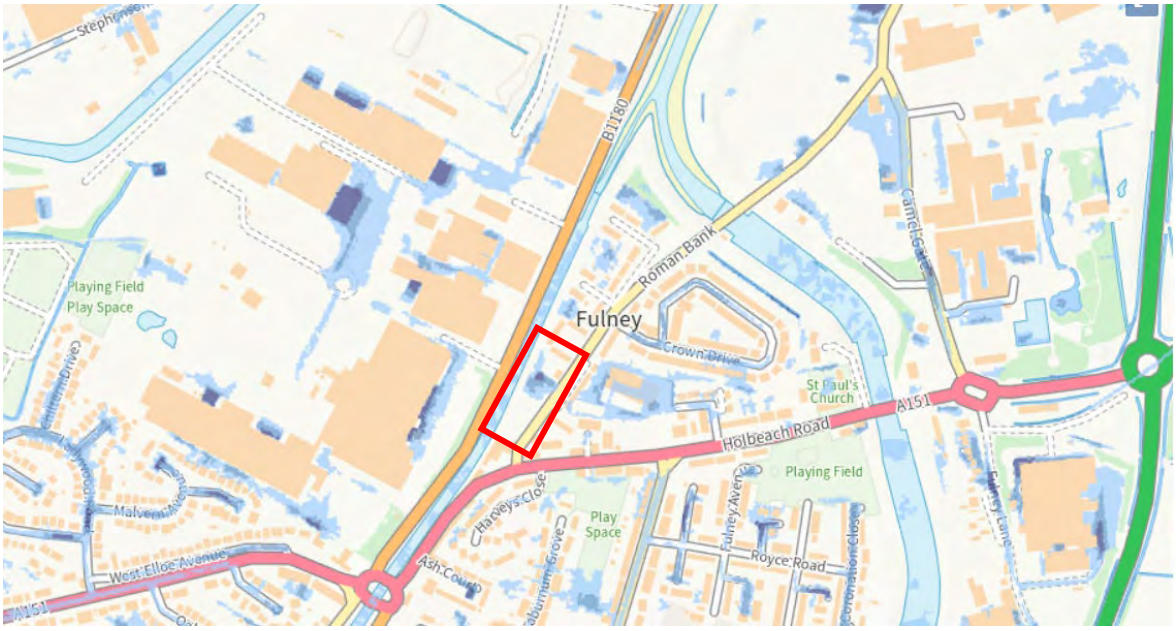


Figure 2 : Extract of the Environment Agency Surface water Flood Map

The flood map shows that the north section of the site is subject to medium-high risk of surface water flooding. This is expected due to the existing low -lying areas with an absence of surface water drainage.

The proposed site will be providing impermeable surfaces within this area that will be positively drained and attenuated. It is therefore considered that the site is at low risk of surface water flooding.

4.5 Flooding from Artificial sources

The Environment Agency Long Term Flood Risk Mapping has been reviewed to determine the risk of flooding from artificial sources such as reservoirs, canals or flood defences. These maps will show any areas of potential risk of flooding due to failure of such structures.

The below extract of the EA flood maps shows that the site is adjacent to an area affected by Reservoir flooding, however this is only shown as being a risk when river flooding has also occurred and the extent does not breach the river bank.

Such failures would be a catastrophic event and flooding is extremely unlikely. All large reservoirs, canals and flood defences are regulated, inspected and supervised. The risk to the site from such failure is therefore considered to be low.

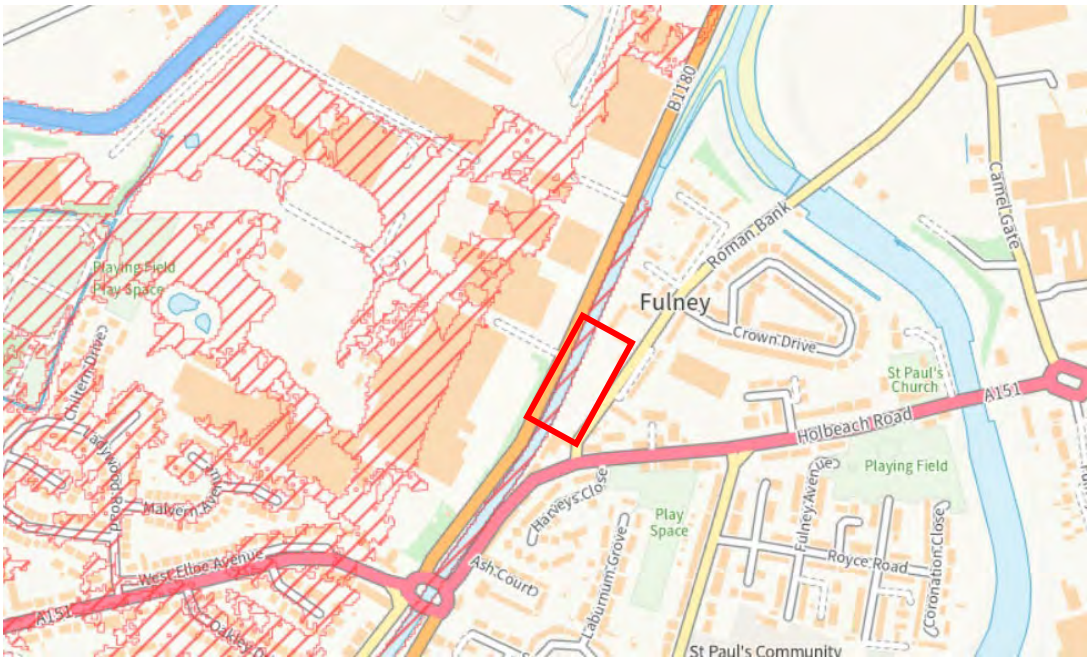


Figure 3 : Extract of the Environment Agency Resevoir Flood Map

4.6 Ground water flooding

According to a Phase I Geo-environmental Assessment undertaken by Hydrock 3E, the site is not located within an area identified by the BGS as being at risk of groundwater flooding at the surface.

4.7 Sewer Flooding

A further possible source of flooding is from the flooding of existing/proposed drainage systems and the public sewers. Sewers may be at risk of flooding during times of heavy rainfall, which can cause sewers to surcharge.

The existing public sewers are shown to be located in the public highways surrounding the site. Should flooding occur to these sewers it is considered that surface water flows would pass along the highways away from the proposed development to the south.

The new surface water drainage system within the site will be designed to ensure any flooding occurring from a storm event in excess of this up to a 1 in 100 year + 40% climate change event will be retained on site where possible.

Therefore, the site is considered to be at low risk of flooding from sewers.

5. SURFACE WATER AND FOUL DRAINAGE

5.1 Existing Surface Water

There is no existing surface water drainage present within the site. The site is currently unoccupied greenfield.

5.2 Proposed Surface Water

In line with the NPPF, the aim should be to discharge surface water run-off from the site in line with the order of priority within the surface water drainage hierarchy;

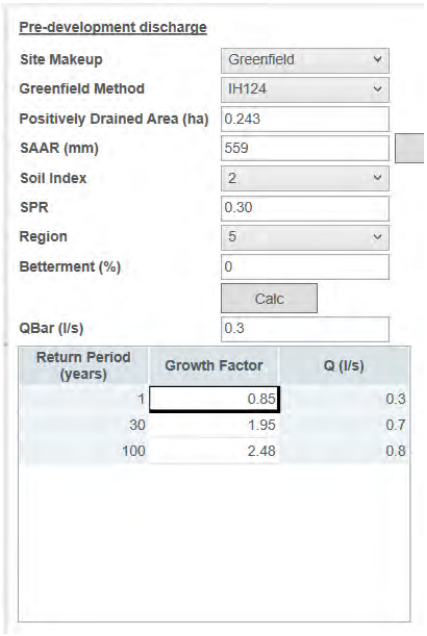
1. Into the ground (infiltration)
2. To a surface water body
3. To a surface water sewer, highway drain or another drainage system
4. A combined water sewer.

A Phase I Geo-environmental Assessment has been undertaken by Hydrock 3E which notes that based on the likely presence of a shallow continuous groundwater table below the site, it is unlikely that the use of soakaways for surface water discharge will be feasible. However, this will be assessed further following the findings of a ground investigation.

Due to the close proximity to the River Welland, only 7m off the western site boundary, it is proposed to discharge surface water flows to the river via a newly constructed headwall.

5.3 Surface Water Discharge Rate

In accordance with South Holland Council's and Defra guidance the runoff from the proposed development should be restricted to the equivalent Greenfield runoff Qbar rate. Greenfield runoff estimations have been calculated for the new development drained area of 0.243Ha which can be found below, the result shows a rate of 0.3l/s.



Given the relatively small size of the proposed drained catchment area, it is generally not practical to restrict the offsite surface water flow rate to such a low Qbar rate whilst still ensuring adequate orifice sizes are provided to reduce the risk of potential blockage.

It is therefore proposed to restrict flows to a maximum discharge rate of 5l/s.

Drainage layouts are provided within Appendix F.

5.4 Surface Water Treatment

Sustainable Urban Drainage Systems (SUDS) should also be used wherever possible to mimic as far as practicable the natural run off regime, improve water quality, reduce run-off volume and attenuate peak flows. These should be designed in accordance with the current guidance, The SUDS Manual (CIRIA C753) and should meet the required treatment indices levels in line with this guidance.

According to Table 26.2 of the SuDS Manual (C753), the proposed roof area has been rated as having a low pollution hazard with the following is a list of the pollution hazard indices:

Table 1 Extract of Table 26.2 C753

Pollution Hazard	Total Suspended Solids(TSS)	Metals	Hydrocarbons
Other Roofs - Low	0.3	0.2	0.05

Roof water will pass through filter trenches located within the communal gardens of the site and in line with Table 26.3 of the SuDS manual (C753) this will provide the following mitigation indices.

Table 2 Extract of Table 26.3 C753

Type of SuDS	Total Suspended Solids(TSS)	Metals	Hydrocarbons
Filter Trench	0.4	0.4	0.4

These indices are greater than the pollution hazard indices and therefore provide sufficient treatment from the roof area.

According to Table 26.2 of the SuDS Manual (C753), the proposed access road has been rated as having a low pollution hazard with the following is a list of the pollution hazard indices:

Table 3 Extract of Table 26.2 C753

Pollution Hazard	Total Suspended Solids(TSS)	Metals	Hydrocarbons
General Access Road	0.5	0.4	0.4

Surface water from the access road will pass through a proprietary treatment system, the ESR Stormceptor from Spel and in line with SPEL's datasheets this will provide the following mitigation indices.

Table 4 Extract of SPEL ESR Stormceptor Datasheet

Type of SuDS	Total Suspended Solids(TSS)	Metals	Hydrocarbons
ESR Stormceptor	0.8	0.6	0.9

These indices are greater than the pollution hazard indices and therefore provides sufficient treatment for the access road area.

5.5 Surface Water Attenuation

Based on a maximum discharge rate of 5l/s, a volume of 73m3 will be required within the drainage system to attenuate excess flows.

This will be provided in the form of a cellular storage tank situated within the access road to the north., as detailed on the drainage layout within Appendix F.

Calculations are provided in Appendix G which demonstrate that no flooding will occur up to the 1in100+40%CC.

5.6 Surface Water Maintenance

Insufficient maintenance of drainage structures can result in increasing the risk of flooding as run off is unable to enter the drainage system. This can result in surcharge due to blockages, or flows being directed elsewhere due to it being unable to enter the system. This also results in insufficient treatment of surface water resulting in an increased risk of pollutants entering the system.

Maintenance of all new private drainage should be undertaken in accordance with the proposed maintenance plan attached in Appendix H.

5.7 Surface Water Exceedance Flows

Storage will be provided for the 1 in 1in100+40%CC storm event with all surface water retained below ground within the drainage system, calculations are contained within Appendix G.

In the case of the extreme tidal event discussed in Section 4.2 of this report, flood waters with a depth of up to 2m may encroach the site and would affect all areas of the except for the ground floor of the proposed building. This is demonstrated by the proposed flood depth plan in Appendix I.

The building will also have a basement car park which would allow water to flow into the undercroft during an extreme tidal flood event. The basement level is proposed to be 2.05mAOD meaning it would provide additional storage to offer further mitigation to the prevent the ground floor of the building being flooded.

A Basement drainage layout can be found in Appendix E which shows that flood water would be emptied via a package pumping station use to convey flows into the proposed drainage system and eventually out to the River Welland.

5.8 Foul Water Drainage

It is proposed that foul water flows generated by the proposed development will utilise the existing connection into the public sewer within Roman Bank located within the south east of the site. Details can be found on the drainage layout within Appendix F.

6. CONCLUSIONS AND RECOMMENDATIONS

The site has been reviewed in relation to all potential sources of flooding. The proposed development will not exacerbate flooding elsewhere

It is proposed to discharge flows into the River Welland adjacent to the western boundary of the site. This is subject to the receipt of a flood risk activity permit from the EA.

Following approval of the flood risk activity permit, a separate agreement will be discussed with the EA Estates team to allow access into EA owned land to construct the new headwall.

Surface water flows will be restricted to 5l/s, flows will be restricted through the use of a package pumping station due to the level difference from the site access road to the River Welland.

Restricting flows to 5l/s will require a total attenuation volume 73m3, provided in the form of a cellular storage tank. Details can be found on the drainage layout within Appendix F.

No flooding will occur to the surface for all rainfall events up to and including the 1in100yr+40%CC. As demonstrated within the calculations in Appendix G.

