Portland energy recovery facility

Flood risk assessment

September 2020

Portland Energy Recovery Facility

Powerfuel Portland Limited

Flood Risk Assessment

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Contents

Appendices

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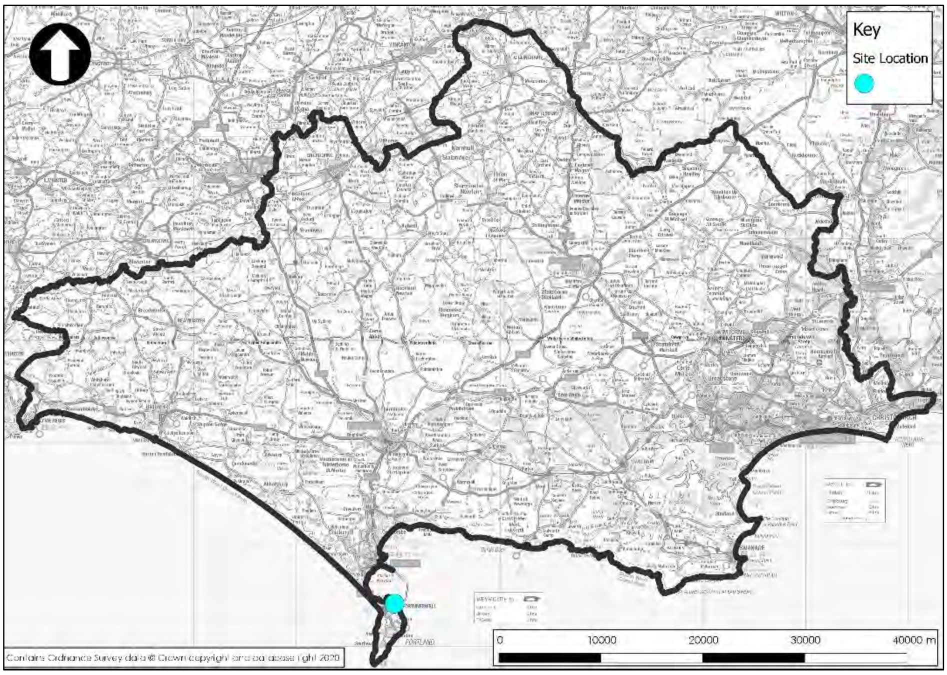
1 Introduction

1.1 Awcock Ward Partnership (AWP) has been commissioned by Powerfuel Portland Limited, to undertake a Flood Risk Assessment (FRA) in support of a detailed planning application for a merchant Energy Recovery Facility (ERF) on a brownfield site within the existing and operational Portland Port.

1.2 The proposed site is identified in Figure 1.1 below.

Figure 1.1 - Site Location – Wide Area



National Planning Policy Framework

1.3 The National Planning Policy Framework (NPPF) and the Planning Practice Guidance were most recently published by the Department for Communities and Local Government in June 2019 and October 2019 respectively.

1.4 The NPPF states that *"A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of* *flooding, where its development would introduce a more vulnerable use"*.

1.5 The aim of a site-specific flood risk assessment is to demonstrate that *"the development should be made safe for its lifetime without increasing flood risk elsewhere"*.

The Bournemouth, Christchurch, Poole, and Dorset Waste Plan

1.6 The Bournemouth, Christchurch, Poole, and Dorset Waste Plan (The Waste Plan) was adopted in December 2019 which promotes the sustainable management of waste through a clear vision, set of objectives and spatial strategy for the development of waste management facilities up to 2033.

1.7 Application for waste management development are considered against the development plan, of which the adopted Waste Plan forms a part.

1.8 In relation to flood risk, the following policies have been identified:

<u>Policy 16 - Natural Resources</u>

Proposals for waste management facilities will be permitted where all of the following criteria are met:

a. it can be demonstrated that the quality and quantity of water resources ground, surface, transitional and coastal waters) would not be adversely impacted and/or would be adequately mitigated;

b. ground conditions are shown to be suitable;

c. site soils would be adequately protected, reused and/or improved as required; and

d. there would not be a loss of the best and most versatile agricultural land (Grades 1, 2 and 3a) unless the environmental, social and/or economic benefits of the proposal outweigh this loss and it can be demonstrated that the proposal has avoided the highest grades of land wherever possible.

<u>Policy 17 - Flood risk</u>

Proposals for new waste management facilities should demonstrate that they have applied the Sequential Test in areas known to be at risk from flooding.

Proposals for new waste management facilities within Flood Zones 2 and 3 and of one hectare or greater within Flood Zone 1 must be accompanied by a Flood Risk Assessment (FRA). This must take into account cumulative effects with other existing or proposed developments and climate change.

Proposals for waste management facilities will be permitted where all of the following criteria are met:

a. they would not be at significant risk of flooding;

b. mitigation measures are provided, where a risk of flooding is identified, so that there would not be an increased risk of flooding on the site or elsewhere;

c. they are compatible with Catchment Flood Management Plans and/or Shoreline Management Plans and the integrity of functional floodplains is maintained;

d. appropriate measures are incorporated or provided to manage surface water run-off including, where appropriate, the use of sustainable drainage systems (SUDS); and

e. they would not have an unacceptable impact on the integrity of sea, tidal, or fluvial flood defences, or impede access for future maintenance and improvements of such defences.

Portland Neighbourhood Plan

<u>Policy Port/EN1 Preventation of flooding and erosion</u>

1.9 Policy EN1 from the Portland Neighbourhood Plan states that ‘development proposals, in areas designated by the South Devon and Dorset Shoreline Management Plan to be protected (‘hold the line’), specifically to prevent coastal erosion or flooding and protect local property and businesses will be supported. In other areas, where economically significant features or infrastructure are at risk, essential flood defence proposals should satisfy the requirements of Local Plan Policy ENV 5.’

1.10 The policy concludes as '*Policy Port/EN1 is generally supportive of development that is necessary to ensure that local property and businesses are protected, and people are kept safe. The policy supports flood defence works specifically designed to protect local property and businesses.*'

'*Where the threat of flood emanates from within an area where the approach in the Shoreline Management Plan is one of 'no active intervention', any development proposal specifically designed to protect valuable assets or infrastructure would need to be assessed in accordance with Policy ENV5 of the current Local Plan, which reflects national policy on flood risk, including sequential and exception testing. We would expect the economic value and community significance of the property or infrastructure at risk to be taken fully into account.*'

Structure and limitations of this FRA

1.11 This site-specific FRA covers the full application boundary but focuses on the ERF area of the site as the remaining boundary mostly facilitates access and utility works.

1.12 The report has been written in accordance with the guidance set by the NPPF and Planning Practice Guidance, using the information that is currently available.

1.13 The report has been structured to describe the existing site parameters, the proposed development and to offer a Surface Water Management Plan (SWMP), indicating how surface water runoff can be managed so that it does not increase flood risk within the downstream catchment.

Consultation

1.14 To scope out any site specific or catchment specific flood risk or drainage requirements we have engaged with various parties.

1.15 We have formally consulted with Dorset Council's (DC) Flood Risk Management (FRM) team, to discuss the principles of the proposed drainage strategy.

1.16 We have also consulted with representatives of Wessex Water's (WW) Developer Services and Planning Liaison Team.

1.17 The output of the consultation process has helped to inform the FRA and inherent SWMP.

Reference

1.18 This FRA has been prepared by reference to the following documents:

- National Planning Policy Framework (June 2019);
- Planning Practice Guidance (October 2019);
- Environment Agency (EA) Flood Warning Information Service ‘Flood Risk from Rivers or the Sea’ and ‘Flood Risk from Surface Water’ (online);
- Portland Port topographic survey (February 2019);
- The Bournemouth, Christchurch, Poole, and Dorset Waste Plan (2019);
- CIRIA Guides 522 Sustainable Drainage Systems, 609 Surface Water Management and the Interim Code of Practice for SuDS (ICOP), 753 The SuDS Manual; and
- Wessex Water’s (WW) Asset Records.

