# South Industrial Zone

## Environmental Statement
July 2020

Volume 3 - Technical Appendices

Appendices to Chapter G
(Water Management and Flooding)

# Appendix G1: Summary of Consultation with statutory consultees Traffic Data and Road Details

## Alice Gent

**From:** Steve Wharton <steve.wharton@nwl.co.uk>
**Sent:** 19 June 2020 13:49
**To:** Alice Gent
**Cc:** Joy Kean
**Subject:** RE: NWG Strategies - 2020s0709: South Tees - SIZ1 EIA Consultation

Afternoon Alice,

Peter has forwarded on your e-mail for me to provide you with a response.

With respect to the questions you have raised with regards Northunbrian Waters assets to accommodate development of this particular site, you will need to follow our pre planning enquiry service.

This is the link on our web site. https://www.nwl.co.uk/services/developers/developer-sewerage-services/pre-planning-enquiries/

In terms of blue green strategies, this is something that you need to take up with the Lead local flood authority for this area. The governance on the management of surface water sits with them.

If you need any further clarity then please feel free to just get in touch with me.

Thanks
Stephen

**Stephen Wharton**
**Developer Services (Planning and Wastewater) Manager**

☎ 0191 419 6617 | ☎ 36617
07713 987544 | 76718
steve.wharton@nwl.co.uk

Leat House | Pattinson Road | Washington | NE38 8LB

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**From:** Alice Gent [mailto:Alice.Gent@jbaconsulting.com]
**Sent:** 19 June 2020 10:54
**To:** 'peter.greenan@nwl.co.uk'
**Cc:** Joy Kean <Joy.Kean@jbaconsulting.com>
**Subject:** FW: 2020s0709: South Tees - SIZ1 EIA Consultation

Dear Peter,

Thank you for your time on the telephone a moment ago. As mentioned, we have been commissioned by Lichfields to undertake a high level assessment for water management for an EIA chapter for one of the sites (SIZ1) within the STDC development site.

Whilst the design for the site is yet to be developed, we would be grateful for Northumbrian Water's comments/policy position on blue green strategies, SUDS and process/considerations needed for ascertaining available capacity available in Northumbrian Water's network to accommodate flows from the development, as part of early engagement.

If you would like any further details, please do not hesitate to contact me.
Thank you.

Kind regards,
Alice

**Alice Gent**
Senior Chartered Analyst

JBA Consulting | www.jbaconsulting.com | t:0131 319 2940
*COVID-19. During the current outbreak JBA remains open for business and we continue to deliver our services. However, we have adopted flexible working with remote working in most cases. I will be receiving and reading email as normal and telephones will be redirected from the office number above.*

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**From:** Joy Kean <Joy.Kean@jbaconsulting.com>
**Sent:** 09 June 2020 12:37
**To:** 'peter.greenan@nwl.co.uk' <peter.greenan@nwl.co.uk>
**Cc:** Alice Gent <Alice.Gent@jbaconsulting.com>
**Subject:** 2020s0709: South Tees EIA Consultation

Dear Peter,

We are writing to consult with Northumbrian Water regarding the proposal for the South Bank EIA. Lichfields have asked in one of their briefing notes that the chapter authors liaise with the various bodies:

The proposed development site is located in the STDC area at South Industrial Zone 1 (SIZ1) centred at Ordnance Survey National Grid Reference (OS NGR) 454181 522251. SIZ1 is 247ha in size and is a brownfield site at the River Tees estuary, located 5km to the west of Redcar. Vehicular access to the site is be from the south along the A1053 (Tees Dock Road) and the South Bank railway station is located outwith the south west corner of the site.

The Southbank project involves undertaking a high-level ES chapter on water management, flooding, and hydrogeology for an outline planning application. In a previous meeting (27th May 2020), JBA Consulting (as part of the STDC Strategy Study) consulted with Northumbrian Water to discuss potential options for flooding and surface water management for the whole site. This included discussing approval to remove structures, re-routing/ diverting watercourses, and implementation of SuDS measures. Please could you email to confirm that your thoughts are the same as previously discussed, and state if you have additional comments at this early stage.

Commentary is therefore required on the following area:

- Flow capacity - Northumbrian Water would need to confirm capacity is available in their network to accommodate flows from the development.

Kind regards,
Joy
**Joy Kean**
Graduate Analyst
Internal extension: 2836

*COVID-19: During the current outbreak all JBA offices remain open and we continue to deliver our services. However, we have adopted flexible working with remote working in most cases.*
*I remain contactable via email, Skype for Business, or email me to request my personal contact number.*

**JBA Consulting, Suite 2F, Ingram House, 227 Ingram Street, Glasgow, Scotland, G1 1DA. Telephone: +441413780730**


*## The first message in this conversation was sent internally from within the JBA organisation. ##*

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## Alice Gent

**From:** Nigel Hill <Nigel.Hill@redcar-cleveland.gov.uk>
**Sent:** 11 June 2020 09:22
**To:** Joy Kean; Lyndsey Hall
**Cc:** Alice Gent
**Subject:** RE: 2020s0709: South Tees EIA Consultation

- Structure removal and proposed blue green network – proposal to improve the current situation but drainage proposals will be determined and included as part of the STDC strategy and further developed at design stage of the project. Acceptable in principal

- Flooding - land above 5.03m AOD (1 in 200 year + climate change allowance still water level) would be suitable for all types of development. The proposed platform level of 5.79m AOD is above the 1000 year plus climate change still water level and has a low probability of flood risk. A high-level site-specific FRA is being undertaken for the site. Acceptable in principal

- Local and National plans and policies - these have been considered OK

- Climate change – the Environmental Statement (ES) will consider the impact of climate change on water levels (as per the baseline assessment using government guidance). Need confirmation that wave overtopping and freeboard are not considered significant. OK

- Water quality - It is assumed that all surface water runoff will require SuDS treatment and attenuation prior to discharge into the Tees or local watercourses. Pollution control measures advised in the water strategy, such as bunding of potential sources of contamination, will be implemented in order to prevent potential contamination incidents to the Tees. OK

Regards
Nigel

---

**From:** Joy Kean <Joy.Kean@jbaconsulting.com>
**Sent:** 09 June 2020 11:48
**To:** Nigel Hill <Nigel.Hill@redcar-cleveland.gov.uk>; Lyndsey Hall <Lyndsey.Hall@redcar-cleveland.gov.uk>
**Cc:** Alice Gent <Alice.Gent@jbaconsulting.com>
**Subject:** 2020s0709: South Tees EIA Consultation

Dear Nigel/ Lyndsey,

We are writing to consult with the Lead Local Flood Authority (LLFA) regarding the proposal for the South Bank EIA. Lichfields have asked in one of their briefing notes that the chapter authors liaise with the various bodies:

The proposed development site is located in the STDC area at South Industrial Zone 1 (SIZ1) centred at Ordnance Survey National Grid Reference (OS NGR) 454181 522251. SIZ1 is 247ha in size and is a brownfield site at the River Tees estuary, located 5km to the west of Redcar. Vehicular access to the site is be from the south along the A1053 (Tees Dock Road) and the South Bank railway station is located outwith the south west corner of the site.

The Southbank project involves undertaking a high-level ES chapter on water management, flooding, and hydrogeology for an outline planning application. In a previous meeting (27th May 2020), JBA Consulting (as part of the STDC Strategy Study) consulted with RCBC to discuss potential options for flooding and surface water management for the whole site. This included discussing approval to remove structures, re-routing/ diverting watercourses, and implementation of SuDS measures. Please could you email to confirm that your thoughts are the same as previously discussed, and state if you have additional comments at this early stage.

Commentary is therefore required on the following areas:

- Structure removal and proposed blue green network – proposal to improve the current situation but drainage proposals will be determined and included as part of the STDC strategy and further developed at design stage of the project.

- Flooding - land above 5.03m AOD (1 in 200 year + climate change allowance still water level) would be suitable for all types of development. The proposed platform level of 5.79m AOD is above the 1000 year plus climate change still water level and has a low probability of flood risk. A high-level site-specific FRA is being undertaken for the site.

- Local and National plans and policies - these have been considered

- Climate change – the Environmental Statement (ES) will consider the impact of climate change on water levels (as per the baseline assessment using government guidance). Need confirmation that wave overtopping and freeboard are not considered significant

- Water quality - It is assumed that all surface water runoff will require SuDS treatment and attenuation prior to discharge into the Tees or local watercourses. Pollution control measures advised in the water strategy, such as bunding of potential sources of contamination, will be implemented in order to prevent potential contamination incidents to the Tees.

Kind regards,
Joy

**Joy Kean**
Graduate Analyst
Internal extension: 2836

**JBA Consulting, Suite 2F, Ingram House, 227 Ingram Street, Glasgow, Scotland, G1 1DA. Telephone: +441413780730**


---

## Alice Gent

**From:** Alice Gent
**Sent:** 26 June 2020 11:58
**To:** Alice Gent
**Subject:** FW: 2020s0709 South Tees EIA Consultation
**Attachments:** EA Charged Request Form - 3e.docx; North East PO Template.pdf

---

**From:** NA NE, Planning <planning.nane@environment-agency.gov.uk>
**Sent:** 22 June 2020 15:14
**To:** Joy Kean <Joy.Kean@jbaconsulting.com>
**Subject:** RE: 2020s0709 South Tees EIA Consultation

Dear Joy,

With respect to the pre-application, please find attached the Environment Agency's planning advice for developers – Frequently Asked Question's document. This document summarises the environmental issues we're responsible for and forms part of our free advice service at the pre-application stage.

The Environment Agency is not funded to undertake any work outside the statutory planning process. Therefore, if you require some site specific or face to face advice, this will be subject to charge. Charges for the Environment Agency's optional planning advice service is £100 per hour, per person (plus VAT). Further information regarding this service is available at https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions and https://www.gov.uk/guidance/environment-agency-fees-and-charges#planning-applications-advice

If you would like to proceed with our charged planning advice service, please complete and return the attached Charged Advice Form detailing the advice that you are seeking. We will use the information outlined in the form to determine the estimated costs and timescales for completing the work.

If you have any further questions please contact Caitlin Newby (Caitlin.newby@environment-agency.gov.uk).

Many thanks,

**Lewis Pemberton**

**Planning Officer**

**Environment Agency** | Tyneside House, Skinnerburn Road, Newcastle, NE4 7AR

Environment Agency staff have commenced working from home as part of a continuity management plan for staff regarding Coronavirus (COVID-19). All staff can be contacted via e-mail or telephone as usual. Please accept our apologies in advance for any delays in our service during this time, which we are minimising as much as possible. Non urgent meetings will be held remotely or will be rearranged.

lewis.pemberton@environment-agency.gov.uk

planning.nane@environment-agency.gov.uk (this is a shared mailbox please use this for any planning related queries)

Mobile: 07387050497





**From:** NE Yorkshire, Customer Contact
**Sent:** 09 June 2020 14:29
**To:** NA NE, Planning <planning.nane@environment-agency.gov.uk>
**Subject:** FW: 2020s0709 South Tees EIA Consultation

One for you I believe

Yorks C&E team

**From:** Joy Kean [mailto:Joy.Kean@jbaconsulting.com]
**Sent:** 09 June 2020 13:18
**To:** Northeast Newcastle, Customer Contact <northeast-newcastle@environment-agency.gov.uk>
**Cc:** NE Yorkshire, Customer Contact <neyorkshire@environment-agency.gov.uk>; Enquiries, Unit <enquiries@environment-agency.gov.uk>; Alice Gent <Alice.Gent@jbaconsulting.com>
**Subject:** 2020s0709 South Tees EIA Consultation

ON HOLD – sent to SP to see if pre app – AH 8/6

Dear Anna,

We are writing to consult with the Environment Agency regarding the proposals for the South Bank EIA/wider STDC Strategy study.
We would therefore like to arrange a tele-conference to discuss these proposals ahead of the South Bank Outline planning application.

South Bank:
The proposed development site is located in the STDC area at South Industrial Zone 1 (SIZ1) centred at Ordnance Survey National Grid Reference (OS NGR) 454181 522251. SIZ1 is 247ha in size and is a brownfield site at the River Tees estuary, located 5km to the west of Redcar. Vehicular access to the site is be from the south along the A1053 (Tees Dock Road) and the South Bank railway station is located outwith the south west corner of the site.

The Southbank project involves undertaking a high-level ES chapter on water management, flooding, and hydrogeology for an outline planning application

Please confirm your availability as soon as possible.

Kind regards,
Joy

**Joy Kean**
Graduate Analyst
Internal extension: 2836

*COVID-19: During the current outbreak all JBA offices remain open and we continue to deliver our services. However, we have adopted flexible working with remote working in most cases.*
*I remain contactable via email, Skype for Business, or email me to request my personal contact number.*

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*## The first message in this conversation was sent internally from within the JBA organisation. ##*

# Appendix 4 Charged advice request form

**SECTION 1**

**About you**

Please provide the following details:

| |
|---|
| Contact Name: |
| Company Name: |
| Your Ref: |
| Address: |
| |
| |
| Postcode: |
| Phone: |
| Email: |

**SECTION 2**

**About your proposed development**

| |
|---|
| Site Address/Location of Site |
| |
| |
| |
| Postcode<br>National Grid Map Reference |

| |
|---|
| Project Description: |

**SECTION 3**

**A checklist for the documents we need**

**Essential documents**
We need the following in order to discuss how we might give you advice:

- **A location plan** clearly showing the boundary of the proposed development. This should be at a scale between 1:100 and 1:2500 and should show any watercourses or water bodies within your development site
- **An indicative layout plan** of the proposed works, including all proposed access roads, buildings and other structures together with any site formation and temporary works that you propose to carry out
- **A plan of any other development or works** that you may carry out, or request others to carry out, in order for you to construct and/or to operate your proposed development

**Documents on which you may want our advice may include:**

- **A draft environmental statement** where required by EIA Regulations (please note that we need to know the complete scope of your proposed environmental statement)
- **A flood risk assessment** – see our standing advice on proposed development in flood risk areas
- **A report on potential impacts on a water body in a River Basin Management Plan** including works in a main river and proposed eel and fish passes
- **A preliminary risk assessment for impacts of land contamination** including the risk of polluting surface water and ground water
- **An assessment of impacts on a wetland site designated under the Habitats or Wild Birds Directive** where those impacts may concern us

**Please list below any other documents you want our advice on:**


# Planning advice for developers – FAQs

## Introduction

Local planning authorities (LPAs) across the North East are required to consult us on certain planning applications which affect flood risk, groundwater, waste, or water quality.