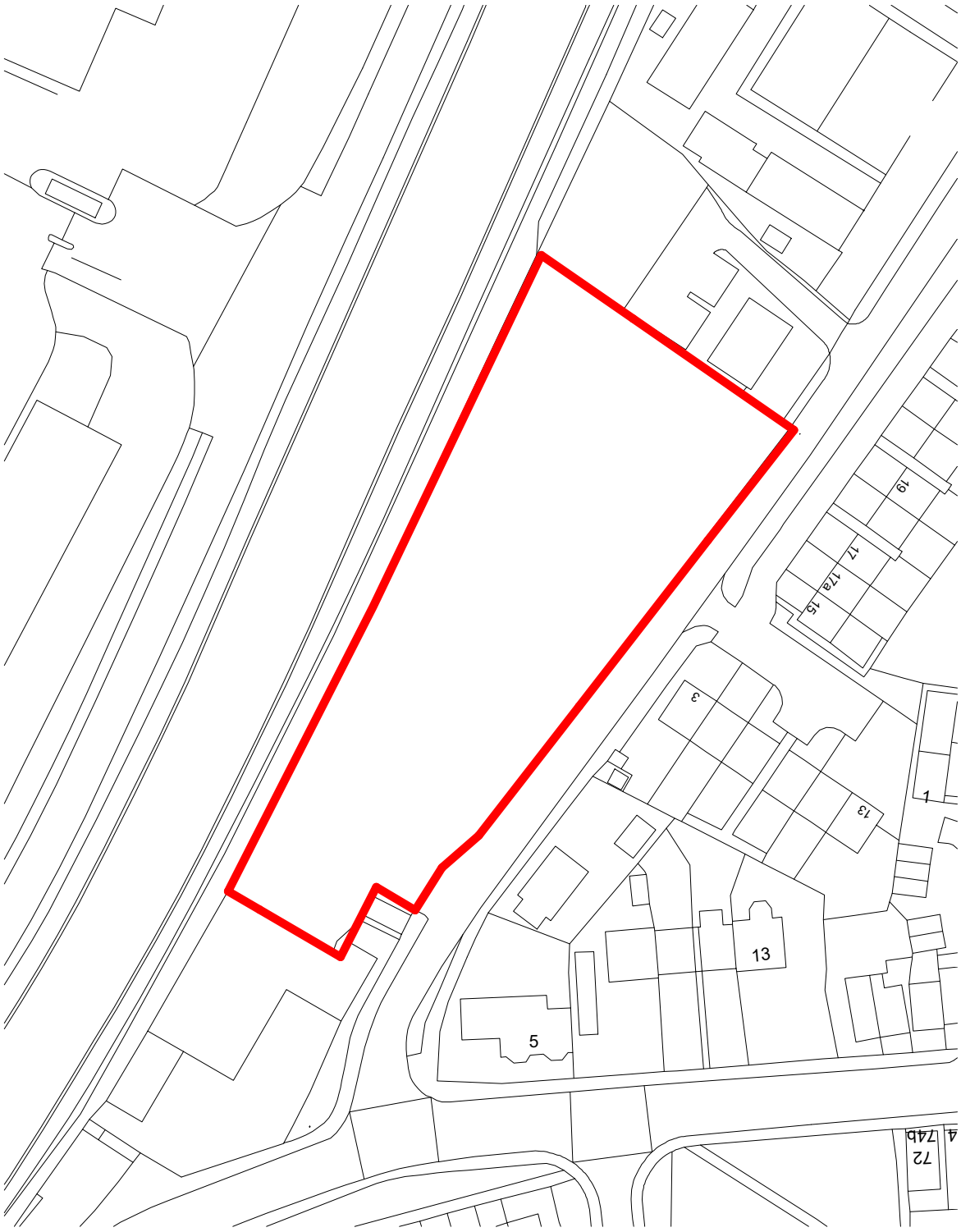
The implications of an extreme tidal event from the Coronation Channel have been described and mitigated against in the form of a raised FFL to suit the maximum flood depth and undercroft flood storage in the form of the basement car park.

Treatment of surface water flows will fully satisfy the required treatment indices as per Ciria guidance, this will be in the form of filter trenches and ESR stormceptor treatment system from SPEL.

Foul drainage will be discharged to the public sewer within Roman Bank, via an existing connection located within the south east of the site.

Appendix A Site Location Plan

NOTES:
1. DO NOT SCALE from the drawing
2. Further dimensions required to be requested from the project technical team
3. Report discrepancies to JDDK project team immediately
4. This model file contains the following consultants model files:-
a) Structural Engineer
b) Mechnical Model
c) Electrical Model
d) Subcontractor Model



Ordnance Survey, (c) Crown Copyright 2022. All rights reserved. Licence number 100022432

1 *Site Location Plan*
1 : 1000

0m 50m 100m

REV	ISSUED BY	DATE	DESCRIPTION

REVISION LOG

JDDK Architects
Millmount Ponteland Road
Newcastle upon Tyne
NE5 3AL
t. 0191 286 0811
f. 0191 286 3870
e. millmount@jddk.co.uk
jddk.co.uk
DISCOVER DESIGN DELIVER

CLIENT
Sea Island Developments

PROJECT TITLE
Roman Bank Extracare

PROJECT ADDRESS
Former Jewsons Builders Merchants Site, Roman Bank, Spalding PE11 2AL

TITLE
Site Location Plan

MAIN CONTRACTOR

QUANTITY SURVEYOR	M&E CONSULTANT
STRUCTURAL CONSULTANT	OTHER CONSULTANT

DRAWING No.	REV
4238-JDK-DR-A-1001	

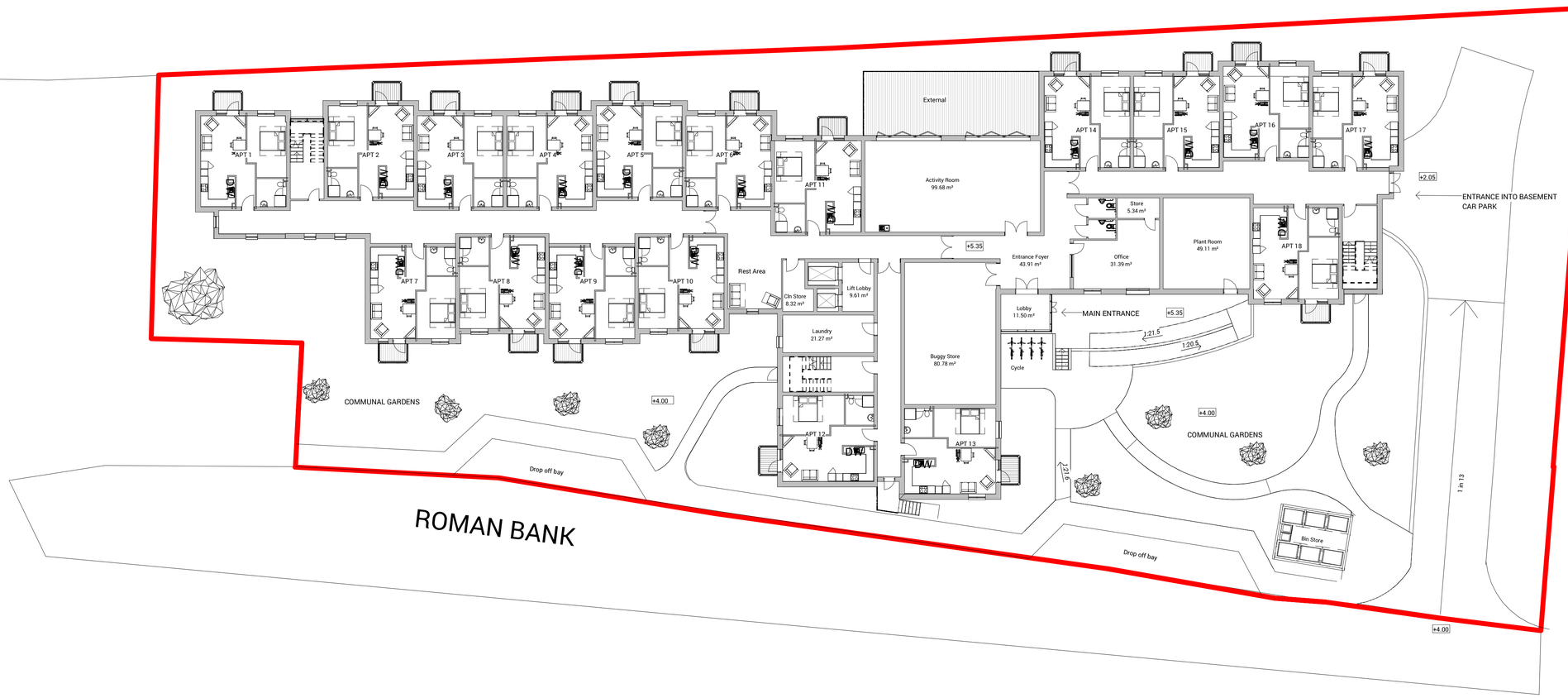
JDDK INTERNAL REF:	4238	JDDK REF NO:	10.01
SCALE:	1 : 1000 @ A3	INITIAL ISSUE:	10/04/22
DRAWN BY:	Author	CHECKED BY:	Checker
STATUS:		PURPOSE OF ISSUE:	

Appendix B Proposed Development Layouts

NOTES:

1. DO NOT SCALE from the drawing
2. Further dimensions required to be requested from the project technical team
3. Report discrepancies to JDDK project team immediately.
4. This model file contains the following consultants model files:-

   a) Structural Engineer
   b) Mechnical Model
   c) Electrical Model
   d) Subcontractor Model



1 *Proposed Site Plan*
1 : 200

0m 10m 20m

REV	ISSUED BY	DATE	DESCRIPTION
3		28/11/22	Access ramp updated. FFL updated to 5.35
2		11/10/22	Drop off layby & levels information added
1		05/10/22	Landscape revised to Glen Kemps layout

REVISION LOG

JDDK Architects
Millmount Ponteland Road
Newcastle upon Tyne
NE5 3AL
t. 0191 286 0811
f. 0191 286 3870
e. millmount@jddk.co.uk
DISCOVER DESIGN DELIVER
jddk.co.uk

CLIENT
Sea Island Developments

PROJECT TITLE
Roman Bank Extracare

PROJECT ADDRESS
Former Jewsons Builders Merchants Site, Roman Bank, Spalding PE11 2AL

TITLE
Proposed Site Plan

MAIN CONTRACTOR

QUANTITY SURVEYOR | **M&E CONSULTANT**

STRUCTURAL CONSULTANT | **OTHER CONSULTANT**

DRAWING No. 4238-JDK-DR-A-1003 | **REV** 3

JDDK REF:	4238	**JDDK REF NO:**	10.03
SCALE:	1 : 200 @ A1	**INITIAL ISSUE:**	10/04/22
DRAWN BY:	Author	**CHECKED BY:**	Checker

STATUS: | **PURPOSE OF ISSUE:**

Appendix C Anglian Water Sewer Records

Pre-Planning Assessment Report

Roman Bank, Spalding

InFlow Reference: PPE-0156121

Assessment Type: Water & Used Water

Report published: 26/10/2022

Thank you for submitting a pre-planning enquiry.

This has been produced for 3E Consulting Engineers Ltd.

Your reference number is **PPE-0156121**.

This report can be submitted as a drainage strategy for the development should it seek planning permission.

If you have any questions upon receipt of this report, you can submit a further question via InFlow. Alternatively, please contact the Planning & Capacity team on **07929 786 955** or email planningliaison@anglianwater.co.uk

---

Section 1 - Proposed development

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	**No. Of units**
Residential institution	69

The anticipated residential build rate is:

Year	Y1
Build rate	69

Development type: Greenfield

Planning application status: Unknown

Site grid reference number: TF2572923813

The comments contained within this report relate to the public water mains and sewers indicated on our records.

Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2 - Assets affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below.

Please be aware that the existing water mains/public sewers should belocated in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used water easement information		
Asset type	Pipe size (mm)	Total easement required (m)
Water mains	80	4.50 m overall easement
Sewer mains	150	3.00 m either side of the centre line
Sewer mains	250	3.00 m either side of the centre line

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3 - Water supply

In examining the available capacity for your development site we assess the capacity and costs for two categories of water main. These are:

Strategic

These are the offsite potable water mains which deliver water within an area to a large number of development sites often across a number of towns. The strategic provision of these water mains enables us to provide of the cheapest solution across a large geographical area.

Local reinforcement

These are localised reinforcement mains to enable us to provide water to your development site. On most sites we also have two categories of water mains the Spine Mains and Housing Estate Mains (HEMs).

To support your budgeting arrangements, we have also examined the estimated cost for delivering the onsite water mains neededfor a site of your size.

Water Supply Network Capacity

There is insufficient capacity in the current network to supply this development site and therefore offsite reinforcements are needed. Details of the necessary upgrades can be found in the water infrastructure section of this report and the cost of these works are included in the infrastructure charge.

If you wish to proceed with the development, then you will need to complete an application for a new supply. This is recommended to be done atthe earliest opportunity as it could take a minimum of 18 months to install any offsite reinforcement works.

The connection point for the site will be from the existing water main in Roman Bank.

It is recommended that you apply for a formal mains connection at the earliest opportunity to allow us to design and plan the delivery of your connection work. Additionally, please note that where offsite reinforcement work has been identified, it could take up to 18 months to complete the necessary offsite reinforcement depending on the level of complexity.