2 Existing Conditions

Context

2.1 This assessment covers the full application boundary but focuses on the ERF area of the site as the remaining boundary facilitates access and utility enabling works. The location of the full application boundary and ERF area are shown on Figures 2.1 and 2.2 respectively.

Figure 2.1 – Site Location – Full Application Boundary

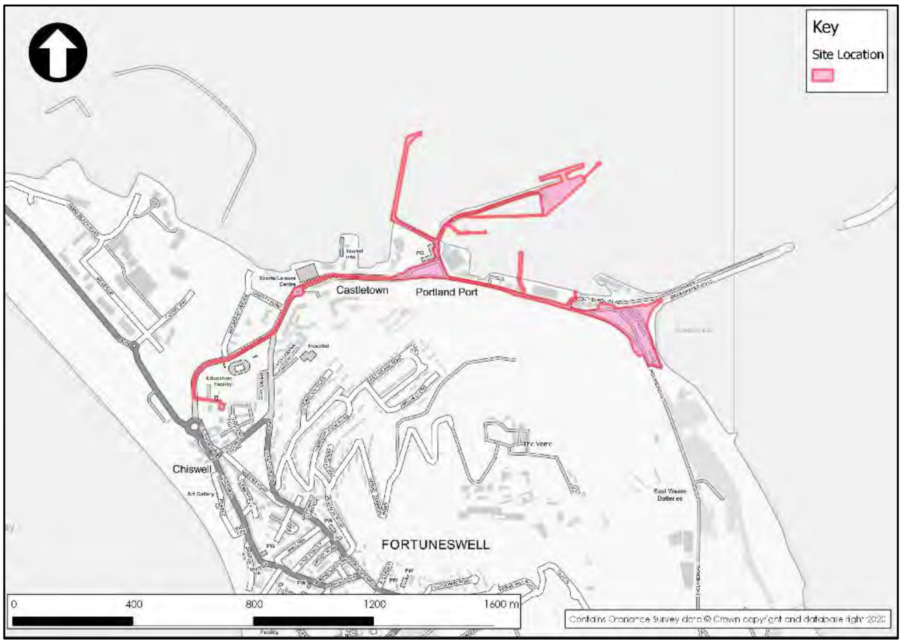
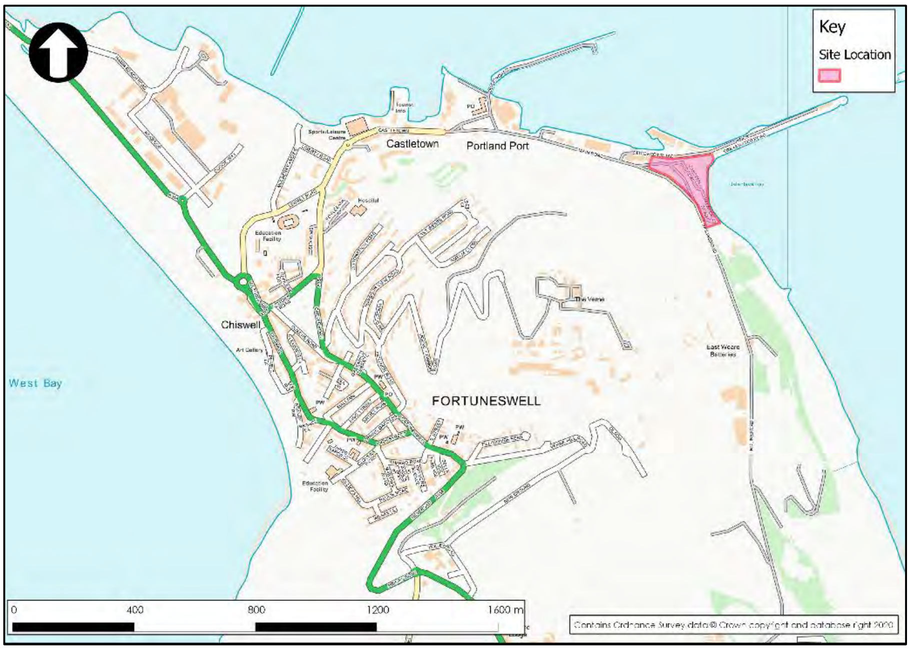


Figure 2.2 – Site Location – ERF Area



Existing land uses

2.2 The proposed site consists of existing previously developed (brownfield) industrial land from previous port uses and is currently fully impermeable.

Surrounding land use

2.3 The site is surrounded by the following land uses:

- To the north is Portland Harbour;
- To the east are rock armour sea defences, a shingle beach at Balaclava Bay and the open English Channel beyond;
- To the south of the site is another internal port road and undeveloped hillside within the adjacent SSSI and SAC;
- To the west is the undeveloped hillside and SSSI and SAC.

Topographic survey

2.4 The topographic survey has been undertaken and identifies that the site typically falls from southwest to northeast, towards Portland Harbour and Balaclava Bay. The site ranges in elevation from 8.3m above ordnance datum (AOD) to 6.8mAOD, with an average gradient of 1:160.

2.5 A copy of the existing topographic survey is included within Appendix A of this report.

Planning History

2.6 The site benefits from an extant planning consent for an Energy Plant fuelled by vegetable oil from January 2010 (DC ref 09/00646/FULE). This was subsequently varied in July 2013 to enable waste rubber crumb from end-of-life tyres to be used as an alternative fuel source (DC ref WP/13/00262/VOC). In October 2019, a certificate of lawful use for development WP/19/00565/CLE was issued by DC confirming that the 2010 consent had been lawfully implemented and that the consent remained extant.

2.7 As part of these applications, the existing flood risk and surface water management plans were approved. This application will build on the measures agreed for the site at those stages, updated to appreciate the latest guidance and requirements.

Existing Flood Risk

2.8 The Planning Practice Guidance requires planning applications for areas at risk of flooding, or sites of 1 hectare or more, to be accompanied by a site-specific Flood Risk Assessment which assesses "flood risk".

2.9 In accordance with Para. 002 of the Planning Practice Guidance, it is required that new developments consider flood risk as a *'combination of the probability and the potential consequences of flooding from all sources'* including rivers and the sea, rainfall, rising groundwater, infrastructure and artificial sources.

2.10 Each potential source of flooding has been assessed as below;

<ins>Fluvial sources (River flooding)</ins>

2.11 An extract of the 'Flood Map for Planning' has been reproduced as Figure 2.3 and shows the ERF area as being within the low risk 'Flood Zone 1', as land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).

Figure 2.3 – Flood Map for Planning

2.12 The wider application boundary includes land inside Flood Zones 2 and 3 however these areas are being used to facilitate utility and highway enabling works and will not be impacted by or have an impact on existing flood risk.

2.13 Still Tidal Water Levels (STWL) have been extracted from the EA's 'Coastal flood boundary conditions for the UK: Update 2018 Technical Summary Report' and are based on data from their Weymouth node, as summarised in Table 2.1 below:

Table 2.1 – Environment Agency Still Tidal Water Levels (mAOD)

Year of occurrence	**Return Period (years)**		
	100	**200**	**1,000**
2018 (Baseline)	2.43	2.55	2.84
2020 (Current)	2.44	2.56	2.85
2120 (Design Life)	3.42	3.54	3.83

2.14 Site levels remain above 6mAOD and will not be impaced by the future estimated tidal water levels. Tidal water levels are therefore not expected to impact the proposed development.

Wave Overtopping

2.15 As part of the previous applications at the site, wave overtopping was assessed within 'The Coastal Flooding Assessment Report' completed by RPS Consulting Engineers. The report and modelling was undertaken to '*provide the wave climate for various return period events for the assessment of risk of coastal flooding at the site*'.