If your development falls into one of these categories, we'll be invited to comment on your planning application. Your LPA, when considering your application, will take our comments into account.

We've produced this guidance to summarise the environmental issues we're responsible for. The guidance forms part of our free advice service; if you require site-specific or face-to-face advice, we'll need to recover our costs through our charged advice service. Engaging with us early can help you identify the big issues, reduce the chances of subsequent delays and help you design a more sustainable and attractive development.

## Development and flood risk

**Is my development proposal at risk of flooding?**

The flood map for planning shows where flooding from rivers and the sea may occur. Whilst this map isn't suitable for a detailed flood risk assessment, it'll show which flood zone your development is located within and therefore will indicate whether further assessment is needed. You should also refer to your LPA's strategic flood risk assessment which will provide additional local information on flood risk, including the location of functional floodplain and areas which are susceptible to other sources of flooding such as from surface water or reservoirs.

**Will my application need to pass the sequential and exception tests?**

Local planning authorities apply the sequential test to steer development towards areas at the lowest risk of flooding. If your proposal is located within flood zones 2 or 3, you should contact your LPA to discuss the sequential test **before** submitting your application. The LPA may require you to submit information with your application in support of the sequential test.

If the LPA confirm that the sequential test has ruled out steering the development to lower risk sites, the development may also need to pass the exception test by demonstrating that its sustainability benefits outweigh flood risk and that it can be made safe for its lifetime, through the production of a site-specific flood risk assessment. Planning practice guidance advises when an exception test will be required, which will depend on the vulnerability of the development and the flood zone it lies within.

**Do I need to submit a flood risk assessment with my planning application?**

You'll need to submit a flood risk assessment if your application lies within flood zones 2 or 3 or is over 1 hectare within flood zone 1. You'll also need to submit an assessment if your proposal could be affected by sources of flooding other than from rivers or the sea. For certain lower risk applications, we've provided 'flood risk standing advice' which enables local planning authorities to assess flood risk assessments without the need to consult us.

**What information should I include in my flood risk assessment?**

We recommend that you refer to the checklist for a site-specific flood risk assessment for detailed advice on what to include in your flood risk assessment. Alongside referring to your LPA's strategic flood risk assessment, you should contact your LPA to find out whether there are any development guidelines which are specific to your locality.

**Can I undertake my own flood risk assessment?**

Your FRA must be appropriate to the scale, nature and location of the development whilst being credible and fit-for-purpose. Whilst it's possible to undertake your own assessment, most applicants employ suitably experienced professionals. We're not able to recommend specific consultants, but a simple web search should help you source a competent individual or company.

**Do I need to consider how climate change will affect my proposal's flood risk?**

Yes, you should demonstrate how flood risk will be managed now and over the development's lifetime, taking climate change into account. Please refer to the following guidance when undertaking your flood risk assessment. In some cases we'll hold the climate change flood data you need. In others you'll need to undertake your own analysis to understand the impacts.

**Where can I get modelled or historic flood levels from?**

Email our Customers and Engagement team (northeast-newcastle@environment-agency.gov.uk) to find out whether we have any modelled or historic flood levels available for your development site. A list of the packages of information we're able to provide can be found under the 'get information to complete an assessment' section of the planning practice guidance. They'll aim to provide this information within 20 days. We no longer charge for providing this information.

**The risk portrayed by your flood map doesn't seem to reflect the site's actual risk. How do I 'challenge' your flood map?**

If you have evidence suggesting that our flood map is inaccurate, please contact our Customers and Engagement team (northeast-newcastle@environment-agency.gov.uk) who will provide you with any existing data we hold. To formally contest our flood zones, you'll need to submit supporting evidence, such as digital copies of a topographic survey or modelling for quality assurance purposes. Digital files of the proposed new flood zones in ArcMap or MapInfo format should also be supplied. Any new outline data you submit must conform to our flood zones policy, copies of which are available on request.

Whilst we'll usually be happy to review any topographical survey or model prior to the application being submitted, we would have to recover our costs for this work. In some cases where work to review and update our existing models is already underway, we may decline to consider a challenge.

As we have to be certain that the data which informs our flood map is fit-for-purpose, any revisions will need to meet stringent quality checks.

## SURFACE WATER AND DRAINAGE

**Who's responsible for managing surface water?**

Lead local flood authorities are responsible for providing advice on the management of surface water resulting from new major development. Internal drainage boards, were established, have permissive powers to manage water levels within their drainage districts, so also play a key role in managing surface water.

**Will I need to provide surface water storage and limit the discharge rate?**

You should contact your lead local flood authority to discuss surface water discharge rates and storage requirements. Typically, they'll ask that your development does not increase run-off and limits the discharge to the existing greenfield run-off rate (usually 1.4l/s/ha if not calculated).

**Do I need to install sustainable drainage systems?**

Sustainable Drainage Systems (SuDS) should always be carefully considered in discussion with your lead local flood authority. A SuDS scheme can reduce flood risk, improve water quality, create better habitats for wildlife, and produce pleasant, more amenable places for people.

Infiltration drainage must not, however, pose a risk to groundwater quality. All infiltration SuDS must:

- Meet the groundwater protection criteria set out on GOV.UK
- Not be constructed in ground affected by contamination

**Who should I contact about connecting my development to the mains sewer?**

Talk to your water company about connecting to their sewerage system. Here are some contact details for water companies operating in the North East Environment Agency area:

Northumbrian Water developmentenquiries@nwl.co.uk

**My development is a long way from the mains sewer. Can I install a 'non-mains' drainage system, such as a package treatment plant?**

New development should connect to the public mains sewer wherever possible. Individual treatment plants can deteriorate local water quality and are more challenging to monitor and regulate. If you can't connect to the mains sewer, your planning submission should outline how you will deal with foul drainage discharge. You should include evidence as to why it is not possible to connect to the mains system, including details of any prohibitive costs. Please note that some 'non-mains' foul water drainage systems will require an environmental permit, irrespective of any planning approval.

## OTHER ENVIRONMENTAL CONSIDERATIONS

**What other environmental issues will you consider with my planning application?**

Your planning application will need to demonstrate that any environmental risks can be managed, through design and construction, for the development's lifetime. Alongside flood risk, the key environmental risks we'll consider are:

- **Land contamination**
  We're mainly interested in those sites where there is a risk of pollution to controlled waters. You should investigate any contamination to see whether the environmental risk or cost of clean-up (remediation) would hinder your proposal. If contamination is known or suspected, a desktop study, investigation, remediation and other works may be required to enable safe development. Our model procedures for the management of land contamination provide further information.

- **Pollution prevention**
  Your application should demonstrate how you'll minimise the risk of pollution from all aspects of your development, including construction and

operation phases. Groundwater can be vulnerable to pollution, as well as rivers and streams. Some areas (source protection zones and aquifers) are especially sensitive to pollutants as they typically supply public drinking water. To find out whether your development is located in an area sensitive to groundwater pollution, visit our interactive maps. Advice on groundwater protection can be found on GOV.UK

- **Fisheries, biodiversity, geomorphology and protected species**
  If your proposal is likely to affect the ecology of a main river, you'll need to carry out a risk assessment. This assessment should show that your development can proceed without demonstrable harm, and should propose mitigation, compensation or enhancements where required. A survey should be carried out if any protected species are thought to be nearby. If this survey confirms the presence of protected species or their habitat, measures should be taken to manage the development's risks. Natural England are the statutory consultee for other biodiversity-related matters. Further information on their remit can be found on GOV.UK

- **Water framework directive**
  If your proposal affects ground or surface waterbodies, you'll need to consider the Water Framework Directive (WFD) and the actions set out in the Northumbria River Basin Management Plan. You'll also need to submit a WFD Assessment demonstrating how the development will prevent deterioration and improve the waterbody's ecological status.

- **River buffer zone**
  Your development should ensure that an 8m strip of land (planted with locally appropriate, native species) is left undisturbed next to the bank of any main river. This 'river corridor' will improve habitat connectivity and will ensure we're able to access the bank for any future flood defence construction and maintenance.

- **Culverting**
  We're opposed to culverting. Culverts degrade watercourses' ecology and prevent the movement of wildlife and fish. As culverts can easily become blocked, they increase flood risk. They're also difficult to inspect and maintain. We may object to any planning applications involving culverting on a main river and may refuse to grant an environmental permit. Existing culverts should be removed and the river channel and bankside habitat reinstated to restore the ecological continuity of the river channel and its corridor.

**Will I need any other Environment Agency permits for my development?**

You might need an environmental permit if your development manages or produces waste or emissions that pollute the air, water or land or is work that affects a main river or a sea defence. The lead local flood authority is responsible for any consents relating to ordinary watercourses.

The Environmental Permitting Regulations (England and Wales) 2015 cover water discharges, groundwater activities, flood risk activities, radioactive substances, waste, mining waste and installations. They also include provision for a number of directives including batteries. Further information, including contact details for further permitting related enquiries, can be found here.

As planning and permitting decisions are often closely linked, we have issued detailed guidance for developments requiring planning permission and environmental permits. This guidance explains how, when responding to planning consultations that require environmental permits, we will advise of three possible positions:

- No major permitting concerns
- More detailed consideration is required and parallel tracking is recommended
- Don't proceed – unlikely to grant a permit.

## PRE-APPLICATION ADVICE

**Can you provide site-specific advice, review a submission document, or attend a site meeting before I submit my planning application?**

We encourage you to seek pre-application advice as it can help you solve key environmental issues early, reduce the chance of an objection and help you design a more sustainable development. If you'd like to take advantage of this service, please email our Sustainable Places team so that we can provide further details and estimated costs.

Please note that any pre-application guidance we provide doesn't represent our final view in relation to any future planning application. We recommend that you seek your own expert advice prior to submitting your application.

**Who should I contact for further information?**

North East planning enquiries: planning.nane@environment-agency.gov.uk

General enquiries: 03708 506 506

Tyneside House Skinnerburn Road Newcastle Business Park Newcastle upon Tyne NE4 7AR
https://www.gov.uk/government/organisations/environment-agency

# Appendix G2: Flood Risk Assessment

# South Bank Flood Risk Assessment

## Final Report

**June 2020**

**www.jbaconsulting.com**

**South Tees Development Company**
Teeside Management Offices
REDCAR
TS10 5QW

## JBA Project Manager

Alice Gent BSc CEnv MCIWEM C.WEM
Unit 2.1 Quantum Court,
Heriot Watt Research Park,
Riccarton,
Research Ave S,
Edinburgh
EH14 4AP

## Revision History

| Revision Ref/Date | Amendments | Issued to |
|---|---|---|
| 26/06/2020 | Draft Report | John McNicholas and Lichfields |
| 03/06/2020 | Minor amendments following comments | John McNicholas and Lichfields |
| 06/07/2020 | Marked as final | John McNicholas and Lichfields |

## Contract

This report describes work commissioned by John McNicholas, on behalf of South Tees Site Company, by an email dated 18 May 2020. South Tees Site Company's representative for the contract was John McNicholas of South Tees Site Company. Alice Gent, Bryony McLeod and René Dobson of JBA Consulting carried out this work.

Prepared by ..... Alice Gent BSc MCIWEM C.WEM CEnv

Chartered Senior Analyst

..... Bryony McLeod BSc MSc

Analyst

Reviewed by ..... Rene Dobson BEng CEng MICE

Associate Director

## Purpose

This document has been prepared as a Final Report for South Tees Site Company. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to South Tees Site Company.

## Acknowledgements

JBA wishes to thank Redcar and Cleveland Council and the Environment Agency for supply for flood history records.

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JBA is aiming to reduce its per capita carbon emissions.