Connection point(s)

Connection Point	Address	National Grid Reference (NGR)
CP-7834	Roman Bank	TF2577523821

Budget Water Costs

In order to supply your site, the following upgrades are required:

Estimated Local reinforcement Mains	Based on
Offsite Reinforcement	Offsite reinforcement is required of 325m of 90mmOD along Holbeach from TF 25903 23733 to TF 25706 23712, continuing to POC in Roman Bank TF 25775 23821. The offsite reinforcement cost is covered by the infrastructure charge

The costs provided in this report are based on the current information available. These costs are provided as an indicative estimate to help inform you on a budget for supplying water to your site.

Your development site will be required to pay an **infrastructure charge** for each new property connecting to the public water network that benefits from Full planning permission. The infrastructure charge replaces the zonal charge as previously identified.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

• The Infrastructure Charge is based on the cost of any reinforcement and upgrades to our existing network("Network Reinforcements"), whether designed to address strategic or local capacity issues.

• For moreinformation on our Infrastructure Charge, please see the 'Useful Information' section of this report.

• The Site-Specific costs are calculated at a 100% contribution on any new infrastructure that is required to be built to connect the development site to our existing network. This includes new infrastructure from (and including) the point of connection to our network. The development will receive an income offset in accordance with our 22-23 Developer Charging Arrangements on any new domestic or non-household domestic connection made to our network and applied to the water infrastructure charge as a plot connects.

A detailed cost breakdown for non-residential developments will be provided on receipt of a formal application for a new water main

Onsite water main	Number of units	Estimated cost
Estimated cost of onsite main delivery	1	To be confirmed

Water Infrastructure Charge

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non-household premises, the infrastructure charges is calculated according to the number and type of water fittings in the premises.

This is called the "relevant multiplier" method of calculating the charge. Details of the relevant multiplier for each fitting can be found at our website.

Our 22/23 Developer Charging Arrangements includes an income offset discount on new domestic connections made to our network and is applied when the plot connects to the water network.

The associated water infrastructure and a detailed cost breakdown for non-residential developments will be provided on receipt of a formal application for a new water main

The Water Infrastructure charge for your dwellings is:

Infrastructure charge	Number of units	Total
£ 293	0	To be confirmed

The Infrastructure discount for your dwellings is:

Infrastructure discount	Number of units	Total
-£ 420	0	To be confirmed

Alternatively, you may wish to have the onsite main delivered by a Self-lay Provider under terms set out in a self-lay agreement. For more information on water mains and self-lay of water mains, please visit our website.

Please note that you should also budget for infrastructure charges on non-household premises where applicable and these will be calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge and the relevant multiplier will be applied to the figures set out in our 2022-23 Developer Charging Arrangements to arrive at the amount payable. Details of the relevant multiplier for each fitting can be found on our website.

Section 4 - Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and effluent quality arising from your development.

Water recycling centre

The foul drainage from the proposed development is in the catchment of Spalding Water Recycling Centre, which currently does not have capacity to treat the flows from your development site.

Anglian Water are obligated to accept the foul flows from your development with the benefit of planning consent and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the planning authority grant planning permission.

Used water network

Our assessment has been based on development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from of the point of connection, including making the connection to our existing network. This connection point has been determined in reference to the calculated discharge flow and on this basis, a 150mm internal diameter pipe is required to drain the development site. The nearest practicable connection is to the 150mm diameter sewer at manhole 7705 that crosses the development site at National Grid Reference NGR TF2570923766. Our assessment has been based on conveyance pump operating assumptions, details of which can be found on our website. Based on these assumptions, we would expect to see a rising main nominal bore of 80mm and a pumped rate of no more than 5l/s Anglian Water has assessed the impact of a pumped conveyance from the planned development to the public foul sewerage network and we can confirm that this connection is acceptable as the foul sewerage system, at present, has available capacity for your site. In line with Design and Construction Guidance, the pumped discharge will need to connect via an intermediate manhole and at least 5 metres of an appropriately sized gravity sewer. The final pump rate and configuration of the connection will be determined with your detailed design. You should submit this detail with your Section 106 new connection application. Please note that Anglian Water will request a suitably worded condition at planning application stage to ensure this strategy is implemented to mitigate the risk of flooding.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

As advised on the telephone on 13 October 2022, there are no public surface water sewers within the vicinity of the proposed development. Therefore Anglian Water will be unable to provide the site with a feasible solution of surface water disposal within the current assets. Alternative methods of surface water disposal will need to be investigated such as infiltration techniques or a discharge to a watercourse in accordance with the surface water management hierarchy as outlined in Building Regulations Part H. The alternative is that a new surface water sewer is constructed which is used to convey your surface water to a watercourse or as part of a SuDs scheme, where appropriate. Subject to the sewer being designed in accordance with the current version of Sewers For Adoption, the sewer can be put forward for adoption by Anglian Water under Section 104 of the Water Industry Act 1991. If the outfall is to a watercourse, the applicant will be required to obtain consent to discharge via the appropriate body. If your site has no means of drainage due to third party land then you may be able to requisition Anglian Water, under Section 98, to provide a connection to the public sewer for domestic drainage purposes. As part of this option, you may wish to enter into a works agreement in accordance with Section 30 of the Anglian Water Authority Act 1977. This will allow you to design and construct the public sewer using Anglian Waters' statutory powers in accordance with Section 159/168 of the Water Industry Act 1991.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website. We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating than the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website

As the proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

Your development site will be required to pay an Infrastructure charge for each new property connecting to the public water and sewerage network that benefits from Full planning permission. The infrastructure charge replaces the zonal charge as previously identified.

You will be required to pay an infrastructure charge upon connection for each new plot on your development site. The infrastructure charge are types of charges set out in Section 146(2) of the Water Industry Act 1991.

The charge should be paid by anyone who wishes to build or develop a property and is payable upon request of connection.

• The Infrastructure Charge is based on the cost of any reinforcement and upgrades to our existing network ("Network Reinforcements"), whether designed to address strategic or local capacity issues. For more information on our Infrastructure Charge, please see the 'Useful Information' section of this report.

Infrastructure charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage).

The Water Recycling Infrastructure charge for your dwellings is:

Infrastructure charge	Number of units	Total
£ 490	0	To be confirmed

Please note that you should also budget for infrastructure charges on non-household premises where applicable and these will be calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge and the relevant multiplier will be applied to the figures set out in our 2022-23 Developer Charging Arrangements to arrive at the amount payable. Details of the relevant multiplier for each fitting can be found on our website.

Section 5 - Map of Proposed Point of Connection(s)



Figure 1: Showing your water point of connection



Figure 2: Showing your water recycling foul point of connection

Section 6 - Useful information

Water Industry Act – Key water sections

Section 41:

This provides you with the right to requisition a new water main for domestic purposes to connect your site to the public water network.

Section 45:

This provides you with the right to have a connection for domestic purposes from a building or part of a building to the public water main.

Section 51A - E:

This provides you with the right to provide the water main or service connection yourself and for us to vest them into our company.

Section 55:

This applies where you request a supply of water for non-domestic purposes.

Section 185:

This provides you with the right to make a reasonable request to have a public water main, sewer or public lateral drain removed or altered, at your expense.

Details on how you can make a formal application for a new water main, new connection or diversion are available on from our Development Services team on **0345 60 66 087** or via our website

If you have any other queries on the rights to requisition or connect your housing to the public water and sewerage infrastructure then please contact our Development Services team at:

Anglian Water
PO Box 495
Huntingdon
PE29 6YY

Telephone: 0345 60 66 087
Email: developmentservices@anglianwater.co.uk

Water pressure and flow rate

The water pressure and consistency that we must meet for your site is laid out in the Water Industry Act (1991). This states that we must supply a flow rate of 9 litres per minute at a pressure of 10 metres of head to the external stop tap. If your water pressure requirements exceed this then you will need to provide and maintain any booster requirements to the development site.

Self-lay of water mains

A list of accredited self-lay provider organisations can be found on the Lloyds Registrar website

Water Industry Act – Key used water sections

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website or via our Development Services team on **0345 60 66 087**.

Sustainable drainage systems

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. .

Our preferred method of surface water disposal is through the use of Sustainable Drainage Systems or SuDS.

SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website

We recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for your site to discuss your application.

Private sewer transfers

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

Surface water sewers and lateral drains that do not discharge to the public sewer, e.g. those that discharged to a watercourse.

Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.

Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

It is anticipated that all new sewer applications will need to have an approved Section104 application ahead of a Section 106 connection

Encroachment

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website

Locating our assets

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from digdat

All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge.

We have more information on our website

Our charging arrangements and summary for this year's water and used water connection and infrastructure charges can be found on our website

Section 7 - Disclaimer

The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content.

Furthermore, in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid from the date issued and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s). Our pre-planning reports are valid for 12 months, however please note Anglian Water cannot reserve capacity and available capacity in our network can be reduced at any time due to increased requirements from existing businesses and houses as well as from new housing and new commercial developments.

Appendix D Environment Agency Correspondence

Martin Pearse
martin.pearse@3econsult.com

Our ref: CCN-2022-283996

Date: 04/11/2022

Dear Martin,

Provision of Flood Risk Information for Roman Bank, Spalding

Thank you for your request for our flood risk information for the above site. The information is set out below and attached. It is important you read any contextual notes on the maps provided.

If you are preparing a Flood Risk Assessment (FRA) for this site, please note this information may not be sufficient by itself to produce an adequate FRA to demonstrate the development is safe over its lifetime. Additional information may be required to carry out an appropriate assessment of all risk, such as consequence of a breach in defences.

We aim to review our information on a regular basis, so if you are using this data more than twelve months from the date of this letter, please contact us again to check it is still valid.

1. Flood Map

The attached map includes the current Flood Map for your area. The Flood Map indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

In some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defences, water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow depths and could leave pockets of locally slightly higher land as isolated dry islands. It is important to understand the actual risk of the flooding to these dry islands, particularly in the event of defence failure.

The Flood Map also shows the location of formal raised flood defences and flood storage reservoirs. It represents areas at risk of flooding for present day only and does not take account of climate change.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered flooding may occur from other sources such as surface water sewers, road drainage, etc.

2. Historic Flood Event Outlines

With regards to the history of flooding I can advise we do not have any records of flooding in this area. It is possible recent flooding may have occurred which we are currently investigating, therefore this information may be subject to change. It is possible other flooding may have occurred which other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist) have responsibility.

3. Schemes in the area

There are no ongoing capital projects to reduce or sustain the current flood risk to this site.

4. Fluvial Flood Risk Information

4.1 Fluvial Defence Information

The existing fluvial defences reducing the risk of flooding from main river to this site consist of earth embankments. They are in fair condition and reduce the risk of flooding (at the defence) to a 2% (1 in 50) chance of occurring in any year. We inspect these defences routinely to ensure potential defects are identified.

4.2 Fluvial Modelled Levels and Flows

Available modelled fluvial flood levels and flows for the model nodes shown on the attached map are set out in the data table attached. This data is taken from the model named on the data table, which is the most up-to-date model currently available.

Please note these levels are “in-channel” levels and therefore may not represent the flood level on the floodplain, particularly where the channel is embanked or has raised defences.

Our models may not have the most up to date climate change allowances. In time we will update our models for the latest allowances. You should refer to 'Flood risk assessments: climate change allowances' to check if the allowances modelled are appropriate for the type of development you are proposing and its location. You may need to undertake further assessment of future flood risk using different allowances to ensure your assessment of future flood risk is based on best available evidence.

4.3 Fluvial Modelled Flood Extents

Please find attached a map showing available modelled flood extents, taking into account flood defences, for your area. This data is taken from the model named on the map, which is the most up-to-date model currently available.

In some cases the flood extents shown may not be from main river, but may be from other sources such as IDB lowland drainage networks.

4.4 Fluvial Hazard Mapping

For certain locations we have carried out modelling to map the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from overtopping and / or breaching of defences at specific locations for a number of scenarios.

At present this information is available for fluvial flood risk in Northampton, Lincoln, Wainfleet and some isolated rural locations.

The number of locations we have this information for is expected to increase in time.

At present this site is not covered by any Environment Agency hazard mapping.

Detailed Hazard Mapping is available within the 2017 Update of South Holland Strategic Flood Risk Assessment. This can be downloaded via the following link:
http://www.southeastlincslocalplan.org/water/

5. Tidal Flood Risk Information

This site is not considered to be at risk from tidal flooding.

6. Development Planning

If you would like local guidance on preparing a flood risk assessment for a planning application, please contact our Sustainable Places team at LNplanning@environment-agency.gov.uk. It will help if you mention this data request and attach your site location plan.

We provide free preliminary advice; additional/detailed advice, review of draft FRAs and meetings are chargeable at a rate set to cover our costs, currently £100 (plus VAT) per hour of staff time. Further details are available on our website at https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals.

General advice on flood risk assessment for planning applications can be found on GOV.UK at https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

Climate change will increase flood risk due to overtopping of defences. Please note, unless specified otherwise, the climate change data included has an allowance for 20% increase in flow. Updated guidance on how climate change could affect flood risk to new development - 'Flood risk assessments: climate change allowances' was published on GOV.UK in **July 2021**. The appropriate updated climate change allowance should be applied in a Flood Risk Assessment.

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

7. Data Licence and Other Supporting Information

We respond to requests for recorded information we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

This information is provided in accordance with the Open Government Licence which can be found here: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Further information on flood risk can be found on the GOV.UK website at: https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

8. Other Flood Risk Management Authorities

The information provided with this letter relates to flood risk from main river or the sea. Additional information may be available from other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist).

I hope we have correctly interpreted your request. If you have any queries or would like to discuss the content of this letter further please contact Alexander Tan using the email address below and quoting our CCN reference number above.