2.16 Following the assessment, the report concluded:

'The present day overtopping rates were found to be very low and there is no significant risk of coastal flooding of this site due to storm events at the present day sea levels. Even taking account of 100 year of sea level rise due to climate change and land settlement due to the proposed Gas Storage project at Portland, the amount of overtopping of the existing site defences during storm events is predicted to be relatively low.'

2.17 As this assessment was undertaken relatively recently in terms of coastal flooding, it is considered that wave overtopping will not pose a significant risk to the development.

2.18 Extracts of the original report are included within Appendix B.

Pluvial sources (surface water flooding)

2.19 An extract of the EA's 'Flooding from Surface Water' map has been reproduced as Figure 2.3. The mapping is based on LIDAR data and indicates the typical conveyance routes of surface water runoff in up to the 1000 year return period (low to medium risk).

Figure 2.3 – Flood Risk from Surface Water

2.20 The mapping shows that the site is susceptible to very minor areas of surface water flooding. This mapping presents a worst case scenario as it ignores the presence of any existing storm drainage within the site.

2.21 It is likely that the areas at risk of pluvial flooding relate to runoff generated by the existing site and that through re-development with a positive drainage system these risks will be appropriately mitigated.

2.22 Whilst the wider application boundary may include areas at risk of pluvial flooding, these areas areas are being used to facilitate utility and highway enabling works and will not be impacted by or have an impact on existing flood risk.

Groundwater sources

2.23 A desktop study of The Hydrogeological Map of England and Wales indicates that the site is underlain by Kimmeridge Clay, containing black shales with thin cementstones and oil shales – impermeable rocks, generally without groundwater.

2.24 On review of the British Geological Survey (BGS) data and through consultation with the DC FRM team, it is anticipated that groundwater levels are likely to have connectivity to adjacent tidal levels. As tidal levels are not anticipated to affect the site, groundwater is also not expected to affect the site.

2.25 The geology and potential tidal related groundwater are however expected to preclude the use of soakaway based drainage.

2.26 The site is also not located within a groundwater source protection zone.

<u>Infrastructure (overwhelmed sewers or drainage systems)</u>

2.27 It is anticipated that there are existing private sewers within the site and the surrounding developed land. There are also existing WW apparatus to the west of the site. There are no known on-site flood risks associated with infrastructure failure.

2.28 The proposed SWMP will identify new systems to manage on-site surface water runoff.

<u>Artificial sources (Reservoirs, Canals & Lakes)</u>

2.29 The site is not within an identified extent of flooding from any reservoirs.

Existing site drainage

2.30 An assessment of brownfield runoff from the existing site area (measuring 2.14ha impermeable catchment) has been completed using the Modified Rational Method equation (HR Wallingford 1990). The anticipated runoff rates are identified below in Table 2.2 with a copy of the calculations included within Appendix C.

Table 2.2 – Brownfield Runoff Rates

Storm Event Return Period (years)	Runoff Rate (l/s)
2	226
30	617
100	820

2.31 It is understood that the existing site drainage network benefits from at least two separate surface water outfalls. One inside Portland Harbour and another within Balaclava Bay. Where the outfall pipes have inadequate capacity to convey the above peak flows, runoff is expected to surcharge the system and with no on-site attenuation it is likely that runoff will sheet flow overland towards the coast.

Existing Committed Development

2.32 Through the EIA scoping process, flooding and water resources were excluded. However, DC identified a number of sites that should be assessed as committed development.

2.33 The sites that have been identified are:

- Ocean Views, Hardy Complex, Castle Road, Portland (Phase 2): redevelopment of former naval accommodation block into 157 apartments, together with the development of 191 new build homes, with associated car parking (application reference: 02/00703/FUL, as amended);
- Royal Manor Arts College, Weston Road, Portland: demolition of existing buildings and erection of 98 dwellings (application reference: WP/19/00919/OUT);
- Verne Common Road and Ventnor Road, Portland: development of vacant land by the demolition of garage and erection of 25 dwellings (application reference: WP/18/00662/FUL)
- Southwell Primary School, Sweethill Lane, Portland: demolition of existing buildings and construction of up to 58 dwellings (application reference: WP/17/00866/OUT)
- Ferrybridge Inn, Portland Road, Weymouth: demolition of existing public house and construction of up to 22 residential units (application reference: WP/14/00929/OUT)
- Disused Quarry Works Stockyard, Bottom Coombe, Park Road, Portland: development of approximately 62 dwellings (application reference: WP/14/00591/OUT)
- Redundant Buildings at Bumpers Lane, Portland: demolition of existing redundant industrial buildings and erection of approximately 64 dwellings (application reference: WP/14/00330/OUT)
- Plot X, Mulberry Avenue, Portland: erection of two blocks of two storey business units comprising three B1 units and six B8 units (total floorspace 766 sqm) with associated parking and landscaping (application reference: WP/18/00940/FUL)
- Plot M1B, Hamm Beach Road, Portland: erection of three industrial and commercial buildings (B1, B2 and B8, total floorspace 2,879 sqm) and associated external works (application reference: WP/17/00631/FUL, as amended).

2.34 The committed development also includes the remaining development (and associated planning permissions) permitted under the 1997 Portland Harbour Revision Order, which is as follows:

- Project Osprey: construction of two animal feed storage and distribution warehouses, each 140m x 45m x 20m, and an office building 16m x 4m x 5.15m, to handle 250,000-300,000 tonnes per year (Council reference: W/19/00514/SCRE)
- Project Inner Breakwater and Camber Area Alterations: development of operational land for the purposes of shipping and in connection with the embarking, disembarking, loading, discharging or transport of passengers, livestock or goods, including a new berth apron in the Crane Berth Apron Operational Area and a new yard pavement at the Camber Operational Yard to enable the berthing and handling of ships up to 120 m long, their cargoes and passengers (Council reference: WP/15/00328/PD)
- Open storage of waste products, including waste wood and metal, on the Parade Ground area of the Rifle Range
- High Speed Ferries: a cross-Channel passenger / car high speed ferry operating 2-3 daily sailings (round trips) over the 26-week summer season (April-October) and weekend sailings (Friday, Saturday and Sunday) over 20 weeks during the winter season (permitted under the RoRo ferries element of the HRO, but currently seeking finance)
- The HRO grants permitted development rights for B1/B2/B8 development on several areas of land at the Port that have yet to be developed (areas Port 2, Port 3, Port 5, Port 6 and Port 7 on the attached map). While no specific proposals are available for these areas, for the purposes of the assessment it is assumed that each area could be developed for single storey warehouse buildings similar to those proposed at Project Osprey
- Landside aquaculture: construction of a warehouse building for aquaculture, producing 200-300 tonnes of fish, on a site measuring 135m x 37m (application references: WP/14/01033/OUT and WP/16/00150/RES) – these permissions have lapsed, but the site is being marketed as a potential development site for a similar use so, for the purposes of the assessment, it is assumed a similar development could be constructed on the site in the future

2.35 In addition to the 1997 HRO development, it includes development (and associated planning permissions) permitted under the 2010 Portland Harbour Revision Order, as follows:

- New berthing faces to the north and east of New Quay and Coaling Pier Island (Works 1 and 5) and new berthing faces to the retaining structures to the south and west of Queen's Pier (Work 7) by the construction of concrete blockwork quay walls and/or piled and suspended deck sections and/or rock armoured rubble mound retaining embankments

- Reclamation of as much of the foreshore and seabed as is required for the above works (Works 2, 6 and 8)

- Two 30m wide floating linkspans commencing on the new northern and eastern faces of the berthing faces adjacent to the shoreward arm of Queen's Pier (Work 3)

- A 30m wide floating linkspan commencing on the eastern face of Work 7 (Work 9)

- A mooring dolphin lying 70m to the east of the eastern face of Work 1, with bearing piles, mooring structures and reinforced concrete heads, connected to Work 1 by a steel access walkway (Work 4)

- Two lines of mooring dolphins up to 250m long and up to 70m apart, with bearing piles, mooring structures and reinforced concrete heads, connected by steel walkways and the permanent mooring at the dolphins of a floating dry-dock (Work 10)

- A reinforced concrete or steel pontoon providing access to and from Work 10 (Work 11)

2.36 The impact on these developments has been considered as part of this assessment.

3 Development Proposals

Introduction

3.1 The proposed development is for an energy recovery facility with ancillary buildings and works including administrative facilities, gatehouse and weighbridge, parking and circulation areas, cable routes to ship berths and existing off-site electrical sub-station, with site access through Portland Port from Castletown, on a brownfield site (previously developed land) within the existing and operational Portland Port.