## Contents


| | | |
|---|---|---|
| 1 | Introduction | 6 |
| 1.1 | Scope of Works | 6 |
| 1.2 | Reporting guidelines and legislation context | 6 |
| 2 | Flood Risk Assessment | 7 |
| 2.1 | Site Details and location | 7 |
| 2.1.1 | Catchment hydrology | 7 |
| 2.1.2 | Designations within or in proximity to the site | 9 |
| 2.2 | Historical and existing land use | 10 |
| 2.3 | Proposed development | 10 |
| 2.4 | Sources of Flood Risk | 10 |
| 2.4.1 | Fluvial and coastal flooding | 11 |
| 2.4.1.1 | Climate change - fluvial | 13 |
| 2.4.1.2 | Climate change sea level | 14 |
| 2.4.1.3 | Offshore wind speed and extreme wave height allowance | 15 |
| 2.4.2 | Pluvial flooding | 16 |
| 2.4.2.1 | Climate change | 16 |
| 2.4.3 | Groundwater flooding | 17 |
| 2.4.4 | Sewers, culverts and bridges | 17 |
| 2.4.5 | Reservoir flooding / breach | 18 |
| 2.5 | Flood History | 19 |
| 2.6 | Flood estimation | 20 |
| 2.6.1 | Approach to peak flow estimation | 20 |
| 2.6.2 | Hydraulic modelling | 20 |
| 2.6.3 | Assumptions and Limitations of the modelling | 21 |
| 2.6.4 | Pre-development scenario | 29 |
| 2.6.4.1 | Fluvial flood risk | 29 |
| 2.6.4.2 | Coastal and tidal flood risk | 29 |
| 2.6.4.3 | Surface water flood risk | 30 |
| 2.6.5 | Post development scenario | 30 |
| 3 | Flood mitigation measures | 31 |
| 3.1 | Flood warning system and existing alleviation | 31 |
| 3.2 | Asset design and protection | 31 |
| 3.3 | Surface water and drainage management | 31 |
| 3.4 | Safe access and egress | 31 |
| 3.5 | Potential impact of the proposed development on flood risk within and outwith the site | 32 |
| 4 | Conclusions | 33 |

## List of Figures

Figure 2-1: Map showing watercourses on site 7
Figure 2-2: Map showing the hydrological catchments and geology at the site 9
Figure 2-3: Extract from Environment Agency flood map for planning at the site 12
Figure 2-4: : Extract from EA map of long term flood risk flood extent from rivers or the sea 13
Figure 5: Extract from EA Long term surface water flood risk map 16
Figure 2-6 Extract from the EA Flood Maps for reservoir flooding 18

## List of Tables

Table 2-1: Catchment descriptors for both catchments draining to the site. 8
Table 2-2: Initial development parameters 10
Table 2-3: EA Peak flow allowances, Northumbrian River Basin District (use 1961 to 1990 baseline) 14
Table 2-4: EA Sea level allowance for each epoch for Northumbria 14
Table 2-5: Tees Tidal UKCP18 Tees Tidal Uplift Value 14
Table 2-6: Tees Tidal UKCP18 Tees Tidal Climate Change Uplift Levels 15
Table 2-7: EA Offshore wind speed and extreme wave allowance 15
Table 2-8: EA Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline) 17

## Abbreviations

| | |
|---|---|
| AEP | Annual Exceedance Probability |
| ALTBAR | Mean catchment altitude (m above sea level) |
| ASCII | American standard character set for information interchange |
| BFIHOST | Base Flow Index estimated from soil type |
| BGS | British Geological Survey |
| DEFRA | Department of the Environment, Food and Rural Affairs (formerly MAFF) |
| DPLBAR | Index describing catchment size and drainage path configuration |
| DPSBAR | FEH index of mean drainage path slope |
| DTM | Digital Terrain Model |
| EA | Environment Agency |
| EIA | Environmental Impact Assessment |
| FARL | FEH index of flood attenuation due to reservoirs and lakes |
| FEH | Flood Estimation Handbook |
| FRA | Flood Risk Assessment |
| LiDAR | Light Detection And Ranging |
| mAOD | metres Above Ordnance Datum |
| NGR | National Grid Reference |
| NPPF | National Planning Policy Framework |
| OS | Ordnance Survey |
| OS NGR | Ordnance Survey National Grid Reference |
| PDF | Portable Document Format |
| PPG | Planning Policy Guidance |
| PROPWET | FEH index of proportion of time that soil is wet |
| Ramsar | The intergovernmental Convention on Wetlands, signed in Ramsar, Iran, in 1971 |
| SAAR | Standard Average Annual Rainfall (mm) |
| SFRA | Strategic Flood Risk Assessment |
| SPRHOST | Standard percentage runoff estimated from soil type |
| SSSI | Site of Special Scientific Interest |

## Definitions

| | |
|---|---|
| FARL | Flood Attenuation by Reservoirs or Lakes. This provides a guide to the degree of flood attenuation by reservoirs or lakes in the catchment which will have effect on flood response. A value of 1 indicates no attenuation, whereas 0.8 and under indicates substantial attenuation. |

# 1 Introduction

## 1.1 Scope of Works

The South Tees Development Corporation (STDC) commissioned JBA Consulting in May 2020 to prepare the Water Management and Flooding chapter of the Environmental Impact Assessment (EIA) for the outline planning application for one of the sites within the STDC area on the south bank of the River Tees, near Redcar. The chapter will comprise an assessment of water management and flooding, as well as examining drainage and hydrogeology.

This Flood Risk Assessment (FRA) study has been undertaken to provide details that inform the Water Management and Flooding chapter. The study is necessary to meet the requirements of the National Planning Policy Framework[1] (NPPF) and to support the outline planning application in relation to assessing flood risk.

This FRA will comprise the following:

- Data review – including:
  - request for flood records from Redcar and Cleveland Council and the Environment Agency
  - Review of Phase 1 Data Collection and Baseline Assessment report for the wider STDC development
- Review of baseline risk for water management and flooding and assess the impacts of the proposed development
- Discuss flood, surface water and groundwater receptors and identify appropriate mitigation and enhancement measures
- Assess impacts of proposed development

## 1.2 Reporting guidelines and legislation context

This Flood Risk Assessment (FRA) is consistent with the reporting requirements detailed within the National Planning Policy Framework (NPPF).

The aim of this FRA is to present relevant information pertaining to flooding in a clear format that can be reviewed by the Planning Authority and the Environment Agency. It does not guarantee that the proposed development will be acceptable to the Planning Authority and the Environment Agency in terms of flood risk and water management.

1 NPPF https://www.gov.uk/government/publications/national-planning-policy-framework--2 [accessed 25 May 2020]

# 2 Flood Risk Assessment

## 2.1 Site Details and location

The proposed development site is located in the STDC area as part of the South Industrial Zone 1 (SIZ1) – hereafter referred to as the site – and is centred at Ordnance Survey National Grid Reference (OS NGR) 454181 522251. The site is 174ha (1,740,000m$^2$) in size and comprises brownfield land at the River Tees estuary, located 5km to the west of Redcar. Current vehicular access to the site is from the south along the A1053 (Tees Dock Road) and the South Bank railway station is located to the south west of the site. It does however exclude four areas within the outer boundary, which relate to industries /businesses still present.

### 2.1.1 Catchment hydrology

The site lies within the catchment of the River Tees that lies adjacent to the northern boundary of the site. It is also within the catchments of two waterbodies – the Lackenby channel, which drains along the eastern boundary of the site and into which the Cleveland channel drains, and an unnamed channel which drains through the southern section of the site that was historically part of the Holme Beck watercourse that discharged to the Tees (at present, the Holme Beck is culverted and flows are directed to the Cleveland channel). Both channels discharge to the River Tees. The 1m Lidar DTM shows the elevations at the site are mostly between 6-12 mAOD. There is a large raised area in the centre of the site, to the east of the unnamed channel which rises to 27 mAOD.

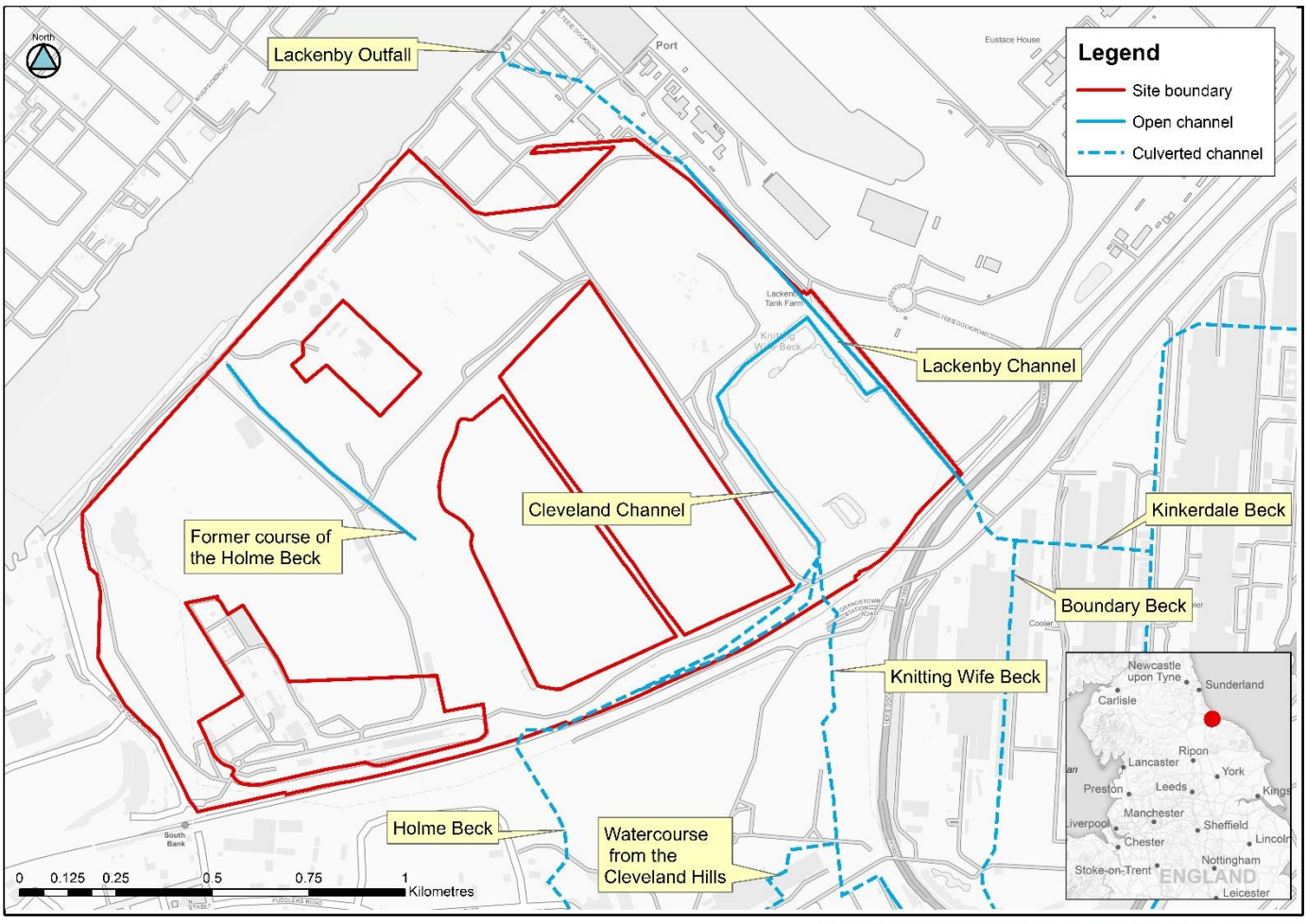





**Figure 2-1: Map showing watercourses on site**

The Cleveland channel is a large open channel which receives flows from the Holme Beck and Knitting Wife Beck culverts at the southern boundary of the development parcel. Flows in the Cleveland Channel are conveyed to Lackenby Channel around an area associated with iron and steel production recycling. The Lackenby Channel which flows along the eastern boundary of the development zone also receives flow from Boundary Beck and Kinkerdale culverts. In the Lackenby Channel downstream of the confluence with the Cleveland channel there is an in-channel structure assumed to act as a tidal weir. Beyond the weir the Lackenby channel is a deep large open channel that drains to a culvert of unknown dimension which conveys flows below Teesport to an outfall on the River Tees.

The hydrological catchment of the Lackenby Channel, down to NZ 54600 22950, has an area of approximately 8.3km$^2$. The catchment drains from the south-east to the north-west. It rises on Eston Moor to the south east of the site at elevations of 240mAOD and drains north west, declining to an elevation of approximately 50 mAOD at the site. The FARL value of 0.844 for the catchment indicates there is capacity for water storage within the catchment, this includes the reservoirs either side of the A174 and the wide open Cleveland Channel that runs parallel to the Lackenby Channel within the development site. Both catchments are shown in Figure 2-2.

The catchment at the downstream extent of the former course of the Holme Back, at NZ 53400 22500 has an area of approximately 4.9km$^2$. It is adjacent to the Lackenby Channel catchment and also originates on Eston Moor. Under current conditions the majority of this catchment is diverted into the Lackenby Channel via a culvert. Both catchments are highly urban.

**Table 2-1: Catchment descriptors for both catchments draining to the site.**

| Catchment Descriptor | Lackenby Channel catchment | Former Holme Beck channel catchment |
|---|---|---|
| AREA (km2) | 8.3 | 4.9 |
| ALTBAR (m above sea level) | 34 | 63 |
| BFIHOST | 0.375 | 0.385 |
| BFIHOST19 | 0.390 | 0.399 |
| DPLBAR (km) | 3.51 | 4.75 |
| DPSBAR (m/km) | 44.2 | 67.9 |
| FARL | 0.844 | 0.997 |
| PROPWET | 0.31 | 0.32 |
| SAAR (mm) | 619 | 635 |
| SAAR4170 (mm) | 620 | 646 |
| SPRHOST (%) | 36.96 | 35.75 |
| URBEXT1990 | 0.4307 | 0.3188 |
| URBEXT2000 | 0.4573 | 0.3965 |

The British Geological Survey[2] online viewer indicates the underlying bedrock geology is Triassic Rock which comprises of sandstone, siltstone and mudstone. The superficial geology is raised Marine deposits, comprising of sand and gravel.