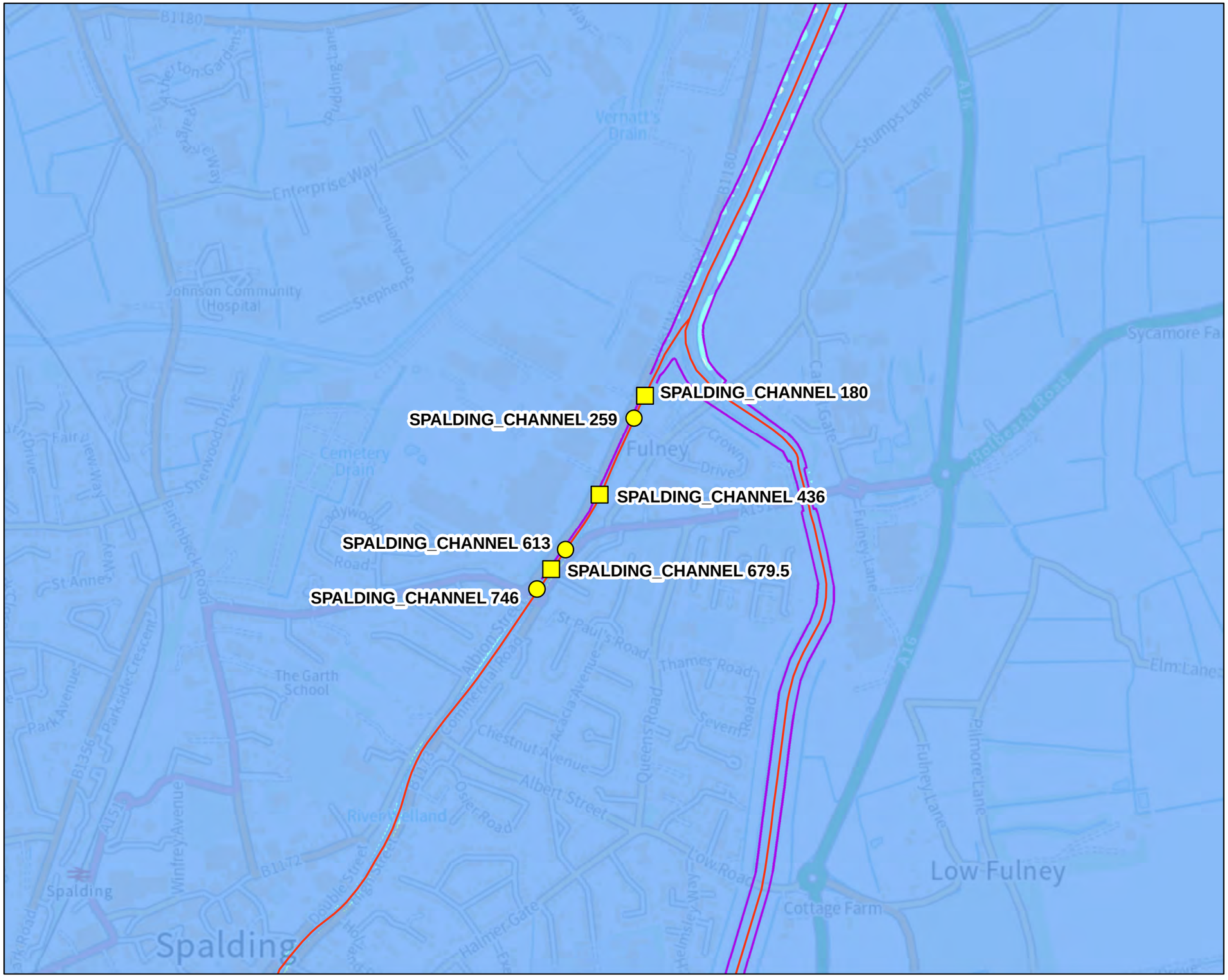
Yours sincerely,



for Alastair Windler
Welland and Nene Partnerships and Strategic Overview Team Leader
e-mail PSOWN@environment-agency.gov.uk

Enc.
Flood Map
Modelled Fluvial Levels and Flows Data Sheet
Modelled Flood Extent Maps.

Flood Map centred on TF 25727 23817 - created November 2022 [Ref: CCN-2022-283996]



Environment Agency

Scale 1:10,000

N

Legend

- Modelled Levels
- Modelled Flows
- Main Rivers
- Raised Defences
- Flood Storage Areas
- Areas at Risk of Flooding from Rivers or the Sea
- Extreme Flood Outline

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.

- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

Created by the Partnerships and Strategic Overview Team, Kettering

© Environment Agency copyright and / or database rights 2022. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency,100024198, 2022.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

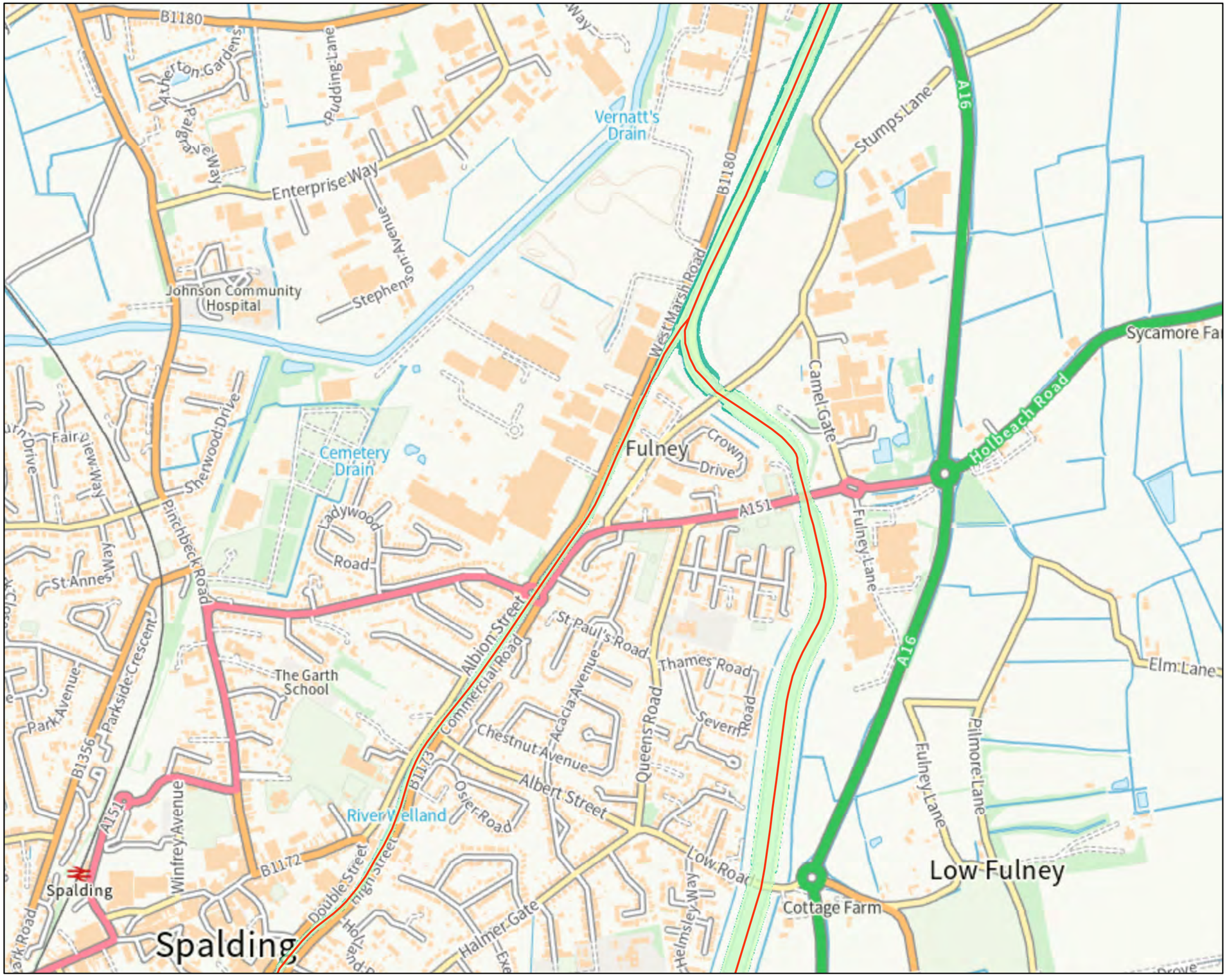
			Annual Exceedance Probability - Maximum Water Levels (mODN)										
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
SPALDING_CHANNEL 259	525779	323995	3.70	4.00	4.17	4.45	4.51	4.52	4.52	4.68	4.53	4.56	4.68
SPALDING_CHANNEL 613	525605	323662	3.70	4.00	4.17	4.45	4.51	4.52	4.52	4.68	4.53	4.55	4.68
SPALDING_CHANNEL 746	525532	323562	3.70	4.00	4.17	4.45	4.51	4.52	4.52	4.68	4.53	4.55	4.68

Fluvial Flood Flows (m^3/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m^3/s).

			Annual Exceedance Probability - Maximum Flows (m^3/s)										
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
SPALDING_CHANNEL 436	525690	323802	0.71	1.06	0.91	1.06	1.03	1.15	1.17	1.65	1.10	1.07	1.93
SPALDING_CHANNEL 679.5	525567	323613	1.30	1.99	1.77	2.06	1.93	2.24	2.31	3.19	2.18	2.06	3.61

Modelled Flood Extents (with defences) Model: Welland Catchment Strategic (2016) centred on TF 25727 23817 - created November 2022 [Ref: CCN-2022-283996]



Environment Agency

Scale 1:10,000

N

Legend

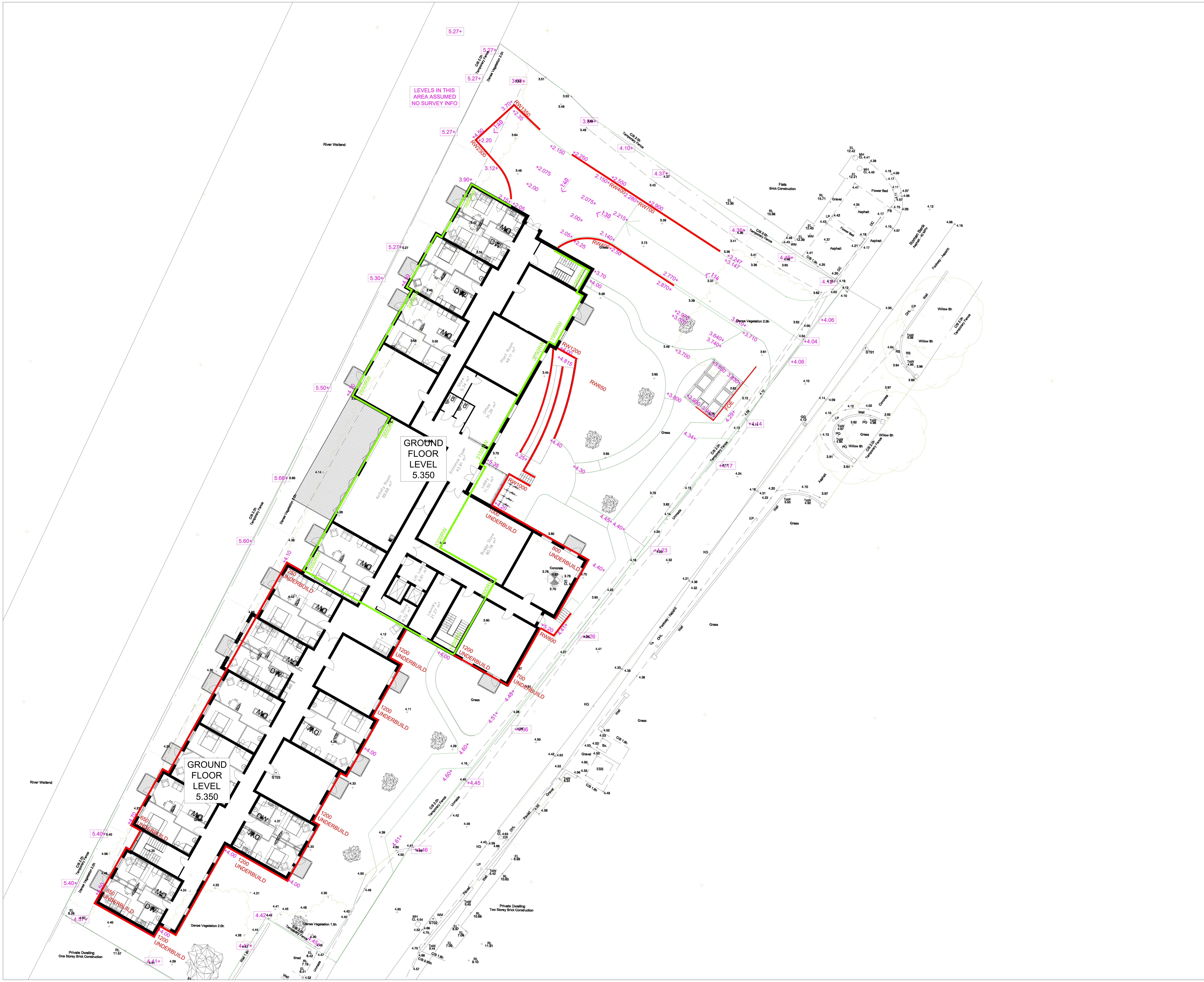
- Main Rivers
- 5% (1 in 20) fluvial event
- 1% (1 in 100) fluvial event
- 1% (1 in 100) inc 20% climate change fluvial event
- 0.1% (1 in 1000) fluvial event
- 0.1% (1 in 1000) inc 20% climate change fluvial event

Created by the Partnerships and Strategic Overview Team, Kettering

© Environment Agency copyright and / or database rights 2022. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency,100024198, 2022.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Appendix E Proposed Levels Plan



KEY PLAN

Retaining wall (retained height shown). (edge protection required over 600mm ht)	RW 0.6M
Flag On Edge. Maximum retained height 0.4m. Not to be constructed supporting driveways or highways	FOE 0.4M
Steps - 250mm Going 150mm Rise (Handrails required to heights over 600mm)	6 STEPS
Proposed Finished Floor Level	FFL 141.000
Proposed spot height	+141.00
Existing spot height	+141.00
Proposed Gradient	1:12
Proposed Engineered Batter / Embankment. (1:2.5 Grad Max unless notes otherwise)	

NOTES

HEALTH & SAFETY

1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.