3.2 A copy of the layout can be found within Appendix E of this report.

Vulnerability

3.3 In accordance with the Planning Practice Guidance, energy infrastructure is the most vulnerable use within this application and is considered to be "Highly Vulnerable". However, with all built development being located entirely within 'Flood Zone 1', Table 3 of the Planning Practice Guidance demonstrates that the proposals are appropriate for the site.

3.4 The wider application boundary includes land inside Flood Zones 2 and 3 however these areas are being used to facilitate utility and highway enabling works and will not be impacted by or have an impact on existing flood risk.

Sequential Test

3.5 The proposed development is located within 'Flood Zone 1' and therefore passes the Sequential Test, as there are no competing sites with a lower flood risk classification.

Cross sections and finished levels

3.6 It is likely that the existing ground profile will need to be modified to achieve suitable developable areas and to reflect the drainage requirements for the proposed development.

3.7 Any future levels design for the site should aim to minimise the extent of re-profiling works and should look to retain existing catchment areas wherever possible.

Safe access and egress

3.8 All access/egress roads surrounding the site are located within 'Flood Zone 1' and hence access and egress for motorised and non-motorised vehicles will not be affected during flood events.

Drainage strategy requirements

3.9 The drainage strategy will follow the principles of the previously agreed strategy for the previously approved scheme at the site and follow consultation with DC FRM. A copy of their preliminary advice is included within Appendix A of this report

3.10 CIRIA C753 advises that surface water disposal should be prioritised in the following order;

1. Infiltration
2. Discharge to surface waters
3. Discharge to a surface water drainage system
4. Discharge to a combined sewer

3.11 As required by the NPPF, the drainage strategy must demonstrate that the development will be safe throughout its lifetime, without increasing flood risk elsewhere, whilst also taking account of the impacts of climate change.

3.12 Made ground and tidal related groundwater are expected to preclude the use of soakaways.

3.13 The site is located adjacent the sea and should therefore prioritise discharge to surface water in line with the drainage hierarchy. Any discharges to sea would have negligible impact on the receiving water and do not require any on site attenuation, however they should seek to minimise impacts by utilising existing outfalls where possible and by offering treatment prior to discharge.

3.14 This principle was discussed and agreed through the previous applications at the site where consultation was held with the EA, who confirmed '*We have no 'in principle' objection to the discharge of surface water from the site provided it is not contaminated. To protect the marine environment, we will request the Local Planning Authority include conditions within any planning permission that will ensure pollution prevention measures (e.g. oil* *interception etc.) be incorporated within any surface water drainage scheme'*.

Climate change impacts

3.15 The NPPF requires that the impact of climate change be considered to minimise vulnerability and provide resilience. The NPPF and Planning Practice Guidance explain that an FRA should demonstrate how flood risk will be managed across the development's lifetime, taking climate change into account at the level of 40%.

3.16 The Environment Agency, as the government's expert on flood risk, released the document 'Flood Risk Assessments: Climate Change Allowances Guidance' in February 2016.

3.17 Table 3.1 below provides an extract detailing the predicted increase in peak rainfall intensity due to climate change over the next 100 years.

Table 3.1 – Peak rainfall intensity allowances (applicable across all of England)

Allowance category	**Total potential change anticipated for (2015 to 2039)**	**Total potential change anticipated for (2040 to 2069)**	**Total potential change anticipated for (2070 to 2115)**
Upper end (90th Percentile)	10%	20%	40%
Central (50th Percentile)	5%	10%	20%

3.18 The guidance states for peak rainfall intensity, FRA should "assess both the central and upper end allowances to understand the range of impact".

3.19 The on-site systems will be sized to cater for climate change to offer flood protection to the development itself as there are no downstream properties to help protect in terms of water discharge. The upper end allowance of 40% will be utilised to present a worst-case scenario.

Exclusions

3.20 Any potential contamination from the site during emergency events (fire, leakages, spillages etc) will be managed within each respective building/yard space within localised storage areas where any contaminants can be isolated from the proposed surface and foul water drainage systems.

3.21 The surface and foul water systems are therefore designed to manage flows during normal design events, with the building and yard layouts designed to manage emergency events separately, by others.

4 Surface Water Management Plan

4.1 To ensure the development is safe throughout its lifetime, the Surface Water Management Plan (SWMP) accounts for runoff in up to the 100-year return period.

4.2 The strategy also safeguards against the upper end allowances for climate change (40%), providing betterment over undeveloped conditions, where the rate and volume of runoff would continue to increase due to climate change.

4.3 Runoff generated by the site will be captured and drained through a private conveyance system, with capacity to safely manage all flows up to the 100 year +40% climate change storm event.

4.4 Runoff from roof areas will drain through an independent system, with uncontrolled discharge to the existing outfall at Balaclava Bay. The risk of pollution from roof runoff only is very low and therefore no on-site treatment measures are proposed. The outfall pipe should be surveyed and any defects remediated to ensure that it is in suitable condition to serve the development.

4.5 Runoff from highway or yard areas will drain through a separate system and will pass through rain gardens where practicable and a new SuDS swale and downstream oil bypass separator prior to reaching the existing outfall at Portland Port.

4.6 The use of SuDS and the oil bypass separator, together with trapped gullies and silt trap manholes will mitigate the risk of pollution upstream of the Portland port outfall.

4.7 The introduction of SuDS and other green spaces within the brownfield site also generate a reduced impermeable catchment and therefore whilst an unattenuated discharge is permitted, future runoff flows and volumes will demonstrate betterment over existing conditions.

4.8 To protect the site against any wave overtopping, site levels are anticipated to slope away from the built development, allowing any overtopping to fall back towards the sea.

4.9 The proposed surface water strategy can be seen identified on the Preliminary Drainage Layout drawing 0979-PDL-101 within Appendix F of this report.

Exceedance events

4.10 During exceedance events beyond the 100 year return period storm runoff will overflow from the systems and away from primary access and egress routes, towards areas of green / yard space, where any excess flows can be impounded.

4.11 Beyond the capacity of these areas, flows will continue off site and be directed towards the tidal water as existing.

Proposed foul water strategy

4.12 The nearest existing WW combined sewer is located to the west of the site, routing from south to north through Portland Port.

4.13 Due to site levels, foul flows from the development will drain towards a new private package pump, with rising main connection to the existing WW combined sewer network.

4.14 Any foul flows from the energy recovery processes and any trade discharges will be subject to a trade effluent consent from WW where details of any additional treatment measures required (additional separators etc) prior to discharge will be agreed.

4.15 The above strategy arrangements have been discussed and confirmed with WW. A copy of their correspondence is included within Appendix G.

4.16 The preliminary alignment of new foul sewerage networks are identified on the preliminary drainage layout drawing included within Appendix F of this report.

Maintenance

4.17 Any adoptable sewerage networks will be designed in accordance with current Sewer Sector Guidance (formerly Sewers for Adoption 8th), and will be offered to WW for adoption.

4.18 Any private drainage and SuDS features will be designed in accordance with Building Regulations Part H and CIRIA C753 , and will become the responsibility of the respective operator or appointed management company.