2 http://mapapps,bgs.ac.uk/geologyofbritain/home.html

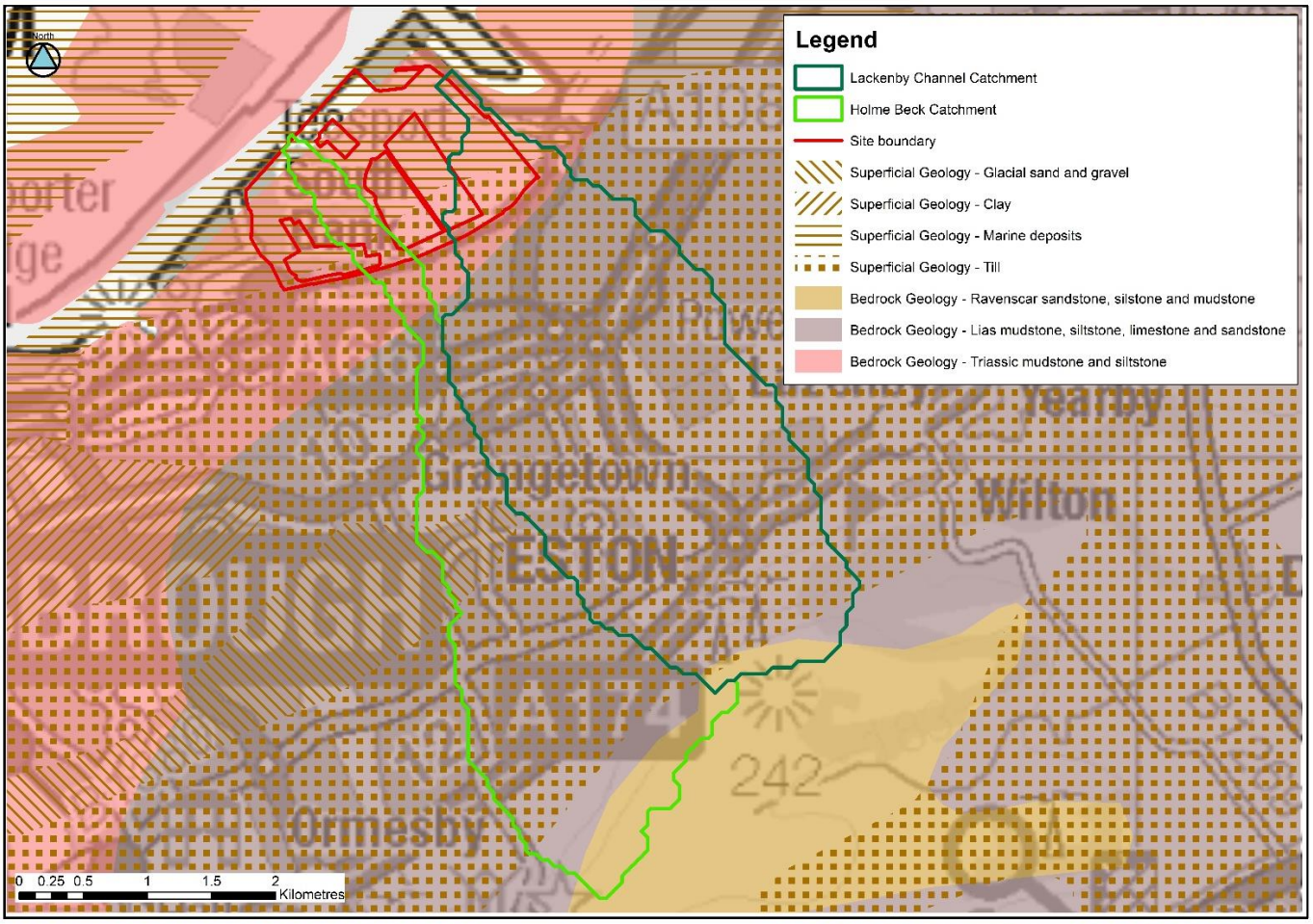





**Figure 2-2: Map showing the hydrological catchments and geology at the site**

### 2.1.2 Designations within or in proximity to the site

A search for designations within or within 2km of the site has been completed using the Defra MAGIC portal[3]. Teesmouth and Cleveland Coast SSSI extends across the whole of the River Tees estuary and lies directly adjacent to the north of the site. This is in place to protect the coastal and freshwater habitats on the estuary. This includes areas of Jurassic and quaternary geology, notably the Redcar Rocks in the area of the site. Sand dunes, saltmarshes, mudflats, rocky and sandy shores, saline lagoons, grazing marshes, reedbeds and freshwater wetlands provide habitats for breeding and non-breeding birds as well as assemblage for invertebrates. The coastal habitat provides breeding areas for harbour seals. The site is located within the SSSI impact risk zone which requires planning applications to be assessed for likely impacts on the SSSI. The site is also located within a Wild Bird General License exclusion zone due to its adjacency with the SSSI protected site, requiring a special licence for any licensable actions to be carried out on site.

Located on the opposite side of the Tees Estuary from the site is a designated Ramsar site for the mudflats which provide a breeding ground for wetland birds. Considerations for this will be the same as those for the SSSI impact risk zone. Approximately 2km to the south east of the site is the Groundwork North East area of community forest. Due to the distance from the site, the proposed development is not anticipated to have any impact on this designated site.

3 https://magic.defra.gov.uk/MagicMap.aspx

## 2.2 Historical and existing land use

The site currently lies unused as brownfield land. The STDC area and the site covers land that was raised and reclaimed from the River Tees and the sea around the 1930s/40s, to progressively realise the current industrial area.

Previous land use at the site includes the iron and steel industries. The south eastern corner was in use as landfill and waste management facilities for the disposal of by-products from these industries. Cement, metals and non-hazardous waste has also been disposed of in this location. Other usage of the site has been for the storage of materials and freight rail infrastructure uses.

Given that much of the former industrial land is reclaimed the site topography is generally very flat with the exceptions of the watercourses where in open channel and current and historic landfills. All of these waterbodies have been heavily modified and many culverted.

## 2.3 Proposed development

The current draft proposed development is for a general Use Class B2 and B8 development over 418,000m$^2$. These are classed as general industry and storage or distribution facilities respectively. The development will also include associated land uses such as ancillary office accommodation, HGV and car parking and associated works. It is noted the planning application will not be specifically linked to the offshore wind industry so it can be promoted to general manufacture occupiers. However, the development parameters will be set to allow use by this specific industry if the opportunity arises. The initial development parameters have been developed by the client and are specified in Table 2-2 below.

**Table 2-2: Initial development parameters**

| Development Parameter | Amount/use |
|---|---|
| Use Class | B2 (General industry)<br>B8 (Storage or Distribution)<br>B1 (Office)(maximum 10% of overall floorspace) |
| Maximum Floorspace | 4.5m sqft / circa 418,000 sqm |
| Maximum Development Height | 46m AOD |
| Finished Floor Level | 5.79mAOD |
| Maximum Building Height | 40.21 AOD |
| Access | 2 access points (Smiths Dock Road and Tees Dock Road) |

The proposed development is being submitted as an outline planning application to Redcar and Cleveland Borough Council.

## 2.4 Sources of Flood Risk

There are a number of potential sources of flooding that could impact any site; these are fluvial (originating from a watercourse), coastal, groundwater, surface water (pluvial), sewers and blocked culverts and infrastructure failure. The purpose of this report is to provide an assessment of flood risk to the site from these sources.

Within England, the Flood Risk and Coastal Change Planning Practice Guidance (FRCC-PPG)[4] sits alongside the NPPF and sets out detailed guidance on how this policy should be

4 Flood risk and coastal change https://www.gov.uk/guidance/flood-risk-and-coastal-change [accessed 25 May 2020]

implemented. It has a three stage approach: assess flood risk, avoid flood risk and manage / mitigate flood risk.

The flood probabilities used to describe Flood Zones as defined in the FRCC-PPG are noted below:

| Flood Zone | Annual Probability of Flooding |
|---|---|
| 1 | This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%). |
| 2 | This zone comprises 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 |
| 3a | This zone comprises 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. |
| 3b | This zone comprises land where water has to flow or be stored in times of flood. This includes land that would flood with an annual probability of 1 in 20 (5%) or 1 in 25 (4%) or greater in any year, or is designed to flood in an extreme (0.1%) flood. Also referred to as functional floodplain. |

As part of the avoidance of flood risk, the Sequential Test is applied which entails steering the development to a location which is in Flood Zone 1 (areas with a low probability of river or sea flooding). If the proposed development is located within Flood Zone 2 then the Exception Test is applied which requires demonstration that the proposed development will a) 'provide wider sustainability benefits to the community that outweigh flood risk and b) that the proposed development will 'be safe for its lifetime without increasing flood risk elsewhere and where possible reduce flood risk overall'

### 2.4.1 Fluvial and coastal flooding

The EA flood map for planning[5], in Figure 2-3, shows the combined flood extents from rivers and the sea at the site. The site is entirely in Flood zone 1, meaning it has a less than 1 in 1000-year annual probability of flooding from river or sea. The Tees Estuary channel and a small portion of land on the river bank adjacent to the site is Flood zones 2 and 3, meaning there is a greater than 1 in 100-year probability of river flooding or greater than 1 in 200-year probability of sea flooding. The flood extents for this mapping are created using coarse scale UK wide fluvial modelling, and incorporates more detailed modelling of specific rivers done for the EA. The watercourses through the site are too small to be included in the coarse modelling and will not have previously been modelled by the EA so any fluvial flooding from these will not be captured in this mapping.

5 Environment Agency Flood map for planning. https://flood-map-for-planning.service.gov.uk/confirm-location?easting=460152&northing=525139&placeOrPostcode=redcar [Accessed 26 May 2020]

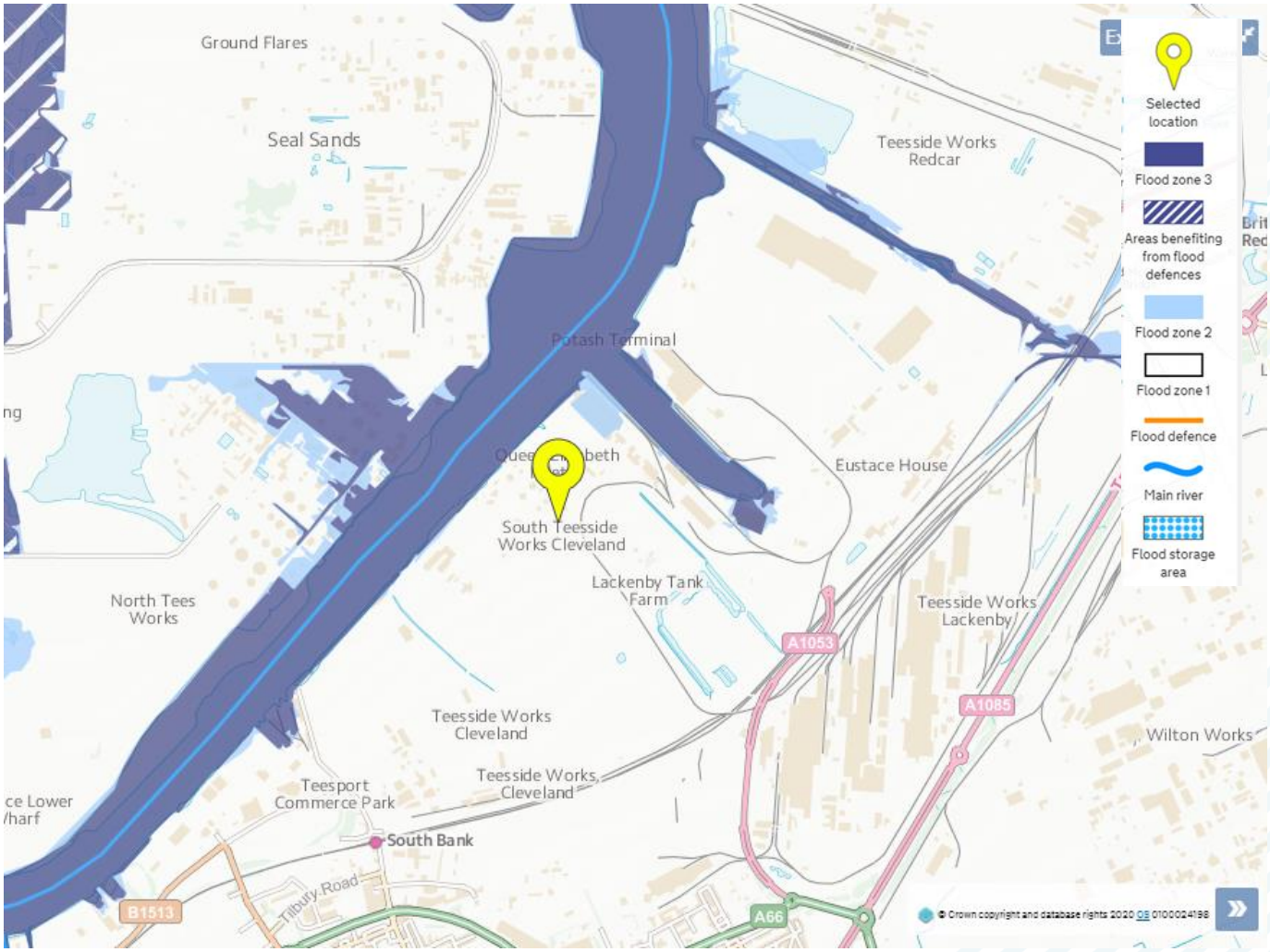



**Figure 2-3: Extract from Environment Agency flood map for planning at the site**

The EA flood maps combine the risk of flooding from river and seas. The EA flood warning information service long term flood risk map shows the risk split into very low, low, medium and high risk categories:

- Very low risk – less than 1 in 1000-year probability
- Low risk – Between 1 in 1000 and 1 in 100-year probability
- Medium risk – Between 1 in 100 and 1 in 30-year probability
- High risk – Greater than 1 in 30-year probability.
- **Error! Reference source not found.** shows the development site is in an area o f very low risk. The Tees Estuary is an area of high risk, and due to the tidal influence in this location is most likely to be from tidal rather than fluvial flooding.