ROADS & DRAINAGE

2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE
3. THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
4. CONNECTIONS TO EXISTING SEWERS TO BE MADE BY SW APPROVED CONTRACTOR ONLY.
5. CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LEPTOSPIROSIS (WEILS DISEASE) AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
6. UNFINISHED MANHOLES MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIER.

PIPES & CABLES

7. SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND DIG AND PROTECTED ACCORDINGLY.

EXCAVATION/FILL

8. CONTRACTOR TO ENSURE RELEVANT MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
9. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
10. CONTRACTOR TO REFER TO GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

REVISIONS

REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P01	INITIAL ISSUE					
	GS	28/11/22	MP	28/11/22	MP	28/11/22

Hydrock 3E
2 Esh Plaza, Sir Bobby Robson Way
Great Park
Newcastle upon Tyne
NE13 9BA
t: +44 (0)191 230 2993
e: newcastle@3econsult.com

CLIENT
SEA ISLAND DEVELOPMENTS

PROJECT
ROMAN BANK EXTRACARE
ROMAN BANK, SPALDING

TITLE
PROPOSED LEVELS PLAN

HYDROCK PROJECT NO.	SCALE @ A1
P22-311	1:200

STATUS DESCRIPTION	STATUS
SUITABLE FOR INFORMATION	S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
P22-311-HYD-XX-XX-DR-C-2000	P01

Plotted 28/11/2022 13:59:57

Appendix F Proposed Drainage Layouts



NOTES

1. ALL DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT WATER SERVICES ASSOCIATION "SEWERS FOR ADOPTION" AND ADOPTING WATER AUTHORITY/SEWERAGE AGENCY REQUIREMENTS AND SPECIFICATIONS.
2. ALL PRIVATE DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH BUILDING REGULATIONS CURRENT EDITION.
3. CONTRACTOR TO ESTABLISH POSITION SIZE AND DEPTH OF ALL EXISTING SEWERS AND SERVICES PRIOR TO COMMENCEMENT ON SITE.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT, AND TEMPORARY AND PERMANENT DIVERSION WORKS, AS NECESSARY TO ALL EXISTING SERVICES.
5. THE CONTRACTOR SHALL ALLOW FOR ALL TRAFFIC MANAGEMENT IN CONNECTION WITH ROAD AND SEWER WORKS.
6. THE CONTRACTOR SHALL ALLOW FOR KEEPING SEWER TRENCHES AND EXCAVATIONS AS DRY AS PRACTICABLE BY PUMPING FROM TEMPORARY SUMPS AND DEWATERING AS APPROPRIATE. THE POINT AND METHOD OF DISCHARGE TO BE AGREED WITH THE DRAINAGE AUTHORITY.
7. PIPES UP TO AND INCLUDING 300mmØ TO BE UNPLASTICISED PVC. PIPES 375mmØ AND GREATER TO BE CONCRETE CLASS H.
8. ALL PIPEWORK TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.
9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS 4027, UNLESS AGREED OTHERWISE WITH THE ADOPTING AUTHORITY.
10. PRECAST CONCRETE PRODUCTS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS 5911 AND BE KITEMARKED. CONCRETE PIPES TO BE CLASS H UNLESS NOTED OTHERWISE.
11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124, HAVE MINIMUM 675 x 675 CLEAR OPENINGS WITH 150 DEEP FRAMES UNLESS OTHERWISE SPECIFIED. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITHOUT CUSHION INSERTS AND BE KITEMARKED. LOAD CLASS D400 IN VEHICULAR TRAFFICKED AREAS AND LOAD CLASS B125 IN FOOTWAYS AND PEDESTRIAN AREAS.
12. GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124 AND BE OF A NON-ROCKING DESIGN WITH CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 FOR ROADS REGULARLY CARRYING FAST MOVING HEAVY VEHICLES. CLASS C250 TO BE USED IN LESSER TRAFFICKED AREAS eg. ESTATE ROADS, CUL-DE-SACS, RESIDENTIAL CAR PARKING AREAS ETC.
13. CLASS Z BEDDING DETAIL SHALL BE PROVIDED WHERE COVER TO THE PIPE BARREL IS LESS THAN 1.2M IN VEHICULAR TRAFFICKED AREAS AND 0.9M ELSEWHERE, TO ALL ROAD GULLY CONNECTIONS AND WITHIN AREAS OF DEEP ROOTING VEGETATION.
14. WHERE CLASS Z TRENCH BEDDING DETAIL IS USED, THE CONCRETE BED AND SURROUND SHALL BE DISCONTINUED AT EACH PIPE JOINT OVER THE FULL CROSS SECTION BY MEANS OF A SHAPED COMPRESSIBLE FILLER.
15. SELECTED BACKFILL MATERIAL SHALL CONSIST OF UNIFORM MATERIAL FREE FROM STONES LARGER THAN 40mm, CLAY LUMPS LARGER THAN 75mm, TREE ROOTS, ORGANIC MATTER AND FROZEN SOIL. SELECTED BACKFILL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL.
16. GENERAL BACKFILL MATERIAL TO BE FREE FROM STONES LARGER THAN 40mm. GENERAL BACKFILL MATERIAL IS TO BE PLACED IN LAYERS NOT EXCEEDING 150mm THICKNESS AND EACH LAYER COMPACTED BY HAND. NO MECHANICAL COMPACTION OF FILL MATERIAL SHALL BE PERMITTED WITHIN 300mm ABOVE THE CROWN/BARREL OF THE PIPE.
17. BACKFILLING AND REINSTATEMENT TO TRENCHES IN PUBLIC HIGHWAYS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS AND SPECIFICATIONS OF THE ADOPTING AUTHORITY, OR, IN THE ABSENCE OF SUCH, IN ACCORDANCE WITH THE REQUIREMENTS OF "THE STREET WORKS REGULATIONS 1992" AND RELEVANT PROVISIONS OF H.A.U.C. "SPECIFICATION FOR THE REINSTATEMENT OF OPENINGS IN HIGHWAYS" JUNE 1992, BOTH UNDER SECTION 71 OF THE NEW ROADS AND STREET WORKS ACT 1991.
18. BACKFILL TO DRAINAGE TRENCHES IN HARD PAVED AREAS SHALL BE G.S.B. TYPE 1.
19. ALL ROAD GULLIES ARE TO BE TRAPPED GULLIES.
20. ALL GULLY LEADS TO BE 150mm DIAMETER.
21. ALL REDUNDANT EXISTING DRAINAGE TO BE GRUBBED UP OR GROUTED, ANY EXISTING LIVE DRAINAGE SHOULD BE REPORTED TO THE ENGINEER AND RECONNECTED.
22. ALL ROAD GULLIES & LEADS TO BE CLEARED OF DEBRIS UPON COMPLETION OF WORKS.
23. ANY EXISTING DRAINAGE WHICH BECOMES UNDER TRAFFICKED AREAS IN THE NEW SCHEME SHOULD BE SUBJECT TO THE FOLLOWING REMEDIALS/REVISIONS. WHERE DEPTH OF COVER IS LESS THAN 1200MM, THE EXISTING PIPEWORK SHALL BE EXPOSED & SURROUNDED WITH 150MM CONCRETE AS CLASS "Z" BEDDING. WHERE THE EXISTING MANHOLE COVER & FRAME IS NOT AS MANHOLE DETAIL A OR B, OR TO BS497 GRADE A, OR EN124 CLASS D, THEN IT SHOULD BE CHANGED FOR SUCH.
24. THE CONTRACTOR MUST ENSURE THAT ANY OF THE EXISTING DRAINAGE WHICH IS LIVE IS KEPT CLEAR OF DEBRIS AND SHOULD ALLOW FOR JETTING THROUGH THE NEW & EXISTING DRAINAGE UPON COMPLETION.
25. CONTRACTOR TO TAKE MEASURES TO PROTECT HIS OPERATIVES WITH RESPECT TO THE PRESENCE OF GAS IN SEWER TRENCHES AND MANHOLES THROUGH THE USE OF GAS MONITORING EQUIPMENT AND BREATHING APPARATUS AS REQUIRED.
26. CONTRACTOR TO APPLY FOR SEWER PERMITS AND ROAD OPENING PERMITS AS NECESSARY FROM THE APPROPRIATE AUTHORITIES, PRIOR TO COMMENCING WORKS.
27. ALL PERFORATED PIPES TO BE TWIN WALL UPVC.
28. ALL MANHOLE COVERS TO BE ALIGNED WITH SURROUNDING FEATURES WHERE POSSIBLE TO SUIT INTERNAL PIPE LAYOUT AND ACCESS REQUIREMENTS.
29. ALL BUILDING DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT PARTS OF BS EN:752 'DRAINS AND SEWER SYSTEMS OUTSIDE BUILDINGS', THE CURRENT BUILDING REGULATIONS AND THE LOCAL AUTHORITY BUILDING CONTROL SPECIFICATIONS AND REQUIREMENTS.
30. ALL SURFACE WATER DRAINAGE WILL BE TESTED IN ACCORDANCE WITH BS EN 1610:1998
31. ALL WASTEWATER DRAINAGE TO BE TESTED IN ACCORDANCE WITH NATIONAL ANNEX NG OF BS EN 12056-1:2000

KEY PLAN

- Proposed Foul drain and manhole
- Proposed Storm drain and manhole
- Existing Foul sewer and manhole — Ex 375Ø FW Sewer
- Existing Surface Water sewer and manhole — Ex 375Ø SW Sewer
- Existing Combined sewer and manhole — Ex 375Ø CW Sewer
- Private storm rodding eye
- 450mm dia. private inspection chamber.
- 600mm dia. private inspection chamber.
- Proposed road gully & connecting pipe work. 150Ø pipe unless noted otherwise — RG 150Ø
- Proposed channel drain with D400 rated pedestrian type covers and sump outlets — SO

NOTES

HEALTH & SAFETY
1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.
ROADS & DRAINAGE
2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE
3. THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
4. CONNECTIONS TO EXISTING SEWERS TO BE MADE BY SW APPROVED CONTRACTOR ONLY.
5. CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LEPTOSPIROSIS (WEILS DISEASE) AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
6. UNFINISHED MANHOLES MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIER.
PIPES & CABLES
7. SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND DIG AND PROTECTED ACCORDINGLY.
EXCAVATION/FILL
8. CONTRACTOR TO ENSURE RELEVANT MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
9. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
10. CONTRACTOR TO REFER TO GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

CONTRACTOR TO PROVIDE CCTV SURVEY OF ALL NEW DRAINAGE UPON COMPLETION

REVISIONS

REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P01	INITIAL ISSUE					
	GS	28/11/22	MP	28/11/22	MP	28/11/22

Hydrock 3E
2 Esh Plaza, Sir Bobby Robson Way
Great Park
Newcastle upon Tyne
NE13 9BA
t: +44 (0)191 230 2993
e: newcastle@3econsult.com