4.19 The operation and maintenance of any SuDS features will be undertaken in accordance with 'CIRIA C753 – The SUDS Manual, Chapter 32 – Operation and Maintenance'.

4.20 At the detailed engineering design stage a 'Drainage Maintenance Plan' should be prepared. The Plan will set out maintenance tasks, responsibilities and frequencies for the entire drainage network, including private, adopted and SuDS drainage.

5 Miscellaneous Issues

Construction issues

5.1 It is recommended that a construction stage drainage plan is prepared at the engineering design stage to ensure the site and downstream catchment are adequately protected throughout construction. The plan should be agreed with the Local Planning Authority and implemented prior to commencement of construction.

5.2 Any facilities for the storage of oils, fuels or chemicals need to be situated in suitable bunded bases that will be equivalent to at least the volume of the tank plus 10%.

Residual flood risks

5.3 The residual risk of blockage or failure of any key component within the proposed drainage strategy will be reduced through appropriate operation and maintenance procedures.

5.4 At the design stage, the residual risks from exceedance storms will be reduced through appropriate design of the external works and highway alignments. The design will aim to steer exceedance flows towards areas of green space and service yards, where any aboveground storage can be utilised.

Health and safety

5.5 Under the CDM Regulations, adequate information about the site must be provided by the client in order to allow the potential hazards to be reviewed by the designer, and avoidance / mitigation measures taken where reasonably practicable.

6 Mitigation, Conclusions and Recommendations

Mitigation

6.1 The proposed development has been assessed in line with the NPPF and The Dorset Waste Plan, to allow the planning application to be progressed and to show that the development can be undertaken in an acceptable manner from a flood risk perspective.

6.2 The extent of built development within the ERF area is limited to 'Flood Zone 1' only and is not considered to be at risk of flooding from pluvial, groundwater, infrastructure, artificial sources or wave action.

6.3 The wider application boundary includes land inside Flood Zones 2 and 3 however these areas are being used to facilitate utility and highway enabling works and will not be impacted by or have an impact on existing flood risk.

6.4 To ensure the development is safe throughout its lifetime, the surface water strategy accounts for runoff in up to the 100 year return period.

6.5 The strategy also safeguards against the upper end allowances for climate change (40%), providing betterment over undeveloped conditions, where the rate and volume of runoff would continue to increase due to climate change.

6.6 Made ground from previous site uses and the potential for raised groundwater related to tidal ranges precludes the use of soakaway based drainage.

6.7 Surface water runoff will be captured and discharged directly to sea and will seek to re-use existing points of outfall.

6.8 The proposed development reduces the sites existing impermeable catchment and therefore provides betterment in terms of peak rates and volumes of discharge.

6.9 Runoff from roofs will drain directly to Balaclava Bay, whilst highway and yard areas will drain through a new SuDS swale and bypass separator prior to discharging to Portland Port.

6.10 During exceedance events runoff will be directed towards areas of green space or yard areas where flows can be temporarily stored above ground.

6.11 The reduction in peak runoff from the site and the inclusion of SuDS treatment drainage systems, will ensure provide betterment over existing site conditions and will therefore have no adverse negative impacts on committed development sites that are being assessed as part of the EIA.

6.12 Due to existing levels, foul flows generated by the development will be pumped to the existing WW combined network to the west of the site.

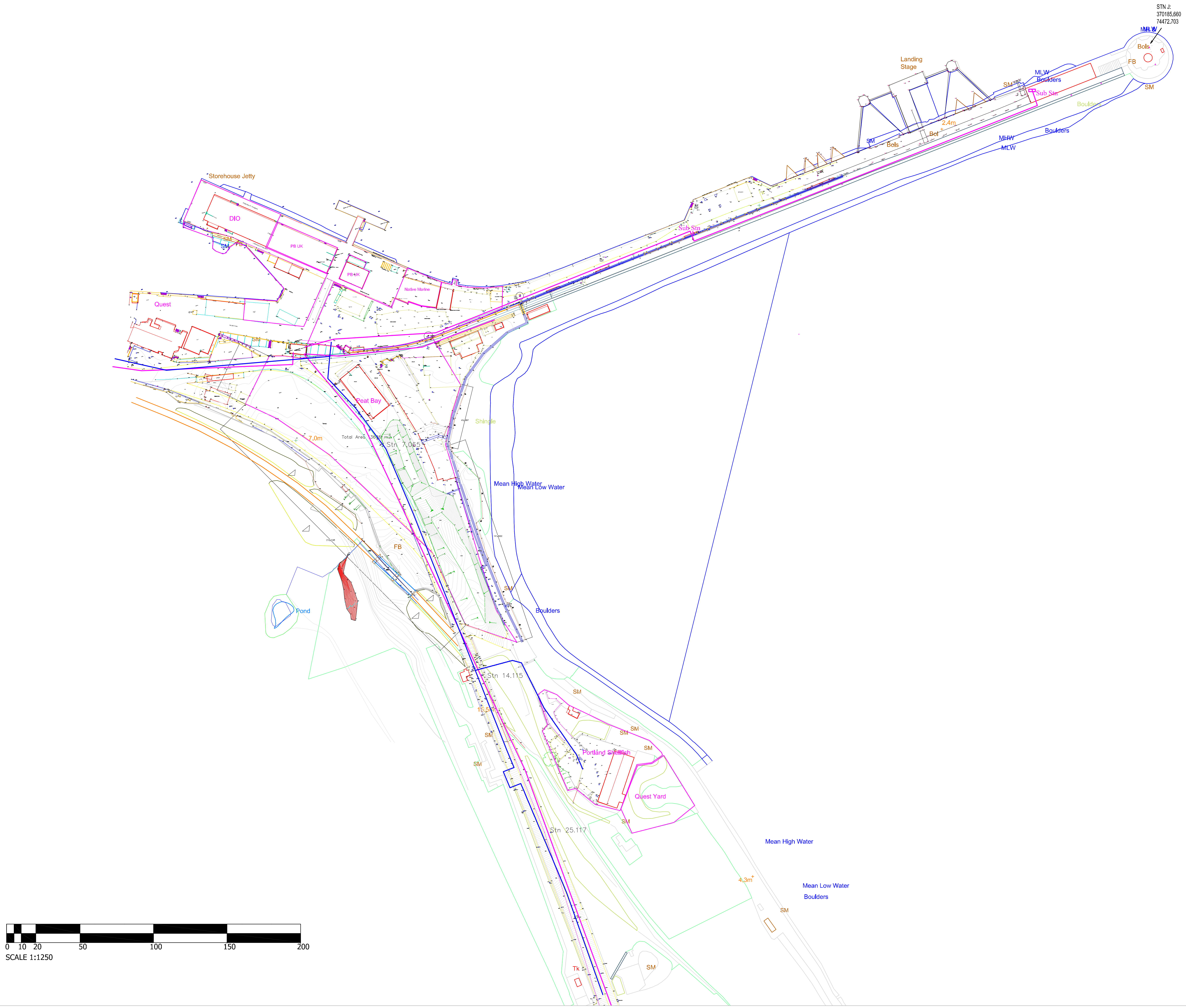
Conclusions

> *This Flood Risk Assessment has been assessed in line with the NPPF. It is concluded that the development can be undertaken in a sustainable manner, whilst also reducing the flood risk to existing properties in the downstream catchment.*
>
> *The FRA does not attempt to present a final design of the surface water systems. Detailed design of the surface water networks and inherent features will commence upon approval of the strategy and will include assessments due to further site investigations, health and safety, CDM*

Recommendations

6.13 As the development will be safe from flooding for its design life and will actively reduce flood risk to properties within the downstream catchments and provide water quality enhancements, it is recommended that the LLFA advise the Local Planning Authority that they have no objections to the proposed development.

Appendix A Existing Topographic Survey



PETE_1:1250@A1

I have included three areas here to help with the visualization of the access way from 50t to peatbay(Pete).