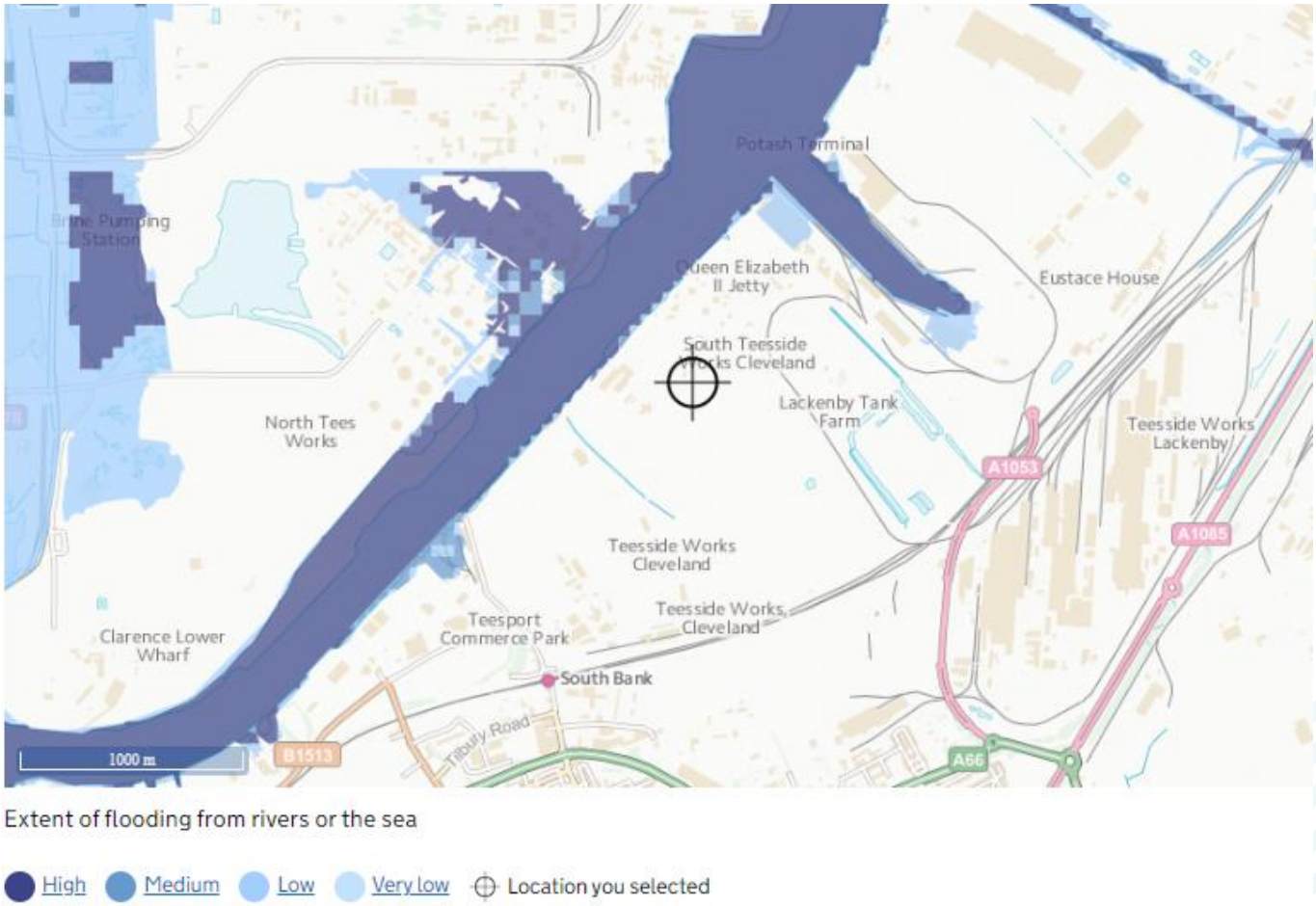



**Figure 2-4: : Extract from EA map of long term flood risk flood extent from rivers or the sea[6]**

#### 2.4.1.1 Climate change - fluvial

NPPF notes that there should be a "proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk".

Peak river flow allowances show the anticipated changes to peak flow by river basin district. Redcar is located within the Northumbria river basin district. The application of allowance category is subject to the Flood Risk Vulnerability Classification (categorises development, considering whether it relates to essential infrastructure or, for example development for vulnerable groups in society e.g. hospitals / care homes) and the Flood Zone in which the site lies.

6 EA flood warning information service map of long term flood risk. https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=453987&northing=522641&address=10034526609&map=RiversOrSea [Accessed 26/05/2020]

**Table 2-3: EA Peak flow allowances, Northumbrian River Basin District (use 1961 to 1990 baseline)[7]**

| Allowance category | Total potential change anticipated for the '2020s' (2015 to 2039) | Total potential change anticipated for the '2050s' (2040 to 2069) | Total potential change anticipated for the '2080s' (2070 to 2115) |
|---|---|---|---|
| Upper end | 20% | 30% | 50% |
| Higher central | 15% | 20% | 25% |
| Central | 10% | 15% | 20% |

#### 2.4.1.2 Climate change sea level

There are a range of allowances for each epoch for sea level rise in Northumbria shown in the table below derived from EA table 3.

**Table 2-4: EA Sea level allowance for each epoch for Northumbria[8]**

| Allowance | 2000 to 2035 (mm) | 2036 to 2065 (mm) | 2066 to 2095 (mm) | 2096 to 2125 (mm) | Cumulative rise 2000 to 2125 (metres) |
|---|---|---|---|---|---|
| Higher central | 4.6 (161) | 7.5 (225) | 10.1 (303) | 11.2 (236) | 1.03 |
| Upper end | 5.8 (203) | 10 (300) | 14.3 (429) | 16.5 (495) | 1.43 |

Since the original Tees tidal model was developed in 2011/2013 and the above table was published, JBA have undertaken an update to the Tees coastal model on behalf of the EA as part of a separate project in 2019/2020 for Port Clarence / Greatham. The update to the model was based on the UKCP18 uplift values utilising 2017 for a base year for extreme sea levels. The table below summarises the results of the updated modelling on the uplift (mm) per epoch.

**Table 2-5: Tees Tidal UKCP18 Tees Tidal Uplift Value**

| Uplift | Epoch | Updated uplift value (mm) |
|---|---|---|
| Present day uplift | 2017-2019 | 0.011 |
| UKCP18 2070 uplift | 2019-2070 | 0.488 |
| UKCP18 2100 uplift | 2019-2100 | 0.947 |
| UKCP18 2030 uplift | 2019-2030 | 0.071 |
| UKCP18 2050 uplift | 2019-2050 | 0.249 |

7 https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1

8 https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-3

**Table 2-6: Tees Tidal UKCP18 Tees Tidal Climate Change Uplift Levels**

| Events | 2017-2019 (present day) | 2030 | 2070 | 2100 |
|---|---|---|---|---|
| T2 (2 year) | 3.45 | 3.52 | 3.94 | 4.40 |
| T100 (100 year) | 3.98 | 4.05 | 4.47 | 4.93 |
| T200 (200 year) | 4.08 | 4.15 | 4.57 | 5.03 |
| T1000 (1000 year) | 4.33 | 4.40 | 4.82 | 5.28 |

#### 2.4.1.3 Offshore wind speed and extreme wave height allowance

Wave heights may change because of increased water depths. The frequency, duration and severity of storms could also change. At this point wave modelling has not been included in EA models. If required at a future stage in the project an allowance of 10% should be applied to coastal modelling. Nationally available flood maps do not currently show the impact of waves.

**Table 2-7: EA Offshore wind speed and extreme wave allowance**

| Applies around all the English coast | 2000 to 2055 | 2065 to 2125 |
|---|---|---|
| Offshore wind speed allowance | 5% | 10% |
| Offshore wind speed sensitivity test | 10% | 10% |
| Extreme wave height allowance | 5% | 10% |
| Extreme wave height sensitivity test | 10% | 10% |

### 2.4.2 Pluvial flooding

The EA long term flood risk mapping shows the site is at some risk from surface water flooding. There is no clear area of flow path present, just many small areas of isolated extent in low spots. This is due to the uneven nature of the DTM at the site and will differ if the site is developed. The surface water flooding is present at low, medium and high risks. The high and medium risk areas at the site are all below 900mm depth, whereas the low risk extents are over 900mm in some places. The A1053 access road has a more continuous area of surface water flood risk, this may cause access issues to site and presents a flow path for surface water flooding.

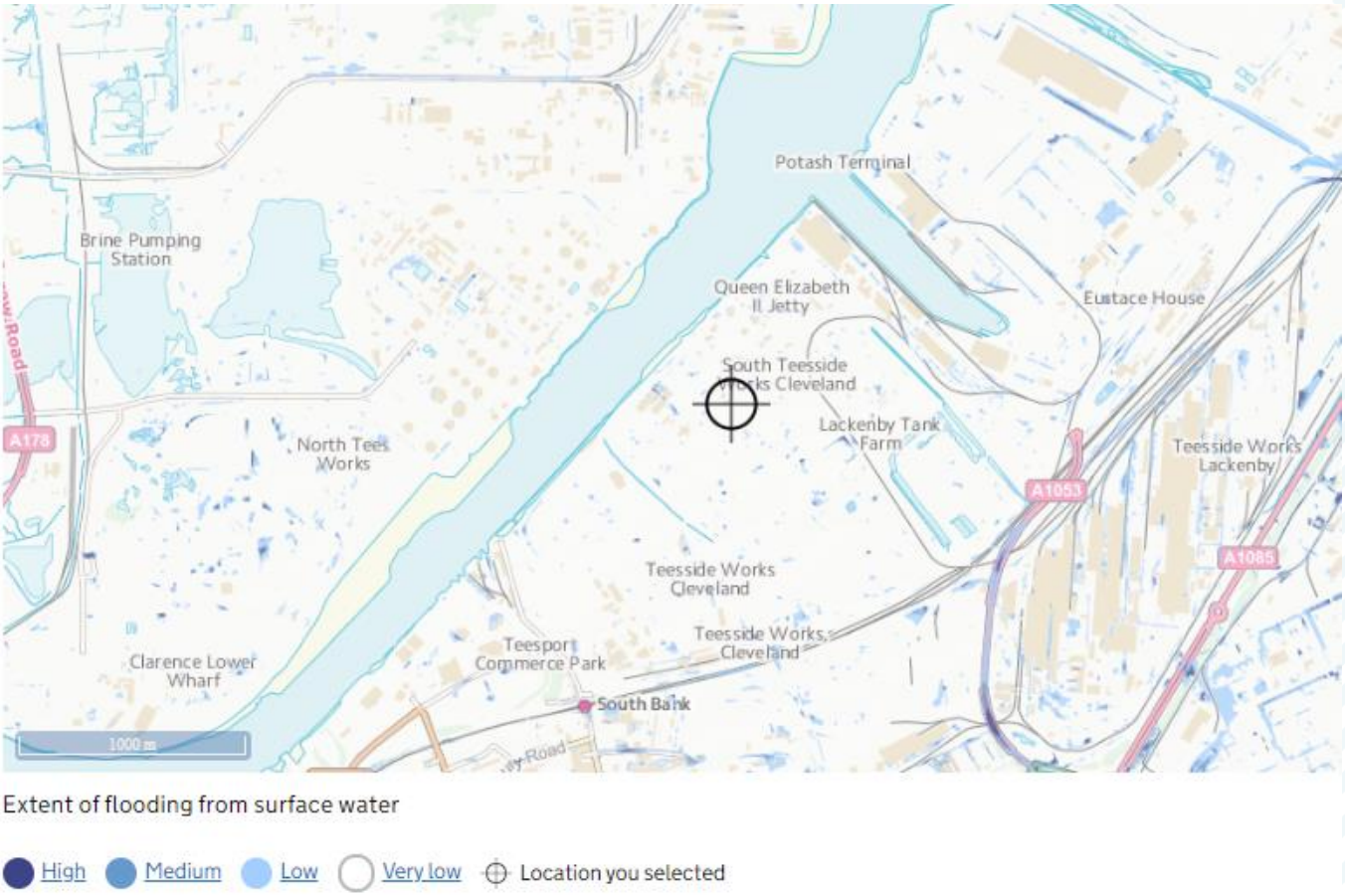



**Figure 5: Extract from EA Long term surface water flood risk map[9]**

#### 2.4.2.1 Climate change

With respect to surface water flood risk mapping and design of drainage systems (including blue-green networks and minor watercourses with a catchment of less than 5km$^2$) the allowances outlined in the table below should be used. As the development has a design life of 100 years the default design parameters are to design for the 20% and sensitivity check for the 40%.

9 EA Long term flood risk for surface water. https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=453987&northing=522641&address=10034526609&map=SurfaceWater [Accessed 26 May 2020]

**Table 2-8: EA Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)**

| Applies across all of England | Total potential change anticipated for the '2020s' (2015 to 2039) | Total potential change anticipated for the '2050s' (2040 to 2069) | Total potential change anticipated for the '2080s' (2070 to 2115) |
|---|---|---|---|
| Upper end | 10% | 20% | 40% |
| Central | 5% | 10% | 20% |

### 2.4.3 Groundwater flooding

Groundwater flooding is flooding that is caused by unusually high groundwater levels or flow rates. During flooding, groundwater can emerge at the ground surface or within man-made underground structures such as basements. There are various mechanisms of groundwater flooding, including clearwater flooding due to prolonged heavy rainfall on distant connected geology alluvial and coastal groundwater flooding, and that associated with minewater rebound or ground subsidence.

The EA alongside the BGS have developed a groundwater vulnerability map[10] accessed through the DEFRA MAGiC Map portal. This designates the site as in an area of Medium-High risk from groundwater. These risk levels are described on the BGS website as:

- High - areas able to easily transmit pollution to groundwater, characterised by high-leaching soils and the absence of low-permeability superficial deposits.
- Medium: areas that offer some groundwater protection. Intermediate between high and low vulnerability.

### 2.4.4 Sewers, culverts and bridges

The watercourses across and surrounding the site have been significantly modified and have either been culverted or straightened. The three main structures are:

- Culvert conveying the Knitting Wife Beck and Holme Beck under the railway to the Cleveland Channel
- Culvert conveying the Boundary Beck and the Kinkerdale Beck under the railway and Tees Dock Road to the Lackenby Channel
- Culvert conveying the Lackenby Channel to the Lackenby outfall to the Tees

The Lackenby Channel comes out of the culvert as it enters the site from the south east and re-enters culvert 1.1km downstream. Google maps online imagery has been used to identify further structures along the channel. Soon after emergence from the culvert the channel flows under the railway bridge, approximately 16m wide. There are two single track vehicle bridges over the Lackenby Channel upstream of the Cleveland Channel confluence. Just before the confluence there appears to be a small in channel weir. Downstream of this there is an in-channel structure assumed to act as a tidal weir. Directly upstream of the culvert is a vehicular bridge, approximately 37m wide. The rail and final vehicular bridge have high clearance and are unlikely to affect channel flows in high conditions.

10 BGS Groundwater vulnerability data. https://www.bgs.ac.uk/products/hydrogeology/GroundwaterVulnerability.html [Accessed 27 May 2020]

The Holme Beck and Knitting Wife Beck tributaries are in culvert of unknown dimensions before entering the site and into the Cleveland Channel. There does not appear to be any further in channel structures before the confluence with Lackenby Channel.

As all the watercourses are in culvert upstream of the site the inflows into the site will be limited by the culvert capacity.