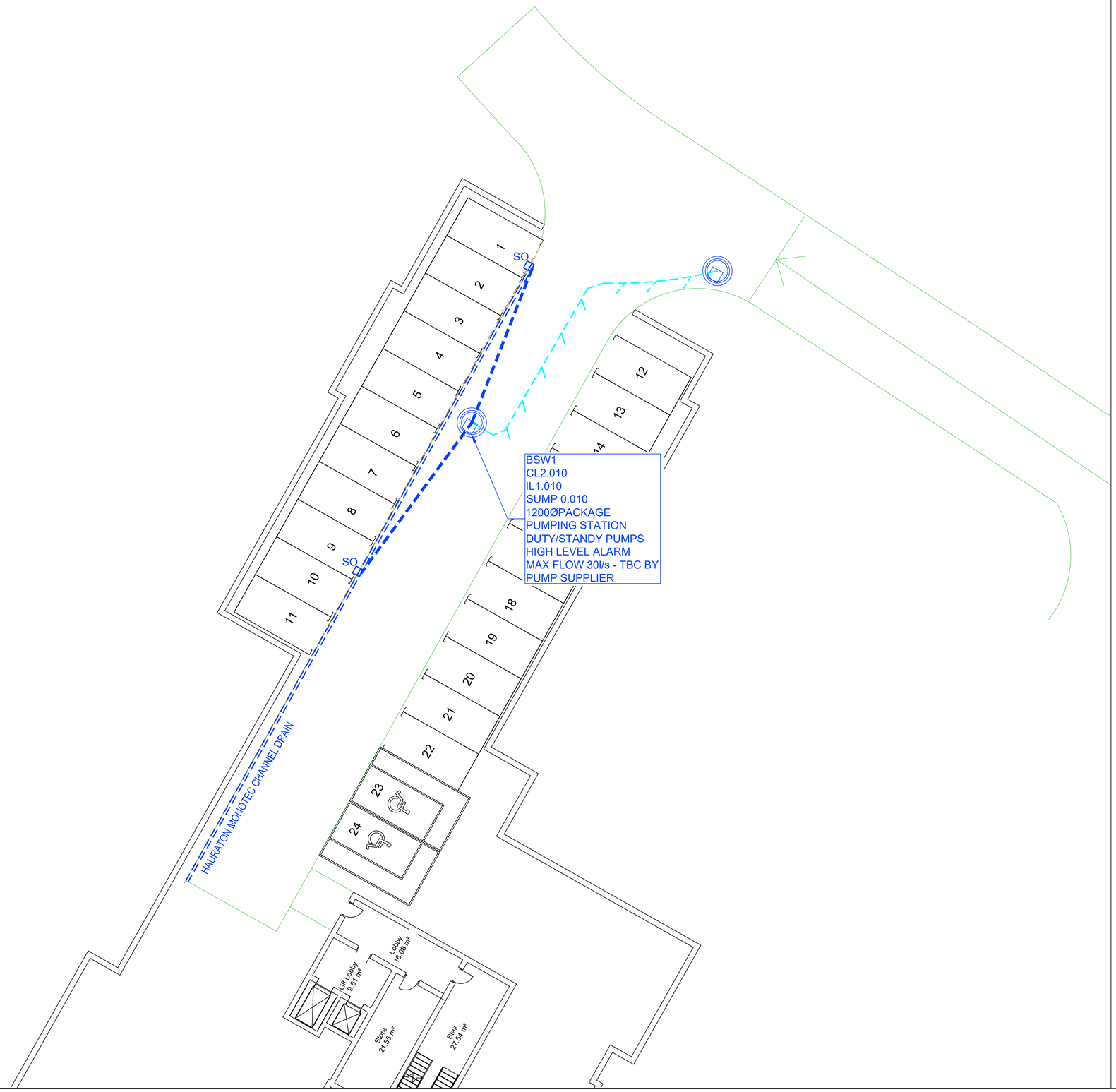
CLIENT
SEA ISLAND DEVELOPMENTS

PROJECT
ROMAN BANK EXTRACARE
ROMAN BANK, SPALDING

TITLE
DRAINAGE LAYOUT

HYDROCK PROJECT NO. P22-311
SCALE @ A1 1:200
STATUS DESCRIPTION SUITABLE FOR INFORMATION
STATUS S2
DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) P22-311-HYD-XX-XX-DR-C-1000
REVISION P01

Plotted 28/11/2022 13:55:34



NOTES

1. ALL DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT WATER SERVICES ASSOCIATION "SEWERS FOR ADOPTION" AND ADOPTING WATER AUTHORITY/SEWERAGE AGENCY REQUIREMENTS AND SPECIFICATIONS.
2. ALL PRIVATE DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH BUILDING REGULATIONS CURRENT EDITION.
3. CONTRACTOR TO ESTABLISH POSITION SIZE AND DEPTH OF ALL EXISTING SEWERS AND SERVICES PRIOR TO COMMENCEMENT ON SITE.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT, AND TEMPORARY AND PERMANENT DIVERSION WORKS, AS NECESSARY TO ALL EXISTING SERVICES.
5. THE CONTRACTOR SHALL ALLOW FOR ALL TRAFFIC MANAGEMENT IN CONNECTION WITH ROAD AND SEWER WORKS.
6. THE CONTRACTOR SHALL ALLOW FOR KEEPING SEWER TRENCHES AND EXCAVATIONS AS DRY AS PRACTICABLE BY PUMPING FROM TEMPORARY SUMPS AND DEWATERING AS APPROPRIATE. THE POINT AND METHOD OF DISCHARGE TO BE AGREED WITH THE DRAINAGE AUTHORITY.
7. PIPES UP TO AND INCLUDING 300mmØ TO BE UNPLASTICISED PVC. PIPES 375mmØ AND GREATER TO BE CONCRETE CLASS H.
8. ALL PIPEWORK TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.
9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS 4027, UNLESS AGREED OTHERWISE WITH THE ADOPTING AUTHORITY.
10. PRECAST CONCRETE PRODUCTS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS 5911 AND BE KITEMARKED. CONCRETE PIPES TO BE CLASS H UNLESS NOTED OTHERWISE.
11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124, HAVE MINIMUM 675 x 675 CLEAR OPENINGS WITH 150 DEEP FRAMES UNLESS OTHERWISE SPECIFIED. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITHOUT CUSHION INSERTS AND BE KITEMARKED. LOAD CLASS D400 IN VEHICULAR TRAFFICKED AREAS AND LOAD CLASS B125 IN FOOTWAYS AND PEDESTRIAN AREAS.
12. GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124 AND BE OF A NON-ROCKING DESIGN WITH CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 FOR ROADS REGULARLY CARRYING FAST MOVING HEAVY VEHICLES. CLASS C250 TO BE USED IN LESSER TRAFFICKED AREAS eg. ESTATE ROADS, CUL-DE-SACS, RESIDENTIAL CAR PARKING AREAS ETC.
13. CLASS Z BEDDING DETAIL SHALL BE PROVIDED WHERE COVER TO THE PIPE BARREL IS LESS THAN 1.2M IN VEHICULAR TRAFFICKED AREAS AND 0.9M ELSEWHERE, TO ALL ROAD GULLY CONNECTIONS AND WITHIN AREAS OF DEEP ROOTING VEGETATION.
14. WHERE CLASS Z TRENCH BEDDING DETAIL IS USED, THE CONCRETE BED AND SURROUND SHALL BE DISCONTINUED AT EACH PIPE JOINT OVER THE FULL CROSS SECTION BY MEANS OF A SHAPED COMPRESSIBLE FILLER.
15. SELECTED BACKFILL MATERIAL SHALL CONSIST OF UNIFORM MATERIAL FREE FROM STONES LARGER THAN 40mm, CLAY LUMPS LARGER THAN 75mm, TREE ROOTS, ORGANIC MATTER AND FROZEN SOIL. SELECTED BACKFILL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL.
16. GENERAL BACKFILL MATERIAL TO BE FREE FROM STONES LARGER THAN 40mm. GENERAL BACKFILL MATERIAL IS TO BE PLACED IN LAYERS NOT EXCEEDING 150mm THICKNESS AND EACH LAYER COMPACTED BY HAND. NO MECHANICAL COMPACTION OF FILL MATERIAL SHALL BE PERMITTED WITHIN 300mm ABOVE THE CROWN/BARREL OF THE PIPE.
17. BACKFILLING AND REINSTATEMENT TO TRENCHES IN PUBLIC HIGHWAYS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS AND SPECIFICATIONS OF THE ADOPTING AUTHORITY, OR, IN THE ABSENCE OF SUCH, IN ACCORDANCE WITH THE REQUIREMENTS OF "THE STREET WORKS REGULATIONS 1992" AND RELEVANT PROVISIONS OF H.A.U.C. "SPECIFICATION FOR THE REINSTATEMENT OF OPENINGS IN HIGHWAYS" JUNE 1992, BOTH UNDER SECTION 71 OF THE NEW ROADS AND STREET WORKS ACT 1991.
18. BACKFILL TO DRAINAGE TRENCHES IN HARD PAVED AREAS SHALL BE G.S.B. TYPE 1.
19. ALL ROAD GULLIES ARE TO BE TRAPPED GULLIES.
20. ALL GULLY LEADS TO BE 150mm DIAMETER.
21. ALL REDUNDANT EXISTING DRAINAGE TO BE GRUBBED UP OR GROUTED, ANY EXISTING LIVE DRAINAGE SHOULD BE REPORTED TO THE ENGINEER AND RECONNECTED.
22. ALL ROAD GULLIES & LEADS TO BE CLEARED OF DEBRIS UPON COMPLETION OF WORKS.
23. ANY EXISTING DRAINAGE WHICH BECOMES UNDER TRAFFICKED AREAS IN THE NEW SCHEME SHOULD BE SUBJECT TO THE FOLLOWING REMEDIALS/REVISIONS. WHERE DEPTH OF COVER IS LESS THAN 1200MM, THE EXISTING PIPEWORK SHALL BE EXPOSED & SURROUNDED WITH 150MM CONCRETE AS CLASS "Z" BEDDING. WHERE THE EXISTING MANHOLE COVER & FRAME IS NOT AS MANHOLE DETAIL A OR B, OR TO BS497 GRADE A, OR EN124 CLASS D, THEN IT SHOULD BE CHANGED FOR SUCH.
24. THE CONTRACTOR MUST ENSURE THAT ANY OF THE EXISTING DRAINAGE WHICH IS LIVE IS KEPT CLEAR OF DEBRIS AND SHOULD ALLOW FOR JETTING THROUGH THE NEW & EXISTING DRAINAGE UPON COMPLETION.
25. CONTRACTOR TO TAKE MEASURES TO PROTECT HIS OPERATIVES WITH RESPECT TO THE PRESENCE OF GAS IN SEWER TRENCHES AND MANHOLES THROUGH THE USE OF GAS MONITORING EQUIPMENT AND BREATHING APPARATUS AS REQUIRED.
26. CONTRACTOR TO APPLY FOR SEWER PERMITS AND ROAD OPENING PERMITS AS NECESSARY FROM THE APPROPRIATE AUTHORITIES, PRIOR TO COMMENCING WORKS.
27. ALL PERFORATED PIPES TO BE TWIN WALL UPVC.
28. ALL MANHOLE COVERS TO BE ALIGNED WITH SURROUNDING FEATURES WHERE POSSIBLE TO SUIT INTERNAL PIPE LAYOUT AND ACCESS REQUIREMENTS.
29. ALL BUILDING DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE RELEVANT PARTS OF BS EN:752 'DRAINS AND SEWER SYSTEMS OUTSIDE BUILDINGS'. THE CURRENT BUILDING REGULATIONS AND THE LOCAL AUTHORITY BUILDING CONTROL SPECIFICATIONS AND REQUIREMENTS.
30. ALL SURFACE WATER DRAINAGE WILL BE TESTED IN ACCORDANCE WITH BS EN 1610:1998
31. ALL WASTEWATER DRAINAGE TO BE TESTED IN ACCORDANCE WITH NATIONAL ANNEX NG OF BS EN 12056-1:2000

KEY PLAN

Proposed Foul drain and manhole	
Proposed Storm drain and manhole	
Existing Foul sewer and manhole	Ex 375Ø FW Sewer
Existing Surface Water sewer and manhole	Ex 375Ø SW Sewer
Existing Combined sewer and manhole	Ex 375Ø CW Sewer
Private storm rodding eye	
450mm dia. private inspection chamber.	
600mm dia. private inspection chamber.	
Proposed road gully & connecting pipe work. 150Ø pipe unless noted otherwise	RG 150Ø
Proposed channel drain with D400 rated pedestrian type covers and sump outlets	SO

NOTES

HEALTH & SAFETY
1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.
ROADS & DRAINAGE
2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE
3. THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
4. CONNECTIONS TO EXISTING SEWERS TO BE MADE BY SW APPROVED CONTRACTOR ONLY.
5. CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LEPTOSPIROSIS (WEILS DISEASE) AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
6. UNFINISHED MANHOLES MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIER.
PIPES & CABLES
7. SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND DIG AND PROTECTED ACCORDINGLY.
EXCAVATION/FILL
8. CONTRACTOR TO ENSURE RELEVANT MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
9. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
10. CONTRACTOR TO REFER TO GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

CONTRACTOR TO PROVIDE CCTV SURVEY OF ALL NEW DRAINAGE UPON COMPLETION

REVISIONS

REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P01	INITIAL ISSUE					
	GS	09/11/22	MP	09/11/22	MP	09/11/22

Hydrock 3E
2 Esh Plaza, Sir Bobby Robson Way
Great Park
Newcastle upon Tyne
NE13 9BA
t: +44 (0)191 230 2993
e: newcastle@3econsult.com

CLIENT
SEA ISLAND DEVELOPMENTS

PROJECT
ROMAN BANK EXTRACARE
ROMAN BANK, SPALDING

TITLE
BASEMENT DRAINAGE LAYOUT

HYDROCK PROJECT NO.	SCALE @ A1
P22-311	1:200

STATUS DESCRIPTION	STATUS
SUITABLE FOR INFORMATION	S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
P22-311-HYD-XX-XX-DR-C-1100	P01

Plotted 09/11/2022 11:10:50

Appendix G Proposed Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S1	0.000	5.00	4.000	600	525711.610	323758.231	1.030
S2	0.035	5.00	4.000	600	525726.893	323784.691	1.235
S3	0.017	5.00	4.200	600	525732.606	323783.513	1.474
S4	0.024	5.00	4.200	600	525743.373	323802.886	1.622
S5	0.000		4.200	600	525747.583	323809.941	1.677
S6	0.018	5.00	3.900	600	525748.349	323827.664	2.565
S7	0.010	5.00	2.100	1200	525747.255	323837.007	1.855
S13	0.028	5.00	2.150	1200	525740.479	323846.072	2.025
S8	0.000	5.00	4.900	600	525691.683	323766.731	0.900
S9	0.045	5.00	4.300	600	525712.336	323803.129	0.900
S10	0.018	5.00	4.900	600	525717.223	323817.242	1.600
S11	0.014	5.00	4.700	600	525723.547	323829.925	1.494
S12	0.015	5.00	4.800	600	525731.828	323846.924	4.600
S14			4.900	1200	525735.425	323853.569	1.830
HW			4.000	150	525725.955	323858.127	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S1	S2	30.556	0.600	2.970	2.766	0.204	150.0	150	5.62	50.0
1.001	S2	S3	5.833	0.600	2.765	2.726	0.039	150.0	150	5.74	50.0
1.002	S3	S4	22.164	0.600	2.726	2.578	0.148	150.0	150	6.19	49.6
1.003	S4	S5	8.216	0.600	2.578	2.523	0.055	150.0	150	6.36	49.0
1.004	S5	S6	17.740	0.600	2.523	2.405	0.118	150.0	150	6.72	47.7
1.005	S6	S7	9.407	0.600	1.335	0.245	1.090	8.6	150	6.77	47.5
1.006	S7	S13	11.318	0.600	0.245	0.125	0.120	94.3	150	6.95	46.9
1.007	S13	S14	9.041	0.600	0.125	3.080	-2.955	-3.1	150	7.10	46.4