TOPO

drawing name PETE_TOPO

drawn by JG 15.02.2019 date

revision REV1 1:1250 scale

PORTLAND
PORT

Portland Port Business
Centre, Castletown,
Portland DT5 1PP

Appendix B Coastal Flooding Assessment Report Extracts

W4B Renewable Energy Limited

Balaclava Bay, Portland - Coastal Flooding Assessment Report

June 2009

RPS Consulting Engineers

RPS CONSULTING ENGINEERS
ELMWOOD HOUSE
74 BOUCHER ROAD
BELFAST BT12 6RZ
Telephone 028 90 667914
Facsimile 028 90 668286

W4B Renewable Energy Limited

Balaclava Bay, Portland - Coastal Flooding

Assessment Report

DOCUMENT ISSUE

Revision	Title	Date	Prepared by	Checked by	Client Receipt
Rev 0	Balaclava Bay Portland – Coastal Flooding	June 09	AKB	MB	
Rev 1 Final	Balaclava Bay Portland – Coastal Flooding	June 09	AKB	MB	

W4B Renewable Energy Limited

Balaclava Bay, Portland - Coastal Flooding Assessment Report

TABLE OF CONTENTS

TABLE OF FIGURES

APPENDICIES

Joint Probability waves and water levels storms from 90° to 134°
Joint Probability waves and water levels storms from 135° to 179°
Joint Probability waves and water levels storms from 180° to 224°
Joint Probability waves and water levels storms from 225° to 269°
Joint Probability waves and surges storms from 90° to 134°
Joint Probability waves and surges storms from 135° to 179°
Joint Probability waves and surges storms from 180° to 224°
Joint Probability waves and surges storms from 225° to 269°

Excel Wave Climate Files
Excel Overtopping Rate Files

1 INTRODUCTION

W4B Renewable Energy Limited (W4BRE) is proposing to construct and operate a Green Electricity Plant on land at Portland Port, Dorset.
The plant will be designed to deliver 17.8MW of power and will comprise the following key elements of infrastructure;

- Power Oil Production Facility capable of processing up to 40,000 tpa of vegetable oil to create 30,000 tpa of 'power oil';
- A Stationary Power Plant comprising two 8.9MW engines;
- A Tank Farm for the storage of up to 10,000 tonnes of vegetable oil;
- Vegetable oil pipelines; and,
- A step up transformer to allow electrical connection to the local grid.

The development site is approximately 2.0 ha and is located in Portland Harbour, Balaclava Bay. It is a roughly triangular shape with the former railway embankment forming the south western boundary, the shingle shoreline and overland pipelines from Portland Bunkers defining the eastern boundary and the existing port development to the north. The site comprises a number of vacant buildings located to the north, with the remainder of the site covered in rubble resulting from the previous demolition of buildings at the site.

As RPS has already undertaken wave and current studies in relation to the marine works for the Portland Gas Storage scheme, the firm was appointed to prepare an assessment of the coastal flood risk at the W4B Renewable Energy site at Balaclava Bay.

The assessment methodology and techniques used in this study are set out below.

2 METHODOLOGY

2.1 Modelling Software

RPS have use their suite of coastal process models to simulate the tidal flow regime and storm wave climate around the Portland site to provide the wave climate for various return period events for the assessment of risk of coastal flooding at this site. The wave and tidal models were developed using the MIKE21 coastal process software which has been developed by the Danish Hydraulics Institute.

2.1.1 Tidal Model

The model simulations for the tidal flow regime at Portland have been completed using a nested 2-D depth averaged MIKE21 HD flow model of the Portland-Weymouth Bay area.

The bathymetry for the model study was taken from hydrographic survey and beach survey data plus digital chart source data supplied by C-Map of Norway. For consistency the bathymetry data was related to Mean Sea Level before being used in the models. The tidal model was calibrated using field data collected during May and June 2006, in addition to published Admiralty data. Details of the model calibration are given in RPS Report No IBE0007/NS/R03, "Brine and HDD Breakout Dispersion Studies", dated March 2007.

2.1.2 Wave Model

The wave model simulations have been undertaken using the MIKE21 Nearshore Spectral Windwave model.

MIKE 21 NSW is a spectral wind-wave model, which describes the growth, decay and transformation of wind-generated waves and swell in nearshore areas.

The model takes into account the effects of refraction and shoaling due to varying depth, local wind generation and energy dissipation due to bottom friction and wave breaking. The model also takes into account the effect of wave-current interaction.

2.1.3 Extreme Value Analysis and Joint Probability Analysis

The EVA toolbox in MIKE Zero comprises a comprehensive suite of routines for performing extreme value analysis. These include a large number of probability distributions, including exponential, generalised Pareto, Gumbel, generalised extreme value, Weibull, Frechét, gamma, Pearson Type 3, Log-Pearson Type 3, log-normal, and square-root exponential distributions.

The joint probability analysis of extreme waves and water levels was undertaken using the techniques and procedures recommended by DEFRA/EA in the technical report FD2308 "Joint probability methods in flood management". The analysis for this technical report was undertaken using software developed as part of the Join-Sea research project.

2.2 Data Sources

2.2.1 Bathymetry

The bathymetry for the model studies has been taken from hydrograhic surveys undertaken for the Portland Gas Storage project and land surveys of the Balaclava Bay site including the beach and sea defence surveys which were specifically undertaken for this project.

The model bathymetry for the areas outside those covered by the hydrographic surveys has been taken from digital chart data supplied by C-Map of Norway.

2.2.2 Offshore Wind and Wave Data

Offshore wave data has been derived from the UK Met Office Wave model for a point at 50.5° N, 2.06° W. The dataset used consists of Spectral Significant Wave Heights, Hm0, Mean Wave Periods, Tm, and Mean Wave Directions every three hours for the 16 year period 1990 to 2006 inclusive. The dataset also includes Mean Hourly Wind Speed and Mean Wind Directions recorded on a three hourly basis.

2.2.3 Tidal Currents and Water Levels

There are no long term data sets for tidal currents in the Weymouth area thus the tidal currents were assumed to be related to the tidal range. The tidal currents for the study were taken from a calibrated 2D depth averaged tidal model of the Portland - Weymouth Bay area. Water levels and surges were derived from 15 years of tidal height records that were obtained from the UK National Tide Gauge Network class A gauge at Weymouth.

2.3 Data Analysis

2.3.1 Extreme Water Levels and Surges

The extreme water levels were derived from an analysis of high tide levels extracted from the 16 years of tidal records at the Weymouth. Figure 1 shows the probability plot of the extreme value analysis of the high water levels which yielded the following return period event levels.