The nature of the channel outfalls into the River Tees is unknown. If these are not flapped or controlled, then the main flood risk due from structures will be the tidal influence of the Tees estuary backing up the Lackenby Channel culvert.

### 2.4.5 Reservoir flooding / breach

The EA flood maps (2020), show that the Lackenby Channel is at risk from flooding from the two small reservoirs which lie to the south east of the site, adjacent to the A1053 located at OS NGR NZ 56843 19311A174. However, whilst there would be an increase in water depth in these channels, the maps do not suggest that the flood extents would extend beyond the channel width.

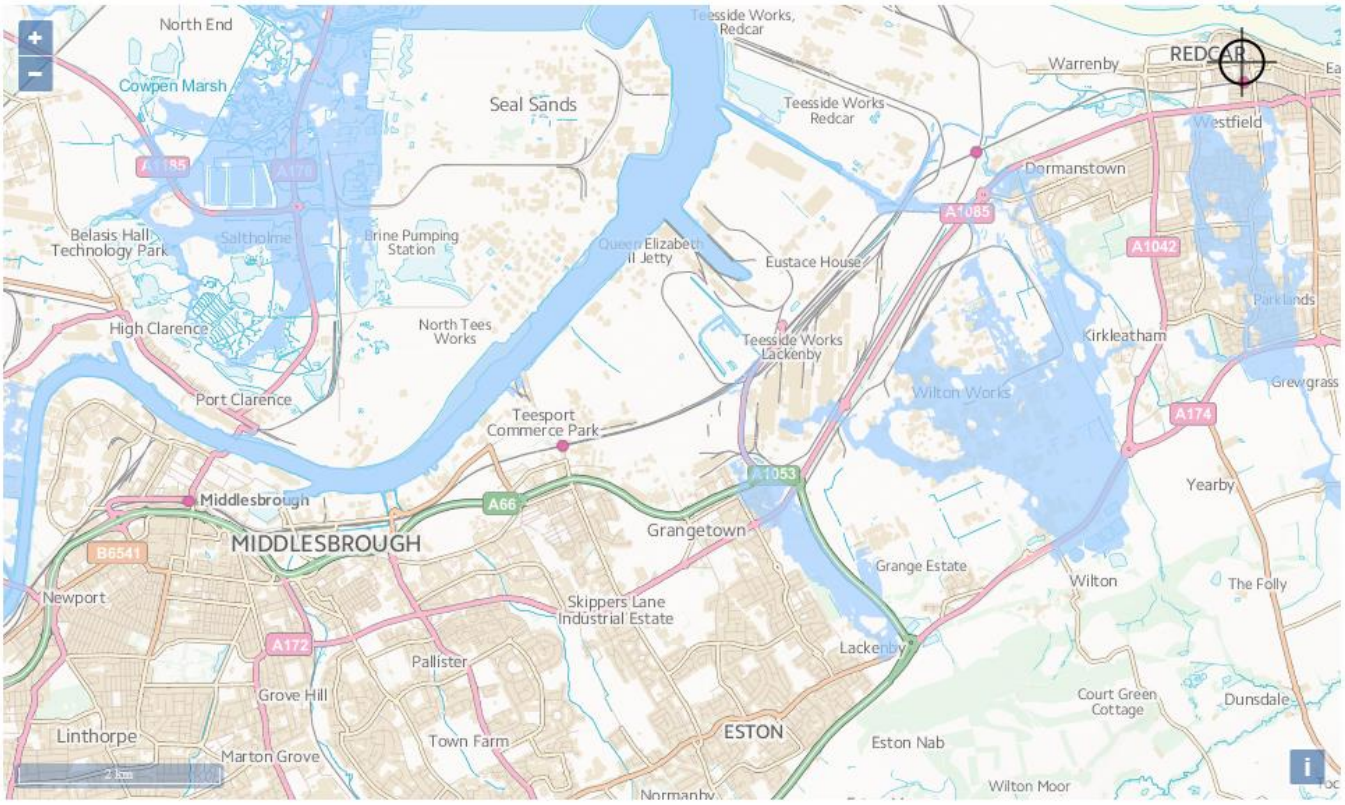



**Figure 2-6 Extract from the EA Flood Maps for reservoir flooding**

## 2.5 Flood History

The following sources were consulted:

- **Readily available archives** - internet based sources including the British Hydrological Society Chronology of British Hydrological Events[11] and Google Newspaper Archive[12]. No specific information for this area was available from these archives.
- **Environment Agency (Risk Management Authority under the Water Management Act and Flood Risk Regulations)** - open data records noted the occurrence of one flood event within the Tees Estuary on 05/12/2013 and was recorded to be due to operational failure/breach of defence and the source was coastal. This event did not breach onto the site. The flood event was due to a high spring tide mixed with the failure of the flood defence embankment at the south side of Greatham Creek (3km to the North-west of the site)[13]. Since this event, a new flood defence scheme has been completed at Port Clarence and Greatham South[14].
- **Redcar and Cleveland Borough Council (Lead Local Flood Authority and Risk Management Authority under the Water Management Act and Flood Risk Regulations)** - provided historic flood photographs for the wider STDC site, these were not georeferenced and lack name and date information which makes locating and using them difficult. One photo showed that Tees Dock Road was flooded in September 2015 (anticipated to be located north of the roundabout where Tees Dock Road is joined to the A66 and A1053, approximately 700m to the south east of the site). Further historic flood records were requested[15] but the RCBC had no records for the main site. This does not indicate that no incidents have occurred but that none have been recorded.
- **The SFRA reports from 2010[16] and 2016[17]** - use of existing data from these projects has been granted by RCBC for this project. The level 1 report states that RCBC have little data on fluvial or tidal flooding. In this report NW provided their register on surface water flood events. These were concentrated in the main residential areas of Eston and Redcar and none were identified in the vicinity of the site.
- **Historical Mapping** – The online National Library of Scotland (NLS)[18] archives have been reviewed. These show the site was originally mudflats in the Tees estuary. Between 1943 and 1955 the western side of the site had been developed for industrial use, with the eastern side remaining mud & sand with drainage channels. None of the historic mapping had any levels recorded.

———————————————————————————————————————

11 Chronology of British Hydrological Events. http://cbhe.hydrology.org.uk/ [Accessed 15 May 2020].

12 Google Newspaper Archive. https://news.google.com/newspapers [Accessed 26 May 2020].

13 Stockton-on-Tees Borough Council LLFA Flood Investigation Report, Tees Tidal Flooding, March 2014

14 "Hartlepool public invited to opening of new £14.5m flood defence scheme", Hartlepool Mail , 16 October 2018

15 Email from Nigel Hill, Drainage & Flood Risk Manager of Council flood team, received 30 January 2020

16 Redcar and Cleveland Borough Council Level 2 Strategic Flood Risk Assessment, August 2010

17 Redcar and Cleveland Borough Council Level 1 Strategic Flood Risk Assessment Update, May 2016

18 National Library of Scotland. https://maps.nls.uk/geo/explore/#zoom=4&lat=55.78537&lon=-3.16449&layers=1&b=1 [Accessed 26 May 2020]

## 2.6 Flood estimation

Flood risk is a combination of the likelihood of flooding and the potential consequences arising. It is assessed using the source – pathway – receptor model.

Flood mapping for fluvial and coastal / tidal risk are available from previous studies undertaken. These studies extend across the site and the surrounding STDC area and which can be used to inform this high level assessment of flood risk:

- Tidal: The Tees Estuary model developed for the EA by JBA documents coastal flood risk for entire site. This was recently updated by JBA to account for the UKCP18 climate change uplift values. Wave action is not accounted for however the protection offered by the existing sand dunes system and historic railway embankment have been included.
- Fluvial: The Fleet system comprising of the Fleet and its main tributaries were modelled for Redcar & Cleveland Borough Council by JBA in 2015. The study featured a detailed survey which included all of the in-channel structures within the STDC site.

No surface water modelling had been undertaken to date and since the EA flood maps indicated that there were pockets of pluvial flooding across the site, a preliminary surface water model was run to give a high-level overview of pluvial flood risk as part of the Data Collection and Baseline Assessment[19] undertaken as Phase 1 of the Water Management Strategy for the STDC development. Details of the pluvial modelling and analysis of flow pathways and potential flood receptors are provided below.

The preliminary pluvial mapping will be updated by more detailed mapping in Phase 2 of the works for the STDC strategy which will allow for a more detailed analysis of flood risk.

### 2.6.1 Approach to peak flow estimation

Preliminary hydrological data for the high level assessment of pluvial flooding was based upon Flood Estimation Handbook (FEH) catchment areas (shown in Figure 2-2) and FEH13 rainfall, which were downloaded from the FEH web-service tool along with the catchment descriptors (tabulated in Table 2-1).

### 2.6.2 Hydraulic modelling

The preliminary surface water flood maps were generated using InfoWorks Integrated Catchment Modelling (ICM) software version 9.5. InfoWorks ICM is an advanced integrated catchment modelling software used to model complicated hydrological and hydraulic systems efficiently. It also allows the user to combine natural solutions with piped (network) modelling to suggest improvements to capacity and create scenarios to optimise flood risk management. The inputs required were a Digital Terrain Model (DTM) to represent the ground of the area of interest and FEH13 rainfall.

The DTM was created using LiDAR 2m spatial resolution DTM data. Denser LiDAR data is available but was not utilised at this high-level stage in the project. DTM processing was completed using 3D analyst tools in ArcMap 10.4 with ASCII files exported and added to InfoWorks ICM to create the ground model.

The modelling directly applied the FEH2013 rainfall from the Lackenby Channel catchment over the 2m LiDAR DTM. The model was run for the 100-year and 100-year plus climate change scenarios. Further model runs will be undertaken during more detailed analysis in Phase 2 of the study.

19 Phase 1 – Data Collection and Baseline Assessment, JBA Consulting for Faithful & Gould on behalf of STDC, May 2020

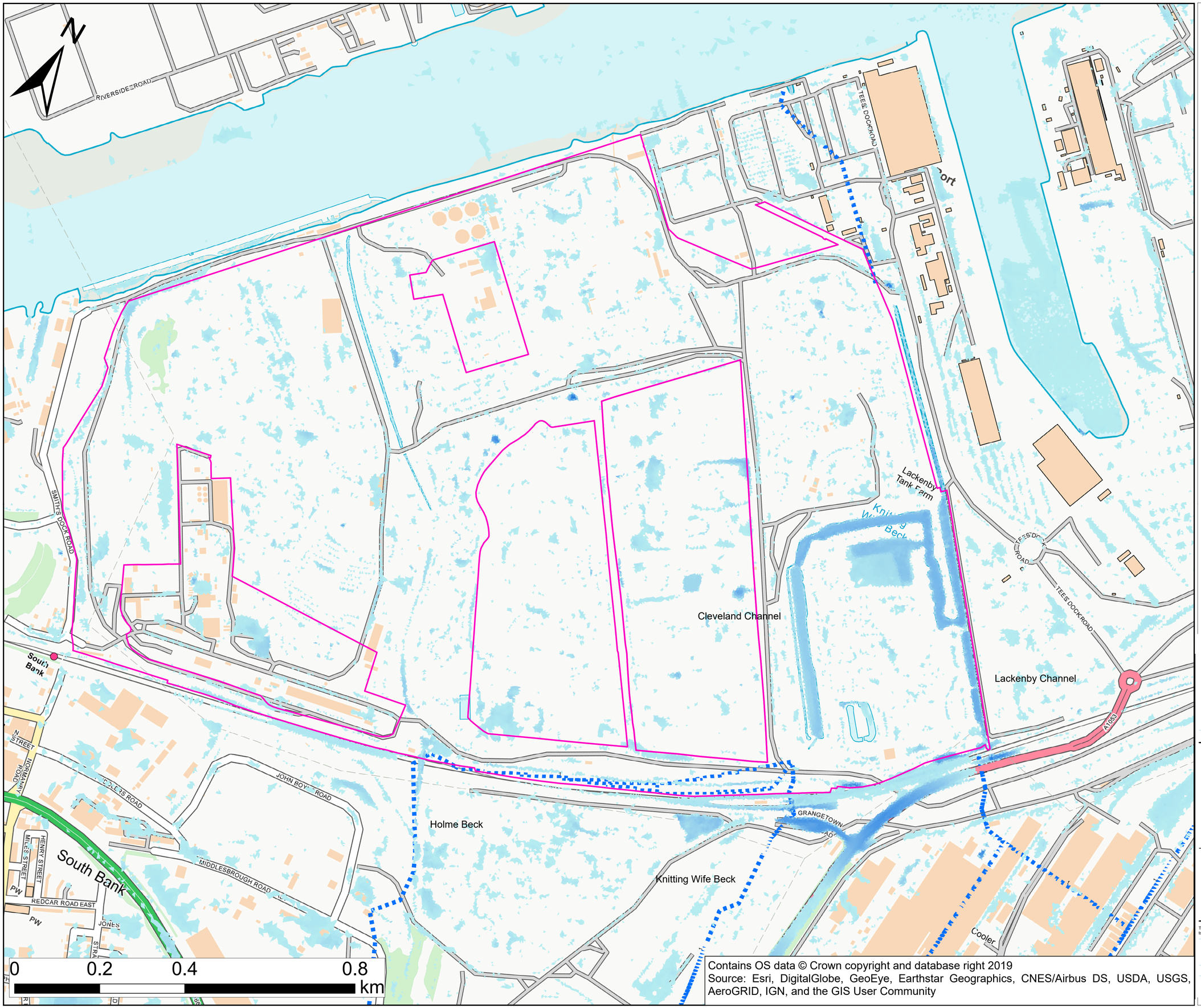
The model results were exported into geodatabases for analysis within ArcMap 10.4 which was used to create the following flood risk screening maps:

- 100yr surface water
- 100yr +20%cc surface water
- 100yr+ 40%cc surface water
- 100yr fluvial (Fleet Model)
- 200yr coastal +SLR
- 200yr coastal +SLR, 100yr surface water, Fleet 100yr
- 200yr coastal +SLR, 100yr+40%cc

### 2.6.3 Assumptions and Limitations of the modelling

The modelling undertaken was for the preliminary stage of the water management strategy and due to the high-level nature of the preliminary flood risk screening exercise it was necessary to make a number of key assumptions and apply limitations for the modelling as follows:

- Limited to 2 scenarios 100yr and 100yr plus climate change.
- A 20% and 40% climate change uplift has been applied to the rainfall hyetographs in line with EA guidance.
- The model was run as a full blockage scenario. This highlights potential flood risk and details areas within the development suitable for conveyance. It can also inform more detailed modelling.
- The model does not include any losses to account for interception into existing surface water drainage systems or infiltration into the ground. A value of 70-75% is applied
- The model does not account for flooding of the sewer network.
- FEH Catchment data from the surrounding areas were used to allow direct application of rainfall on LiDAR within the sites of interest.
- A 2m resolution DTM was utilised.
- A storm duration of 60 minutes was used to allow high level assessment of overland flow paths.