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.818	14.5	0.0	0.880	1.084	0.000	0.0	0	0.000
1.001	0.818	14.5	4.7	1.085	1.324	0.035	0.0	59	0.732
1.002	0.818	14.5	7.0	1.324	1.472	0.052	0.0	74	0.811
1.003	0.818	14.5	10.1	1.472	1.527	0.076	0.0	92	0.883
1.004	0.818	14.5	9.8	1.527	1.345	0.076	0.0	91	0.878
1.005	3.450	61.0	12.1	2.415	1.705	0.094	0.0	45	2.705
1.006	1.035	18.3	13.2	1.705	1.875	0.104	0.0	95	1.126
1.007	1.000	17.7	28.2	1.875	1.670	0.224	0.0	150	0.000

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	S8	S9	41.849	0.600	4.000	3.400	0.600	69.7	150	5.58	50.0
2.001	S9	S10	14.935	0.600	3.400	3.300	0.100	150.0	150	5.88	50.0
2.002	S10	S11	14.172	0.600	3.300	3.206	0.094	150.0	150	6.17	49.7
2.003	S11	S12	18.909	0.600	3.206	3.080	0.126	150.0	150	6.56	48.3
2.004	S12	S13	8.693	0.600	0.200	0.125	0.075	115.9	150	6.71	47.7
1.008	S14	HW	10.510	0.600	3.070	3.000	0.070	150.1	150	7.31	45.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	1.205	21.3	0.0	0.750	0.750	0.000	0.0	0	0.000
2.001	0.818	14.5	6.1	0.750	1.450	0.045	0.0	68	0.782
2.002	0.818	14.5	8.5	1.450	1.344	0.063	0.0	83	0.851
2.003	0.818	14.5	10.1	1.344	1.570	0.077	0.0	92	0.883
2.004	0.932	16.5	11.9	4.450	1.875	0.092	0.0	95	1.014
1.008	0.818	14.4	27.8	1.680	0.850	0.224	0.0	150	0.833

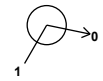
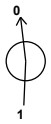
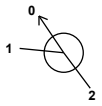
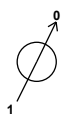
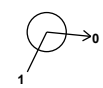
Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	30.556	150.0	150	Circular	4.000	2.970	0.880	4.000	2.766	1.084
1.001	5.833	150.0	150	Circular	4.000	2.765	1.085	4.200	2.726	1.324
1.002	22.164	150.0	150	Circular	4.200	2.726	1.324	4.200	2.578	1.472
1.003	8.216	150.0	150	Circular	4.200	2.578	1.472	4.200	2.523	1.527
1.004	17.740	150.0	150	Circular	4.200	2.523	1.527	3.900	2.405	1.345
1.005	9.407	8.6	150	Circular	3.900	1.335	2.415	2.100	0.245	1.705
1.006	11.318	94.3	150	Circular	2.100	0.245	1.705	2.150	0.125	1.875
1.007	9.041	-3.1	150	Circular	2.150	0.125	1.875	4.900	3.080	1.670
2.000	41.849	69.7	150	Circular	4.900	4.000	0.750	4.300	3.400	0.750
2.001	14.935	150.0	150	Circular	4.300	3.400	0.750	4.900	3.300	1.450
2.002	14.172	150.0	150	Circular	4.900	3.300	1.450	4.700	3.206	1.344
2.003	18.909	150.0	150	Circular	4.700	3.206	1.344	4.800	3.080	1.570
2.004	8.693	115.9	150	Circular	4.800	0.200	4.450	2.150	0.125	1.875
1.008	10.510	150.1	150	Circular	4.900	3.070	1.680	4.000	3.000	0.850

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	600	Manhole	Adoptable	S2	600	Manhole	Adoptable
1.001	S2	600	Manhole	Adoptable	S3	600	Manhole	Adoptable
1.002	S3	600	Manhole	Adoptable	S4	600	Manhole	Adoptable
1.003	S4	600	Manhole	Adoptable	S5	600	Manhole	Adoptable
1.004	S5	600	Manhole	Adoptable	S6	600	Manhole	Adoptable
1.005	S6	600	Manhole	Adoptable	S7	1200	Manhole	Adoptable
1.006	S7	1200	Manhole	Adoptable	S13	1200	Manhole	Adoptable
1.007	S13	1200	Manhole	Adoptable	S14	1200	Manhole	Adoptable
2.000	S8	600	Manhole	Adoptable	S9	600	Manhole	Adoptable
2.001	S9	600	Manhole	Adoptable	S10	600	Manhole	Adoptable
2.002	S10	600	Manhole	Adoptable	S11	600	Manhole	Adoptable
2.003	S11	600	Manhole	Adoptable	S12	600	Manhole	Adoptable
2.004	S12	600	Manhole	Adoptable	S13	1200	Manhole	Adoptable
1.008	S14	1200	Manhole	Adoptable	HW	150	Manhole	Adoptable

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	525711.610	323758.231	4.000	1.030	600		0	1.000	2.970	150
S2	525726.893	323784.691	4.000	1.235	600		1 0	1.000 1.001	2.766 2.765	150 150
S3	525732.606	323783.513	4.200	1.474	600		1 0	1.001 1.002	2.726 2.726	150 150
S4	525743.373	323802.886	4.200	1.622	600		1 0	1.002 1.003	2.578 2.578	150 150
S5	525747.583	323809.941	4.200	1.677	600		1 0	1.003 1.004	2.523 2.523	150 150
S6	525748.349	323827.664	3.900	2.565	600		1 0	1.004 1.005	2.405 1.335	150 150
S7	525747.255	323837.007	2.100	1.855	1200		1 0	1.005 1.006	0.245 0.245	150 150
S13	525740.479	323846.072	2.150	2.025	1200		1 2 0	2.004 1.006 1.007	0.125 0.125 0.125	150 150 150
S8	525691.683	323766.731	4.900	0.900	600		0	2.000	4.000	150
S9	525712.336	323803.129	4.300	0.900	600		1 0	2.000 2.001	3.400 3.400	150 150
S10	525717.223	323817.242	4.900	1.600	600		1 0	2.001 2.002	3.300 3.300	150 150
S11	525723.547	323829.925	4.700	1.494	600		1 0	2.002 2.003	3.206 3.206	150 150
S12	525731.828	323846.924	4.800	4.600	600		1 0	2.003 2.004	3.080 0.200	150 150

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S14	525735.425	323853.569	4.900	1.830	1200	1	1.007	3.080	150
									
						0	1.008	3.070	150
HW	525725.955	323858.127	4.000	1.000	150	1	1.008	3.000	150
									

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	20	0	0
100	40	0	0

Node S13 Online Pump Control

Flap Valve	x	Design Depth (m)	3.000	Switch off depth (m)	0.100
Replaces Downstream Link	✓	Design Flow (l/s)	5.0		
Invert Level (m)	0.125	Switch on depth (m)	0.200		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.000	1.000	5.000	2.000	5.000	3.000	5.000

Node S2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	2.765	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	2	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	30.550		

Node S6 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	1.335	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	17.500		

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Node S9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.400	Slope (1:X)	70.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	4	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	41.800		

Node S10 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.300	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	15.000		

Node S11 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	3.206	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	14.000		

Node S12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.200	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	16.000		

Node S13 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.125	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	218	Depth (m)	1.360
Safety Factor	2.0	Width (m)	3.200	Inf Depth (m)	
Porosity	0.96	Length (m)	20.000		

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	1	2.970	0.000	0.0	0.0000	0.0000	OK
15 minute winter	S2	11	2.830	0.065	4.9	0.1545	0.0000	OK
15 minute winter	S3	11	2.799	0.073	7.0	0.0375	0.0000	OK
15 minute winter	S4	11	2.680	0.102	10.2	0.0590	0.0000	OK
15 minute winter	S5	11	2.619	0.096	10.1	0.0273	0.0000	OK
15 minute winter	S6	11	1.381	0.046	12.4	0.0702	0.0000	OK
120 minute winter	S7	84	0.396	0.151	4.8	0.1866	0.0000	SURCHARGED
120 minute winter	S13	84	0.393	0.268	9.7	15.6201	0.0000	SURCHARGED
15 minute summer	S8	1	4.000	0.000	0.0	0.0000	0.0000	OK
15 minute winter	S9	11	3.469	0.069	6.3	0.1454	0.0000	OK
15 minute winter	S10	11	3.387	0.087	8.5	0.2186	0.0000	OK
15 minute winter	S11	12	3.301	0.095	10.3	0.2545	0.0000	OK
120 minute winter	S12	84	0.395	0.195	4.2	0.7509	0.0000	SURCHARGED
30 minute winter	S14	22	3.134	0.064	5.0	0.0725	0.0000	OK
30 minute summer	HW	23	3.061	0.061	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S1	1.000	S2	0.0	0.000	0.000	0.1058	
15 minute winter	S2	1.001	S3	4.7	0.592	0.323	0.0460	
15 minute winter	S3	1.002	S4	7.0	0.654	0.483	0.2355	
15 minute winter	S4	1.003	S5	10.1	0.827	0.702	0.1015	
15 minute winter	S5	1.004	S6	10.0	0.864	0.691	0.2057	
15 minute winter	S6	1.005	S7	12.3	1.391	0.203	0.0836	
120 minute winter	S7	1.006	S13	4.6	0.491	0.252	0.1992	
120 minute winter	S13	Pump	S14	5.0				
15 minute summer	S8	2.000	S9	0.0	0.000	0.000	0.1608	
15 minute winter	S9	2.001	S10	6.1	0.666	0.425	0.1381	
15 minute winter	S10	2.002	S11	8.4	0.758	0.581	0.1570	
15 minute winter	S11	2.003	S12	9.9	0.865	0.688	0.2174	
120 minute winter	S12	2.004	S13	3.8	0.433	0.231	0.1530	
30 minute winter	S14	1.008	HW	5.0	0.725	0.347	0.0729	13.8

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	13	2.987	0.017	0.4	0.0047	0.0000	OK
15 minute winter	S2	12	2.981	0.216	12.1	1.2376	0.0000	SURCHARGED
15 minute winter	S3	12	2.966	0.240	12.3	0.1233	0.0000	SURCHARGED
15 minute winter	S4	12	2.854	0.276	18.5	0.1599	0.0000	SURCHARGED
15 minute winter	S5	12	2.736	0.213	18.2	0.0602	0.0000	SURCHARGED
15 minute winter	S6	11	1.400	0.065	23.8	0.1274	0.0000	OK
120 minute winter	S7	98	0.837	0.592	11.2	0.7331	0.0000	SURCHARGED
120 minute winter	S13	100	0.834	0.709	22.2	43.3413	0.0000	SURCHARGED
15 minute summer	S8	1	4.000	0.000	0.0	0.0000	0.0000	OK
15 minute winter	S9	12	3.608	0.208	15.6	0.7399	0.0000	SURCHARGED
15 minute winter	S10	13	3.540	0.240	18.1	0.9838	0.0000	SURCHARGED
15 minute winter	S11	13	3.416	0.210	18.9	0.7898	0.0000	SURCHARGED
120 minute winter	S12	98	0.836	0.636	9.9	3.0213	0.0000	SURCHARGED
60 minute summer	S14	29	3.134	0.064	5.0	0.0724	0.0000	OK
480 minute winter	HW	144	3.061	0.061	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	-0.4	0.058	-0.028	0.2850	
15 minute winter	S2	1.001	S3	10.2	0.639	0.705	0.1027	
15 minute winter	S3	1.002	S4	12.8	0.733	0.886	0.3902	
15 minute winter	S4	1.003	S5	18.2	1.036	1.262	0.1446	
15 minute winter	S5	1.004	S6	18.2	1.043	1.256	0.2943	
15 minute winter	S6	1.005	S7	23.7	1.635	0.389	0.1173	
120 minute winter	S7	1.006	S13	10.7	0.634	0.587	0.1993	
120 minute winter	S13	Pump	S14	5.0				
15 minute summer	S8	2.000	S9	0.0	0.000	0.000	0.3684	
15 minute winter	S9	2.001	S10	12.2	0.758	0.842	0.2629	
15 minute winter	S10	2.002	S11	14.8	0.842	1.026	0.2495	
15 minute winter	S11	2.003	S12	18.0	1.033	1.242	0.3131	
120 minute winter	S12	2.004	S13	8.5	0.557	0.515	0.1530	
60 minute summer	S14	1.008	HW	5.0	0.726	0.348	0.0729	46.5