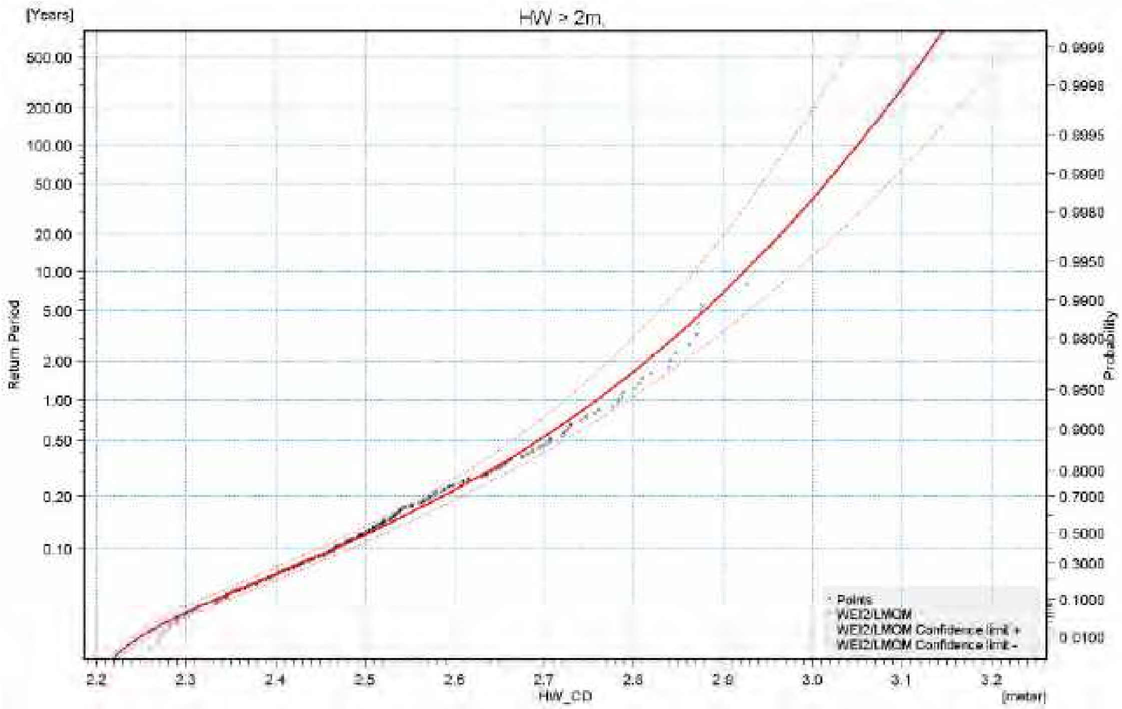


Figure 1 Extreme Value Analysis for High Water Levels – Weymouth 91 – 06

The extreme water levels were found to be as follows:

Return period	Water level to CD	Water level to OD
1 in 1 year	2.760 m	1.820 m
1 in 5 year	2.872 m	1.932 m
1 in 10 year	2.920 m	1.980 m
1 in 50 year	3.014 m	2.074 m
1 in 100 year	3.050 m	2.110 m
1 in 200 year	3.083 m	2.143 m
1 in 1000 year	3.156 m	2.216 m

It will be seen from the above that the site levels at 6.5m to 7.0m or greater above OD will not be subject to direct flooding from the sea. Flooding which may occur can only be as a result of wave overtopping during storms.

A similar extreme value analysis was undertaken for the surges measured at the Weymouth tide gauge. The results of the analysis are shown in Figure 2.

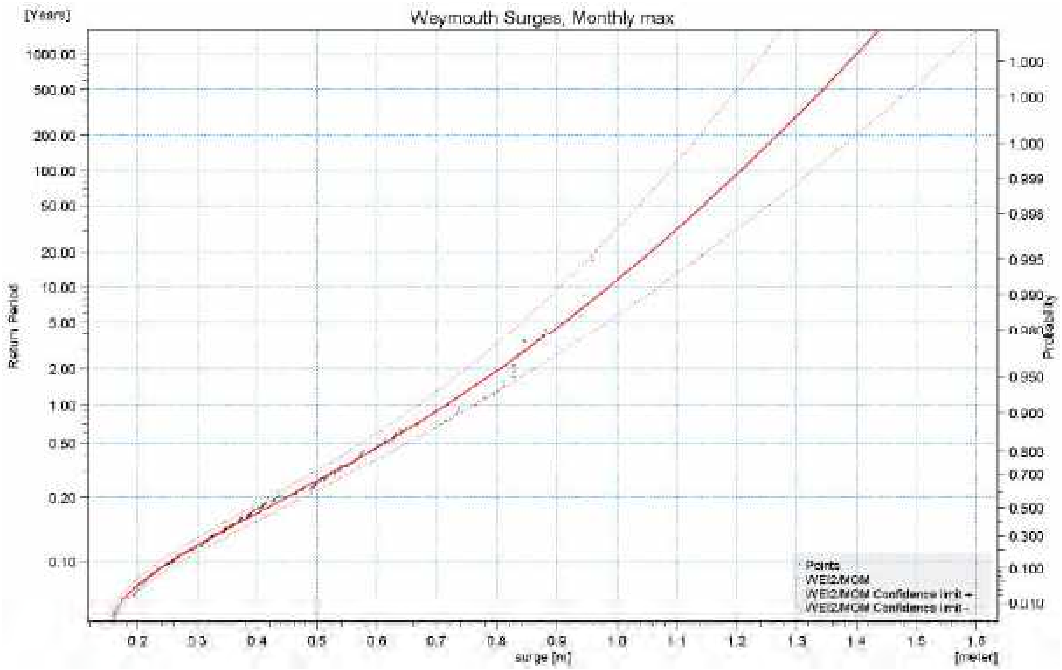


Figure 2 Extreme Value Analysis for Storm Surge Residuals – Weymouth 91 – 06

The results of the storm surge extreme value analysis were as follows:

Return period	Storm surge value
1 in 1 year	0.710 m
1 in 5 year	0.908 m
1 in 10 year	0.981 m
1 in 50 year	1.144 m
1 in 100 year	1.207 m
1 in 200 year	1.268 m
1 in 1000 year	1.400 m

2.3.2 Offshore Wave Data

The offshore wave and wind climate was divided in to 45° sectors and an extreme value analysis undertaken to identify the wave and wind climate for return period events of 1 in 1 year to 1 in 1000 years probability for each wave and wind direction sector. The EVA was undertaken using the MikeZero EVA toolbox and a typical plot for the wave height from the 135° to 179° sector is shown in Figure 3.

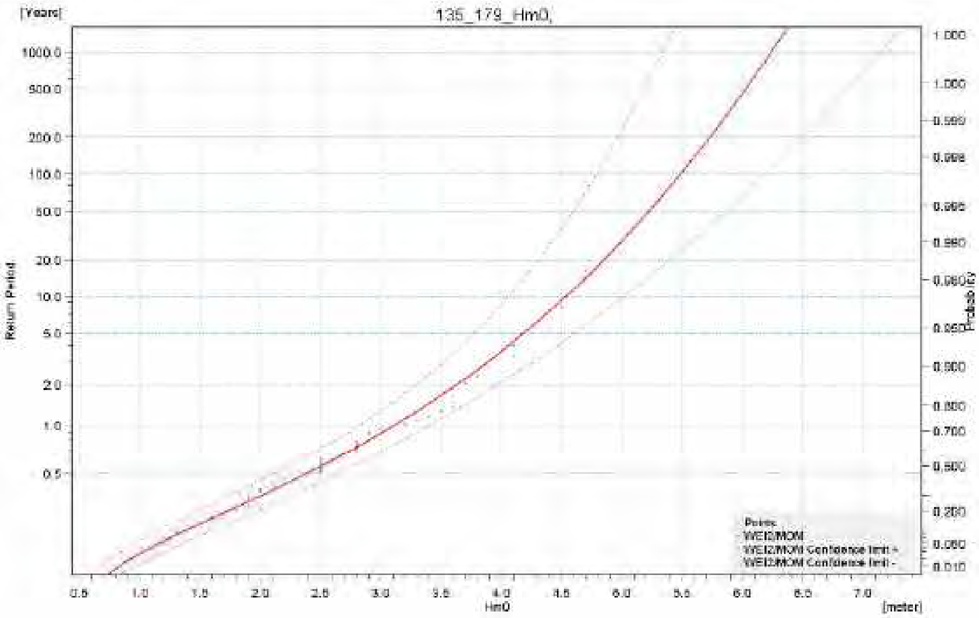


Figure 3 **Extreme Value Analysis for wave heights from 135° to 179° sector**

Examples of the results of the analysis of the offshore wave and wind climate were as follows:

Sector E to SE

Return period years	Wave height Hm0 [m]	Wave Period Tm [s]	Wind Speed U_{10} [m/s]
1 in 1	3.00	6.24	16.5
1 in 50	4.67	7.78	22.6
1 in 200	5.17	8.19	24.4

Sector SE to S

Return period years	Wave height Hm0 [m]	Wave Period Tm [s]	Wind Speed U_{10} [m/s]
1 in 1	3.15	6.39	16.0
1 in 50	5.23	8.23	23.5
1 in 200	5.73	8.62	26.2

Sector S to SW

Return period years	Wave height Hm0 [m]	Wave Period Tm [s]	Wind Speed U_{10} [m/s]
1 in 1	5.22	8.23	23.7
1 in 50	7.30	9.73	33.1
1 in 200	7.88	10.11	36.1

Sector SW to W

Return period years	Wave height Hm0 [m]	Wave Period Tm [s]	Wind Speed U_{10} [m/s]
1 in 1	4.80	7.89	22.1
1 in 50	6.89	9.45	31.6
1 in 200	7.55	9.89	34.6

2.3.3 Joint Probability Analysis

Joint probability analysis was undertaken for both extreme waves and water levels and for extreme waves and storm surges based on the extreme value analysis of offshore waves, water levels and surges.