## Legend

SIZ1 Development Zone

**100-year Surface Water Extents**

**Depth (m)**

High : 5.69

Low : 0.1

Culverted Watercourses

| Rev. | Modifications | Date | Drawn | Checked | Approved |
|---|---|---|---|---|---|

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for

South Tees Development Corporation

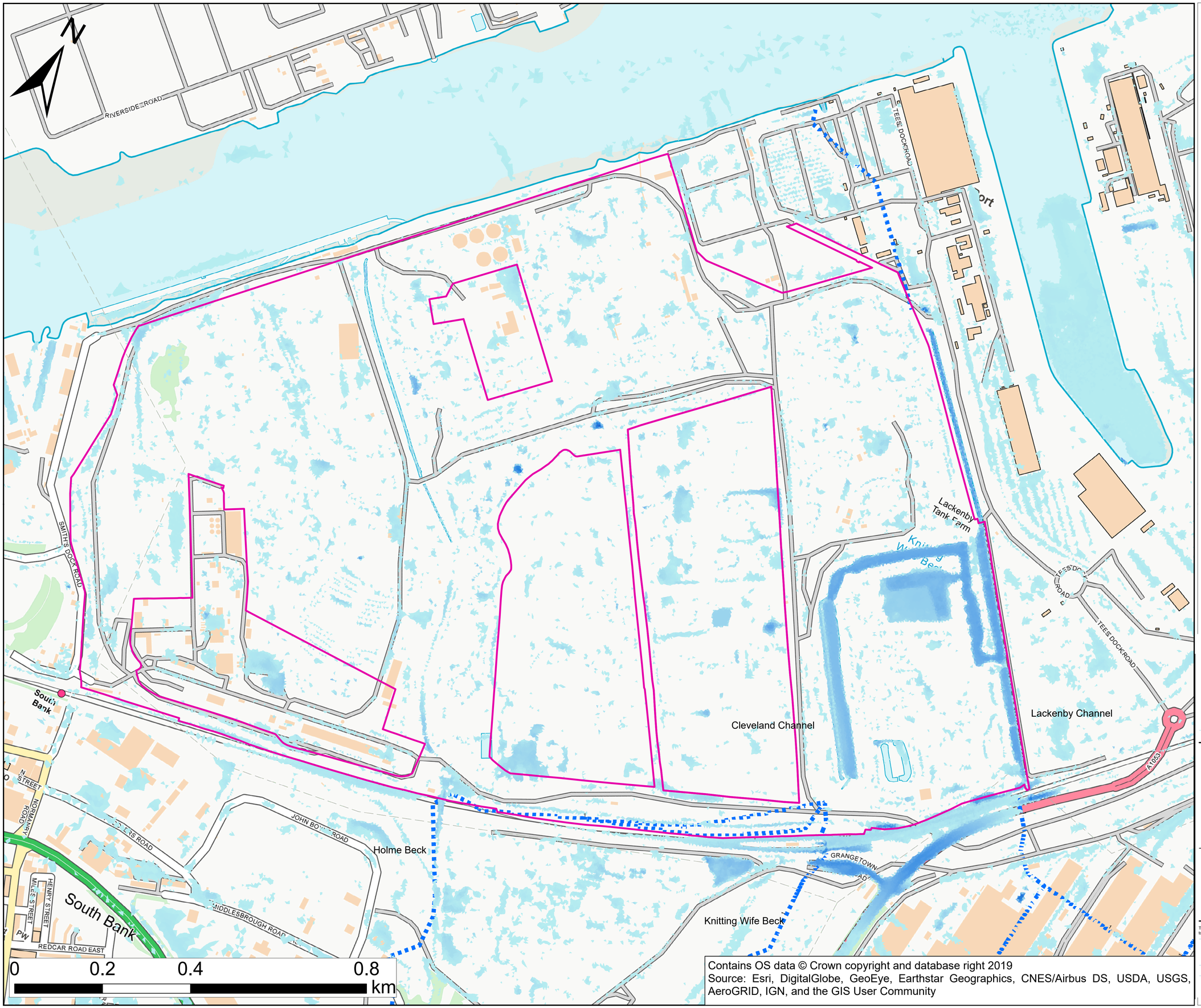
FLOOD RISK SCREENING MAPS
1:100YR SURFACE WATER FLOOD RISK



| | | |
|---|---|---|
| Scale: 1 : 5,000 @ A1 | Drawn | DA 24/03/2020 |
| | Checked | JK 24/03/2020 |
| | Approved | ST 24/03/2020 |

Digital File Name: CHK-JBAU-00-00-DR-C-0001-Flood_Screening_SW_100yr

| Drawing Number: | Sheet No.: | Status: | Rev.: |
|---|---|---|---|
| 0001 | 1 of 8 | S3 | P01 |




Contains OS data © Crown copyright and database right 2019
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

## Legend

- SIZ1 Development Zone
- Culverted Watercourses

**100-year + 20% CC Surface Water Extents**

**Depth (m)**

High : 5.76

Low : 0.1

| Rev. | Modifications | Date | Drawn | Checked | Approved |
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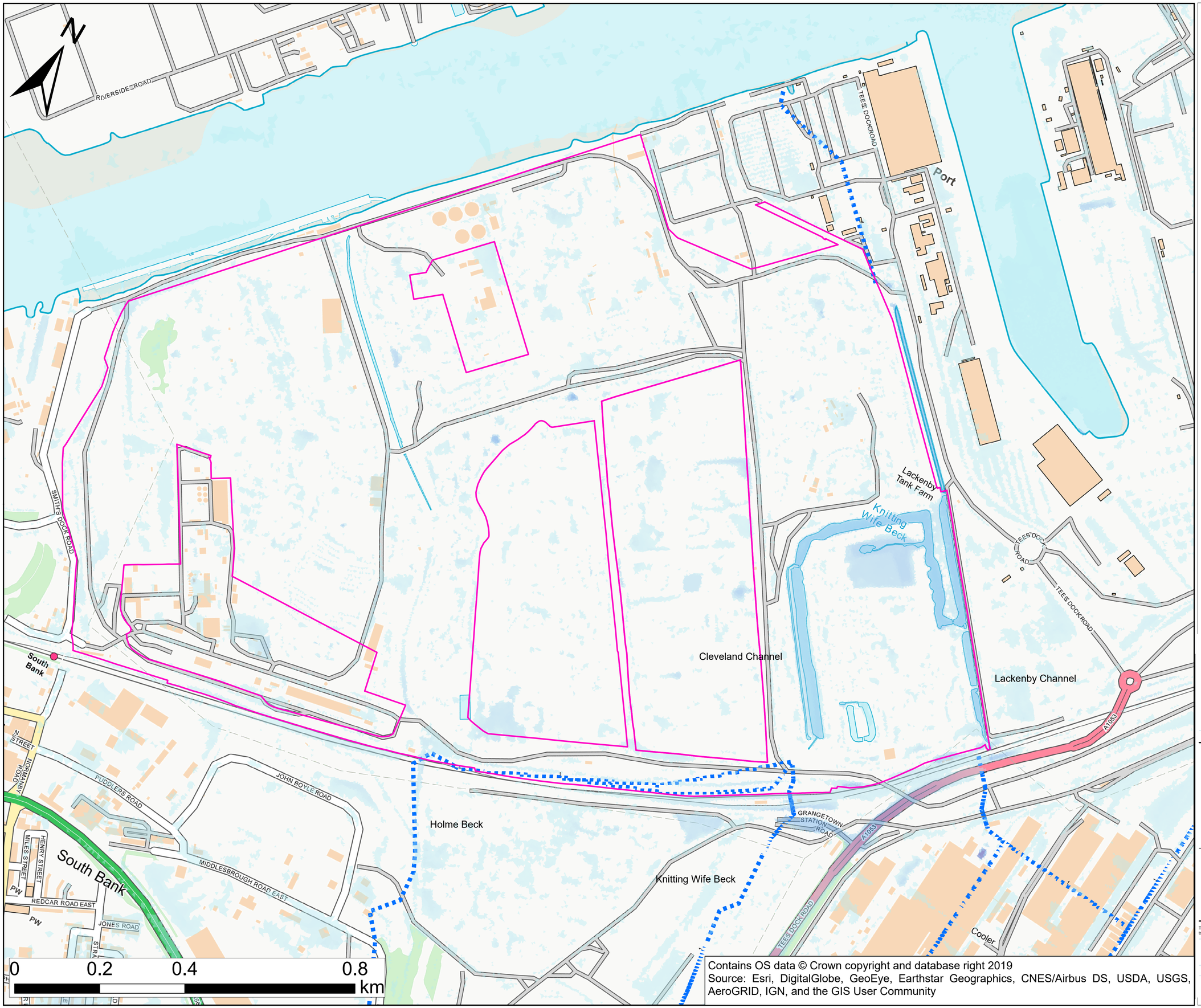
# FLOOD RISK SCREENING MAPS
# 1:100YR + 20% SURFACE WATER FLOOD RISK



| | | |
|---|---|---|
| Scale: 1 : 5,000 @ A1 | Drawn | DA 24/03/2020 |
| | Checked | JK 24/03/2020 |
| | Approved | ST 24/03/2020 |

Digital File Name: CHK-JBAU-00-00-DR-C-0002-Flood_Screening_SW_100yr_20cc

| Drawing Number: | Sheet No.: | Status: | Rev.: |
|---|---|---|---|
| 0002 | 2 of 8 | S3 | P01 |






## Legend

- SIZ1 Development Zone
- Culverted Watercourses

**100-year + 40% CC Surface Water Extents**

**Depth (m)**

High : 6.91

Low : 0.1

| Rev. | Modifications | Date | Drawn | Checked | Approved |
|---|---|---|---|---|---|

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# FLOOD RISK SCREENING MAPS
# 1:100YR + 40%CC SURFACE WATER FLOOD RISK



| | | |
|---|---|---|
| Scale: 1 : 5,000 @ A1 | Drawn | DA 24/03/2020 |
| | Checked | JK 24/03/2020 |
| | Approved | ST 24/03/2020 |

Digital File Name: CHK-JBAU-00-00-DR-C-0001-Flood_Screening_SW_100yr

| Drawing Number: | Sheet No.: | Status: | Rev.: |
|---|---|---|---|
| 0001 | 1 of 8 | S3 | P01 |

N

RIVERSIDE ROAD

TEES DOCK ROAD

Port

SMITH'S DOCK ROAD

Lackenby Tank Farm

Knitting Wife Beck

TEES DOCK ROAD

TEES DOCK ROAD

Cleveland Channel

Lackenby Channel

A1053

South Bank

N STREET

NORMANBY ROAD

PUDDLERS ROAD

JOHN BOYLE ROAD

Holme Beck

GRANGETOWN STATION ROAD

A1053

HENRY STREET

MILLES STREET

PW

South Bank

REDCAR ROAD EAST

MIDDLESBROUGH ROAD EAST

Knitting Wife Beck

PW

JONES ROAD

TEES DOCK ROAD

Cooler

0 0.2 0.4 0.8 km



## Legend

- SIZ1 Development Zone
- Culverted Watercourses
- Fleet Model 100-year Flood Extents

| Rev. | Modifications | Date | Drawn | Checked | Approved |
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# FLOOD RISK SCREENING MAPS 1:100YR FLEET MODEL RESULTS



| | | |
|---|---|---|
| Scale: 1 : 5,000 @ A1 | Drawn | DA 24/03/2020 |
| | Checked | JK 24/03/2020 |
| | Approved | ST 24/03/2020 |

Digital File Name: CHK-JBAU-00-00-DR-C-0004-Flood_Screening_FL_100yr

| Drawing Number: | Sheet No.: | Status: | Rev.: |
|---|---|---|---|
| 0001 | 1 of 8 | S3 | P01 |

N

RIVERSIDE ROAD

TEES DOCK ROAD

Port

Lackenby Tank Farm

Knitting Wife Beck

TEES DOCK ROAD

TEES DOCKROAD

SMITH'S DOCK ROAD

Cleveland Channel

Lackenby Channel

A1053

South Bank

N STREET

NORMANBY ROAD

PADDLERS ROAD

JOHN BOYLE ROAD

Holme Beck

GRANGETOWN STATION ROAD

A1053

HENRY STREET

MILES STREET

PW

South Bank

REDCAR ROAD EAST

MIDDLESBROUGH ROAD EAST

Knitting Wife Beck

PW

JONES ROAD

TEES DOCKROAD

Cooler

0 0.2 0.4 0.8 km



## Legend

- SIZ1 Development Zone
- Culverted Watercourses

**200-yr Coastal Risk + Sea Level Rise Allowance**

**Depth (m)**

High : 7.43

Low : 0

| Rev. | Modifications | Date | Drawn | Checked | Approved |
|---|---|---|---|---|---|

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FLOOD RISK SCREENING MAPS
1:200YR COASTAL FLOOD RISK + SEA LEVEL RISE ALLOWANCE TO 2100 (5.03 mAOD)



| | | |
|---|---|---|
| Scale: 1 : 5,000 @ A1 | Drawn | DA 24/03/2020 |
| | Checked | JK 24/03/2020 |
| | Approved | ST 24/03/2020 |