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	14	3.227	0.257	4.2	0.0728	0.0000	SURCHARGED
15 minute winter	S2	13	3.219	0.454	18.9	3.6174	0.0000	SURCHARGED
15 minute winter	S3	13	3.195	0.469	14.7	0.2404	0.0000	SURCHARGED
15 minute winter	S4	12	3.042	0.464	22.9	0.2685	0.0000	SURCHARGED
15 minute winter	S5	12	2.857	0.334	22.6	0.0945	0.0000	SURCHARGED
15 minute winter	S6	12	1.437	0.102	30.9	0.2839	0.0000	OK
120 minute winter	S7	118	1.365	1.120	17.6	1.3873	0.0000	SURCHARGED
120 minute winter	S13	118	1.362	1.237	34.8	76.5167	0.0000	SURCHARGED
15 minute summer	S8	1	4.000	0.000	0.0	0.0000	0.0000	OK
15 minute winter	S9	13	3.830	0.430	24.2	2.5213	0.0000	SURCHARGED
15 minute winter	S10	13	3.732	0.432	22.2	1.9440	0.0000	SURCHARGED
15 minute winter	S11	13	3.546	0.340	24.3	1.3948	0.0000	SURCHARGED
120 minute winter	S12	118	1.364	1.164	15.7	5.7392	0.0000	SURCHARGED
15 minute winter	S14	10	3.134	0.064	5.0	0.0725	0.0000	OK
960 minute summer	HW	390	3.061	0.061	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	-4.2	-0.322	-0.292	0.5379	
15 minute winter	S2	1.001	S3	13.3	0.756	0.921	0.1027	
15 minute winter	S3	1.002	S4	15.5	0.882	1.075	0.3902	
15 minute winter	S4	1.003	S5	22.6	1.283	1.563	0.1446	
15 minute winter	S5	1.004	S6	22.4	1.272	1.547	0.3037	
15 minute winter	S6	1.005	S7	30.2	1.860	0.495	0.1430	
120 minute winter	S7	1.006	S13	16.9	0.958	0.923	0.1993	
120 minute winter	S13	Pump	S14	5.0				
15 minute summer	S8	2.000	S9	0.0	0.000	0.000	0.3684	
15 minute winter	S9	2.001	S10	12.9	0.765	0.893	0.2629	
15 minute winter	S10	2.002	S11	18.1	1.030	1.254	0.2495	
15 minute winter	S11	2.003	S12	22.3	1.268	1.543	0.3236	
120 minute winter	S12	2.004	S13	13.2	0.749	0.801	0.1530	
15 minute winter	S14	1.008	HW	5.0	0.725	0.348	0.0729	50.4

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.77%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	13	3.355	0.385	6.8	0.1089	0.0000	SURCHARGED
15 minute winter	S2	14	3.351	0.586	22.0	4.9491	0.0000	SURCHARGED
15 minute winter	S3	13	3.324	0.598	16.0	0.3067	0.0000	SURCHARGED
15 minute winter	S4	12	3.149	0.571	25.4	0.3304	0.0000	SURCHARGED
15 minute winter	S5	12	2.930	0.407	24.6	0.1152	0.0000	SURCHARGED
120 minute winter	S6	120	2.090	0.755	18.6	3.9797	0.0000	SURCHARGED
120 minute winter	S7	120	2.088	1.843	20.3	2.2830	0.0000	FLOOD RISK
120 minute winter	S13	120	2.085	1.960	40.1	85.1217	0.0000	FLOOD RISK
15 minute summer	S8	1	4.000	0.000	0.0	0.0000	0.0000	OK
15 minute winter	S9	14	3.924	0.524	28.3	3.5840	0.0000	SURCHARGED
15 minute winter	S10	13	3.817	0.517	24.1	2.3698	0.0000	SURCHARGED
15 minute winter	S11	13	3.609	0.403	26.4	1.6885	0.0000	SURCHARGED
120 minute winter	S12	120	2.086	1.886	18.0	9.4600	0.0000	SURCHARGED
15 minute summer	S14	10	3.134	0.064	5.0	0.0725	0.0000	OK
60 minute winter	HW	21	3.061	0.061	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	-6.8	-0.398	-0.469	0.5379	
15 minute winter	S2	1.001	S3	14.5	0.821	1.000	0.1027	
15 minute winter	S3	1.002	S4	17.0	0.965	1.176	0.3902	
15 minute winter	S4	1.003	S5	24.6	1.395	1.699	0.1446	
15 minute winter	S5	1.004	S6	24.3	1.382	1.682	0.3065	
120 minute winter	S6	1.005	S7	18.3	1.232	0.301	0.1656	
120 minute winter	S7	1.006	S13	19.4	1.104	1.063	0.1993	
120 minute winter	S13	Pump	S14	5.0				
15 minute summer	S8	2.000	S9	0.0	0.000	0.000	0.3684	
15 minute winter	S9	2.001	S10	13.8	0.783	0.953	0.2629	
15 minute winter	S10	2.002	S11	19.3	1.095	1.333	0.2495	
15 minute winter	S11	2.003	S12	23.9	1.359	1.654	0.3261	
120 minute winter	S12	2.004	S13	15.2	0.861	0.920	0.1530	
15 minute summer	S14	1.008	HW	5.0	0.725	0.347	0.0728	52.6

Flow+ v10.4 Copyright © 1988-2022 Causeway Technologies Ltd

Appendix H Proposed Drainage Maintenance Plan



SW DRAINS & MANHOLES

TO BE MAINTAINED BY BUILDING MANAGEMENT COMPANY

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
REGULAR MAINTENANCE	INSPECT AND IDENTIFY ANY AREAS THAT ARE NOT OPERATING CORRECTLY. IF REQUIRED TAKE REMEDIAL ACTION	MONTHLY FOR 3 MONTHS THEN ANNUALLY
OCCASIONAL MAINTENANCE	SURVEY INSIDE OF OUTLET PIPES TO CHECK FOR SEDIMENT BUILD UP AND REMOVE IF NECESSARY	EVERY 5 YEARS OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR PHYSICAL DAMAGE IF NECESSARY	AS REQUIRED

FILTER TRENCH

TO BE MAINTAINED BY BUILDING MANAGEMENT COMPANY

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
REGULAR MAINTENANCE	INSPECT INLETS STONE SURFACE FOR SEDIMENT AT SURFACE	QUARTERLY / AFTER STORM EVENTS
	INSPECT GEOTEXTILE MEMBRANE FOR SEDIMENT AT SURFACE	
	INSPECT INLETS, OUTLETS FOR SILT ACCUMULATION. ESTABLISH SILT REMOVAL FREQUENCIES	MONTHLY (AT START, THEN AS REQUIRED)
	GRASS CUTTING AT EDGES	
	MANAGE VEGETATION AND REMOVE NUISANCE PLANTS	MONTHLY (AT START, THEN AS REQUIRED)
	REMOVE LITTER AND DEAD LEAVES	MONTHLY
OCCASIONAL MAINTENANCE	REMOVE SEDIMENT FROM STONE SURFACE	1 – 5 YEARS OR AS REQUIRED
	REMOVE SEDIMENT FROM GEOTEXTILE MEMBRANE	1 – 5 YEARS OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR PHYSICAL DAMAGE OF STONE SURFACE AND GEOTEXTILE MEMBRANE	AS REQUIRED

BYPASS SEPARATOR

TO BE MAINTAINED BY BUILDING MANAGEMENT COMPANY

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
REGULAR MAINTENANCE	INSPECT CHAMBERS AND REMOVE SILT ACCUMULATION, LIGHT LIQUIDS AND SEDIMENTS.	EVERY 6 MONTHS OR AS REQUIRED
OCCASIONAL MAINTENANCE	SURVEY OUTLET PIPES TO CHECK FOR SEDIMENT BUILD UP AND REMOVE IF NECESSARY	EVERY 2 YEARS OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR PHYSICAL DAMAGE IF NECESSARY	AS REQUIRED

PUMPING STATION

TO BE MAINTAINED BY BUILDING MANAGEMENT COMPANY

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
REGULAR MAINTENANCE	INSPECT AND REMOVE SILT ACCUMULATION. ESTABLISH SILT REMOVAL FREQUENCIES	MONTHLY FOR 3 MONTHS THEN ANNUALLY
OCCASIONAL MAINTENANCE	REMOVE SILT WHEN 100MM DEEP IN CHAMBER BASE	EVERY 2 YEARS OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR PHYSICAL DAMAGE IF NECESSARY	AS REQUIRED

SW SILT TRAPS

TO BE MAINTAINED BY BUILDING MANAGEMENT COMPANY

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
REGULAR MAINTENANCE	INSPECT ACCESS POINTS FOR SILT ACCUMULATION TO ESTABLISH SILT REMOVAL FREQUENCIES	MONTHLY FOR 3 MONTHS THEN ANNUALLY
OCCASIONAL MAINTENANCE	REMOVE SILT WHEN 100MM DEEP	EVERY 2 YEARS OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR PHYSICAL DAMAGE IF NECESSARY	AS REQUIRED

CELLULAR STORAGE

TO BE MAINTAINED BY BUILDING MANAGEMENT COMPANY

MAINTENANCE SCHEDULE	REQUIRED ACTION	FREQUENCY
REGULAR MAINTENANCE	INSPECT AND IDENTIFY ANY AREAS THAT ARE NOT OPERATING CORRECTLY	MONTHLY FOR 3 MONTHS THEN ANNUALLY
	REMOVE DEBRIS FROM THE CATCH MENT SURFACE (WHERE IT MAY CAUSE RISKS TO PERFORMANCE)	MONTHLY
	REMOVE SEDIMENT FROM PRETREATMENT CATCH PITS	ANNUALLY OR AS REQUIRED
REMEDIAL ACTIONS	REPAIR/REHABILITATE INLETS, OUTLETS AND VENTS	AS REQUIRED
MONITORING	INSPECT/CHECK ALL INLETS, OUTLETS AND VENTS	ANNUALLY
	SURVEY INSIDE OF TANK FOR SEDIMENT BUILD UP AND REMOVE IF NECESSARY	EVERY 5 YEARS OR AS REQUIRED

KEY PLAN

- Proposed Foul drain and manhole
- Proposed Storm drain and manhole
- Existing Foul sewer and manhole — Ex 375Ø FW Sewer
- Existing Surface Water sewer and manhole — Ex 375Ø SW Sewer
- Existing Combined sewer and manhole — Ex 375Ø CW Sewer
- Private storm rodding eye
- 450mm dia. private inspection chamber.
- 600mm dia. private inspection chamber.
- Proposed road gully & connecting pipe work. 150Ø pipe unless noted otherwise — RG 150Ø
- Proposed channel drain with D400 rated pedestrian type covers and sump outlets — SO

NOTES

HEALTH & SAFETY
1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.
ROADS & DRAINAGE
2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE
3. THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
4. CONNECTIONS TO EXISTING SEWERS TO BE MADE BY SW APPROVED CONTRACTOR ONLY.
5. CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LEPTOSPIROSIS (WEILS DISEASE) AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
6. UNFINISHED MANHOLES MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIER.
PIPES & CABLES
7. SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND DIG AND PROTECTED ACCORDINGLY.
EXCAVATION/FILL
8. CONTRACTOR TO ENSURE RELEVANT MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
9. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
10. CONTRACTOR TO REFER TO GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

CONTRACTOR TO PROVIDE CCTV SURVEY OF ALL NEW DRAINAGE UPON COMPLETION

REVISIONS

P01	INITIAL ISSUE					
	GS	08/11/22	MP	08/11/22	MP	08/11/22
REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE

Hydrock 3E
2 Esh Plaza, Sir Bobby Robson Way
Great Park
Newcastle upon Tyne
NE13 9BA
t: +44 (0)191 230 2993
e: newcastle@3econsult.com

CLIENT
SEA ISLAND DEVELOPMENTS

PROJECT
ROMAN BANK EXTRACARE
ROMAN BANK, SPALDING

TITLE
DRAINAGE MAINTENANCE PLAN

HYDROCK PROJECT NO.	SCALE @ A1
P22-311	1:200
STATUS DESCRIPTION: SUITABLE FOR INFORMATION	STATUS: S2
DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER): P22-311-HYD-XX-XX-DR-C-1200	REVISION: P01

Plotted 28/11/2022 13:56:17

Appendix I Proposed Flood Depths Plan



KEY PLAN

FLOOD DEPTH DATA

NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR
1	0.00	0.30	
2	0.30	0.60	
3	0.60	0.90	
4	0.90	1.20	
5	1.20	1.50	
6	1.50	1.80	
7	1.80	2.10	
8	2.10	2.40	
9	2.40	2.70	
10	2.70	3.00	
11	3.00	3.30	

NOTES

HEALTH & SAFETY
1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.
ROADS & DRAINAGE
2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE
3. THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
4. CONNECTIONS TO EXISTING SEWERS TO BE MADE BY SW APPROVED CONTRACTOR ONLY.
5. CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LEPTOSPIROSIS (WEILS DISEASE) AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
6. UNFINISHED MANHOLES MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIER.
PIPES & CABLES
7. SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND DIG AND PROTECTED ACCORDINGLY.
EXCAVATION/FILL
8. CONTRACTOR TO ENSURE RELEVANT MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
9. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
10. CONTRACTOR TO REFER TO GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

REVISIONS

REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P01	INITIAL ISSUE					
	MH	19/10/22	DG	19/10/22	DG	19/10/22

Hydrock 3E
2 Esh Plaza, Sir Bobby Robson Way
Great Park
Newcastle upon Tyne
NE13 9BA
t: +44 (0)191 230 2993
e: newcastle@3econsult.com

CLIENT
SEA ISLAND DEVELOPMENTS

PROJECT
ROMAN BANK EXTRACARE
ROMAN BANK, SPALDING

TITLE
PROPOSED FLOOD DEPTHS PLAN
5.35mAOD EXTREME TIDAL FLOOD EVENT

HYDROCK PROJECT NO.	SCALE @ A1
P22-311	1:200

STATUS DESCRIPTION	STATUS
SUITABLE FOR INFORMATION	S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
P22-311-HYD-XX-XX-DR-C-0001	P01

Plotted 28/11/2022 15:03:13