Digital File Name: CHK-JBAU-00-00-DR-C-0001-Flood_Screening_CO_200yr_20cc

| Drawing Number: | Sheet No.: | Status: | Rev.: |
|---|---|---|---|
| 0001 | 1 of 8 | S3 | P01 |

N

RIVERSIDE ROAD

SMITHS DOCK ROAD

TEES DOCK ROAD

Lackenby Tank Farm

Knitting Wife Beck

Cleveland Channel

Lackenby Channel

TEES DOCK ROAD

A1053

South Bank

NEW STREET

NORMANBY ROAD

COLLIS ROAD

JOHN BOYD ROAD

HENRY STREET

MILES STREET

PW

REDCAR ROAD EAST

PW

JONES

STRA

MIDDLESBROUGH ROAD

Holme Beck

Knitting Wife Beck

GRANGETOWN

Cooler

0 0.2 0.4 0.8 km



## Legend

SIZ1 Development Zone

**100-year Surface Water Extents**

**Depth (m)**

High : 5.69

Low : 0.1

Culverted Watercourses

**200yr Coastal risk + Sea Level Rise Allowance**

**Depth (m)**

High : 7.43

Low : 0

| Rev. | Modifications | Date | Drawn | Checked | Approved |
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FLOOD RISK SCREENING MAPS
COMBINED FLOOD RISK



| | | |
|---|---|---|
| Scale: 1 : 5,000 @ A1 | Drawn | DA 24/03/2020 |
| | Checked | JK 24/03/2020 |
| | Approved | ST 24/03/2020 |

Digital File Name: CHK-JBAU-00-00-DR-C-0006-Flood_Screening_Combined

| Drawing Number: | Sheet No.: | Status: | Rev.: |
|---|---|---|---|
| 0001 | 1 of 8 | S3 | P01 |

N

RIVERSIDE ROAD

TEES DOCK ROAD

Port

Lackenby Tank Farm

Knitting Wife Beck

TEES DOCK ROAD

TEES DOCKROAD

Cleveland Channel

Lackenby Channel

A1053

SMITH'S DOCK ROAD

South Bank

N STREET

NORMANBY ROAD

PUDDLERS ROAD

JOHN BOYLE ROAD

Holme Beck

GRANGETOWN STATION ROAD

A1053

MILES STREET

HENRY STREET

South Bank

PW

REDCAR ROAD EAST

MIDDLESBROUGH ROAD EAST

Knitting Wife Beck

PW

JONES ROAD

TEES DOCKROAD

Cooler

0 0.2 0.4 0.8 km



## Legend

- SIZ1 Development Zone
- Culverted Watercourses

### 100-year + 40% CC Surface Water Extents

**Depth (m)**

High : 6.91

Low : 0.1

### 200yr Coastal risk + Sea Level Rise Allowance

**Depth (m)**

High : 7.43

Low : 0

| Rev. | Modifications | Date | Drawn | Checked | Approved |
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# FLOOD RISK SCREENING MAPS
# COMBINED FLOOD RISK WITH CLIMATE CHANGE



| | | |
|---|---|---|
| Scale: 1 : 5,000 @ A1 | Drawn | DA 24/03/2020 |
| | Checked | JK 24/03/2020 |
| | Approved | ST 24/03/2020 |

Digital File Name: CHK-JBAU-00-00-DR-C-0007-Flood_Screening_Combined_CC

| Drawing Number: | Sheet No.: | Status: | Rev.: |
|---|---|---|---|
| 0001 | 1 of 8 | S3 | P01 |

### 2.6.4 Pre-development scenario

Findings from previous studies and the surface water modelling described above have been used to summarise flood risk to the site from different sources.

At the flood risk screening stage it is necessary to assign a preliminary flood risk to each of the development areas. Flood risk is typically classed based on likelihood of flooding to occur combined with the severity and consequence of the flooding. At this stage in the process information is limited to the return periods available during the data gathering process and preliminary surface water modelling. Hence in order to give preliminary flood risk categories the following scoring system has been adopted.

- High: Substantial coverage of proposed development area by flooding of one or more flooding sources. Flow paths are often clear and linked with flood water ponding at substantial depths (1m>).
- Moderate: Moderate cover of the proposed development area by one or more flooding sources. Flow paths maybe less clear with areas of ponding typically between 0.3m-1m deep.
- Low: Only a small portion of the proposed developable land is affected by ponding of shallow depths typically up to 0.3m deep. Isolated areas of shallow ponding are frequent typically related to the demolition of industrial buildings.
- Very Low: Little to no flooding within developable area. Any flooding is typically isolated to localised low points at depths of <0.3m. Isolated areas of shallow ponding are frequent typically related to the demolition of industrial buildings

#### 2.6.4.1 Fluvial flood risk

The site is at a low risk from fluvial flooding. Any flood risk relating to fluvial sources will be restricted to the east of the site. The Cleveland channel is a large open channel which receives flows from the Holme Beck and Knitting Wife Beck culverts at the southern boundary of the development parcel. Flows in the Cleveland Channel are conveyed to the Lackenby Channel around an area associated with iron and steel production recycling. The Lackenby Channel which flows along the eastern boundary of the development zone also receives flow from Boundary Beck and Kinkerdale culverts. In the Lackenby Channel downstream of the confluence with the Cleveland channel there is an in-channel structure assumed to act as a tidal weir. Beyond the weir the Lackenby channel is a deep large open channel that drains to a culvert of unknown dimension which conveys flows below Teesport to an outfall on the River Tees.

A site specific hydraulic model will be required to develop the drainage design and to analyse the flood risk from the surface water on site and in relation to the Cleveland Channel and Lackenby Channel. However, at this stage we can assume that as both the Cleveland Channel and Lackenby Channel receive flows from culverted watercourses the inflows are limited to the capacity of the upstream culverts. Both channels are very large open channels with significant capacity. The main flood risk relates to the performance of the downstream culvert into the River Tees particularly when under tidal influence.

#### 2.6.4.2 Coastal and tidal flood risk

The site is at a moderate risk from coastal flooding. As part of the Level 2 Strategic Flood Risk Assessment (SFRA), a detailed model was created to supersede the broad scale EA tidal flood risk mapping.

The modelling shows inundation in the south east corner at the former land fill and iron and steel recycling area (the SLEMS site). However, the existing coastal model is unlikely to account for the structure assumed to be a tidal weir in the Lackenby Channel which is likely to limit the tidal influence is this area.

As previously mentioned, the coastal flood modelling does not take into account the presence of tidal limiting structures such as flap valves and weirs. As such there is a lower confidence in the flood mapping of the inland areas.

#### 2.6.4.3 Surface water flood risk

The site is at a moderate risk from surface water flooding. The areas at most risk are the localised depressions associated with the landfill in the centre of the site as well as the area associated with iron and steel recycling in the south east. There are no clear overland flow paths associated with surface water flooding. The surface water flooding across the remainder of SIZ1 is predominantly formed of a large number of shallow (0.3m-0.5m deep) localised depressions in which water can pond. With redevelopment there is the opportunity to regrade the ground and provide positive overland flow paths to drainage channels where surface water can be managed.

### 2.6.5 Post development scenario

In terms of planning and plot-based design it is likely that the tidal levels are to be the defining factor in terms of plot elevations. A tidal flood level of 5.03mAOD represents the 1:200yr Coastal Flood Risk + Sea Level Rise Allowance to 2100 design scenario. It is understood that the ground levels for the site will be set to 5.79mAOD and therefore above the level to which flooding is anticipated.

The water management strategy for the STDC area including this site is currently being developed. Whilst the straightened and culverted watercourses through and surrounding the site present constraints to development, they also provide significant opportunities to manage flood risk and improve biodiversity, linking a number of priority habitats and species with internationally important designations. In addition, as mentioned previously, the current The Holme Beck is culverted from Eston Road into the Lackenby channel via a 1.2m diameter culvert, but there is an opportunity for daylighting of the culvert to return it to its original channel, as the section of the former Holme Bec channel that discharges to the Tees is still present, as shown in Figure 2-1.

There is therefore an aspiration for a Water Sensitive Urban Design, which is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, into urban design to minimise the cost of infrastructure, environmental degradation, and improve aesthetic and recreational appeal. This could take the form of blue-green networks which would extend across the site.

# 3 Flood mitigation measures

## 3.1 Flood warning system and existing alleviation

The site is not within an EA Flood Warning or Flood Alert area. Within the Tees Estuary and low-lying land surrounding it there is the Tidal River Tees flood alert area (code 121WAT926). The monitoring station for this area is the River Tees at Tees Dock, station ID 8372, located at the Teesport dock, 500m north of the site boundary.

There are no flood alleviation schemes within the site or affecting the small watercourses through the site. The closest scheme is the Port Clarence and Greatham South scheme, mentioned in section 2.5. These are designed to protect homes and businesses in Port Clarence.

## 3.2 Asset design and protection

Any new development should be located outwith the functional floodplain with a final floor level equivalent to the 0.5% (200 year) flood level plus allowances for climate change and freeboard.

It is understood that the ground levels proposed for the development are 5.79mAOD. The tidal flood level of 5.03mAOD represents the 200 year Coastal Flood Risk + Sea Level Rise Allowance to 2100 design scenario. It is understood that the ground levels for the site will be set to 5.79mAOD and therefore above the level to which flooding is anticipated.

There is a residual risk of groundwater flooding throughout the STDC site however, this is expected to be limited to basements and other below ground structures where flood resilience will rely on the performance of waterproofing and pumping systems.

This assessment has been undertaken as a high level analysis of flood risk to the site. Further mapping and modelling of flood risk will be required as part of the reserved matters stage of the planning process in relation to the drainage design and this will further identify opportunities and constraints.

## 3.3 Surface water and drainage management

One of the core principles of STDC's strategy for the area is to promote a low carbon circular economy development, reducing energy costs and waste minimisation. Key principles to achieve this are embodying a strategy of Water Sensitive Urban Design. Water sensitive urban design is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, into urban design to minimise the cost of infrastructure, environmental degradation, and improve aesthetic and recreational appeal. Considering this principle and the information about the site a drainage strategy has been devised using blue-green corridors which offer multiple benefits including habitat creation, place making, increased amenity benefit and re-naturalisation of watercourses.

Blue-green infrastructure is of importance within the drainage strategy and forms a key part of delivering a sustainable eco-industrial park. The preliminary drainage strategy has been created by analysing the overland flow paths, drainage catchments, topography and development parcels. These blue-green corridors for drainage flow paths have been identified in the site along the Lackenby Channel, Cleveland Channel and the unnamed channel.

## 3.4 Safe access and egress

Whilst outwith the site boundary, the flood maps show that the main access route from the south along the A1053 (Tees Dock Road) is at risk from flooding from surface water sources to depth and velocities of under 0.9m and 0.25ms$^{-1}$ (towards the site) at the high risk level. At a medium risk the depths remain under 0.9m but flood velocities increase over 0.25 ms$^{-1}$ in some locations and water flows towards a low spot to the south of the

railway crossing. At a low risk (less than 0.1% AEP) the flood velocities are mostly over 0.25 $ms^{-1}$ and depths reach over 0.9m for a 150m stretch along the road. Large emergency vehicles may be able to operate in flood depths of up to 0.9m[20], so in the instance of a large flood event, it is anticipated that emergency access would be possible to most of the site. Emergency access and egress routes shall be included as part of the site operations plan.

## 3.5 Potential impact of the proposed development on flood risk within and outwith the site

Since the ground levels are understood to be above the 200 year Coastal Flood Risk + Sea Level Rise Allowance to 2100 design scenario, the proposed development is not anticipated to have an impact on fluvial flood risk within or outwith the site.

The site boundary at present is located at or greater than 20m from the Tees. An environmental permit is required for any activity that may pollute the air, water or land; increase flood risk; or adversely affect land drainage and work on or near main rivers requires a permit. The River Tees is designated as a main river but as the other watercourses (open and culverted) across the site are not main rivers, the EA guidelines advise contacting the local council or internal drainage board to check if land drainage consent is required. https://www.gov.uk/guidance/check-if-you-need-an-environmental-permit Permits are generally required for:

- any activity within 8 metres of the bank of a main river, or 16 metres if it is a tidal main river
- any activity within 8 metres of any flood defence structure or culvert on a main river, or 16 metres on a tidal river.

Once the design for the site is developed, consultation should be undertaken with the Flood Risk Management Authorities.

20 Defra/Environment Agency Flood and Coastal Defence R&D Programme: R&D Outputs: Flood Risks to People, FD2321/TR2 Guidance Document, 2006.

# 4 Conclusions

This high level FRA has been prepared in accordance with NPPF for the proposed development at part of the SIZ1 site that is part of the wider STDC area. The proposed development lies within Flood Zone 1 which means it has a chance of flooding of less than 0.1% - equivalent to the 1000-year event.

Modelling undertaken previously for the Tees indicates that the site is at very low risk from fluvial flooding. Detailed modelling of the watercourses including the Lackenby and Cleveland Channels as well as the culverts, tidal weir at the Lackenby outfall to the Tees and other structures present, has not to date been undertaken to date and would be required to inform future designs as part of the reserved matters stage of the planning process. However, the inflows to the site would be limited by the upstream culverts so there is unlikely to be a high risk from these sources in addition to that already identified by the high level modelling.

There is a moderate coastal/tidal flood risk at the site due to the small area at risk in the south-east corner of the site. A tidal flood level of 5.03mAOD represents the 1:200yr Coastal Flood Risk + Sea Level Rise Allowance to 2100 design scenario. It is understood that the ground levels for the site will be set to 5.79mAOD and therefore above the level to which flooding is anticipated.

Modelling of overland flow indicates that there is a moderate risk from surface water flooding. Water pools in low spots on the site, notably the depressions at the landfill area. Mostly flows are shallow and do not follow any clear overland flow paths. The aspiration for the development of a sustainable drainage strategy and aspiration for blue-green networks will create flow paths for this water to reduce the risk at the site.

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