The DEFRA/EA technical report FD2308 "Joint probability methods in flood management" shows that the correlation coefficient between wave height and sea level in the Weymouth area is 0.48 for directions between 70° and 210° and this coefficient was used for the analysis of waves and water levels in this study. The DEFRA/EA document also shows that the correlation coefficient between wave height and surges in the Weymouth area is 0.73 for all wave directions and this value was used in this study.

The joint probability analysis for extreme waves and water levels was undertaken for each 45° wave sector between 90° and 270°. The analysis of extreme waves and surges was undertaken in a similar manner and the results of both analyses are shown in the tables in the Appendix .

An example of the combinations of the joint 1 in 200 year return period waves and water levels for the 90° to 134° sector is shown below.

Water level to MSL [m]	Significant wave height [m]
1.426	5.166303
1.545	5.166303
1.655	5.166303
1.720	5.166303
1.775	5.148926
1.832	4.829174
1.880	4.575336
1.936	4.309352
1.974	3.935192
2.010	3.630934
2.043	3.303077
2.116	#N/A

An example of the combinations of the joint 1 in 200 year return period waves and surges for the 90° to 134° sector is shown below.

Surge residual [m]	Significant wave height [m]
0.710	5.166303
0.803	5.166303
0.908	5.166303
0.981	5.166303
1.054	5.166303
1.144	4.920150
1.207	4.670344
1.268	4.409071
1.400	#N/A

2.4 Storm Wave Climate

2.4.1 Wave Transformation

The transformation of the offshore waves to the coastal protection site was undertaken using the Mike21 NSW wave model. The tidal flows around Portland are complex with strong currents over part of the area. The wave transformation therefore included the effects of wave current interaction.

The complex tidal flows around the Portland area and the non-sinusoidal shape of the tidal curve results in the currents in the area adjacent to the Balaclava Bay site flowing south for the greater part of the tidal cycle. Typical ebb and flood flow regimes are shown in Figure 4 below.

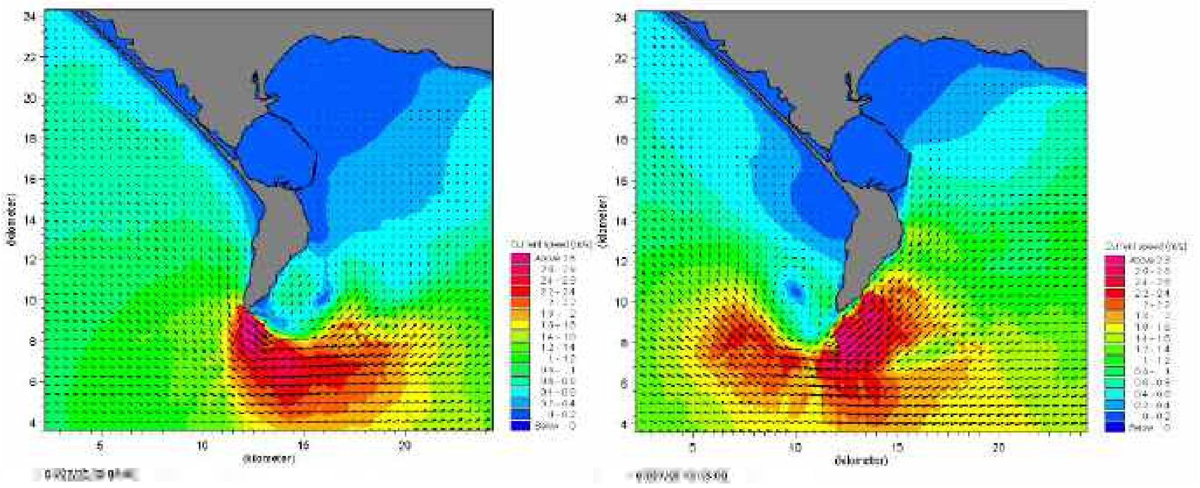


Figure 4 Typical Spring Flood and Ebb Flow Fields around Portland

Previous work undertaken for the Portland Gas Storage project had examined the relationship between tidal levels and tidal flows in the approaches to the Balaclava site. Figure 5 shows typical tidal and current curves in the area.

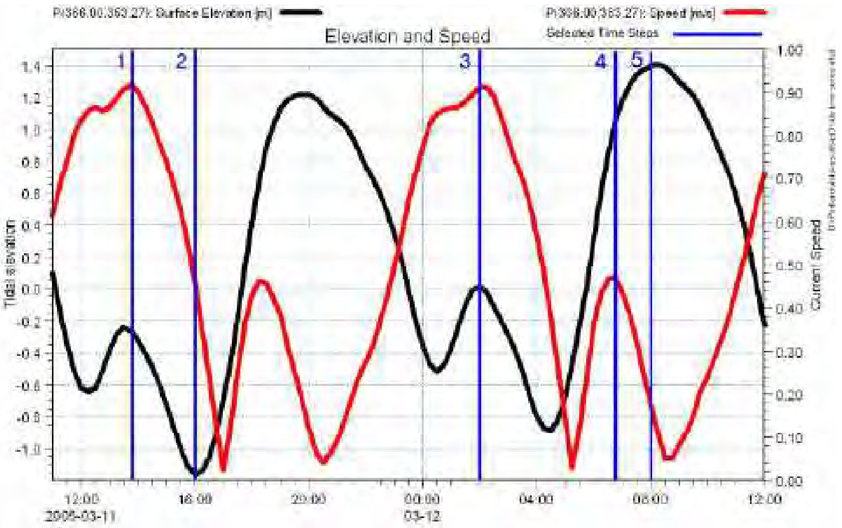


Figure 5 Current Speed and Surface Elevation Time Series

The results of the wave transformations undertaken for the Portland Gas Storage project had shown that the effect of wave current interaction resulted in larger waves approaching the site during times of high south going currents, time step 3, than at times of high water, time step 5.

The wave transformation was therefore undertaken for the combination of extreme waves and water levels using the flow regime at time step 5 and for the range of extreme waves and surges using the flow regime at time step 3.

The offshore wave data set was examined to identify the range of directions from which the largest waves in each directional sector were to be found. This information was used together with some preliminary wave transformation runs to identify the series of offshore wave direction to be used in the analysis. The range of directions selected on this basis was 090°, 105°, 133°, 165°, 180°, 200° and 230°.

In accordance with the recommendations for flood and coastal defence, a joint probability of 1 in 200 years was used as the design standard and the wave transformations were undertaken for the combination of waves and water levels appropriate to this return period. In addition 1 in 1000 year events were simulated for those storm directions which proved to be most severe at the site which were 133°, 165° and 180°.

The wave transformation was undertaken in a two stage process. The main transformation was undertaken using 25m x 100m NSW wave models. The wave approaches to the site were then simulated using a more detailed 2.5m x10m NSW model. The boundary conditions for the fine inshore model were taken from the results of the larger overall model simulations.

The bathymetry of the model for wave transformations from the E to SE directions is shown in Figure 6 and the fine inshore model bathymetry in Figure 7

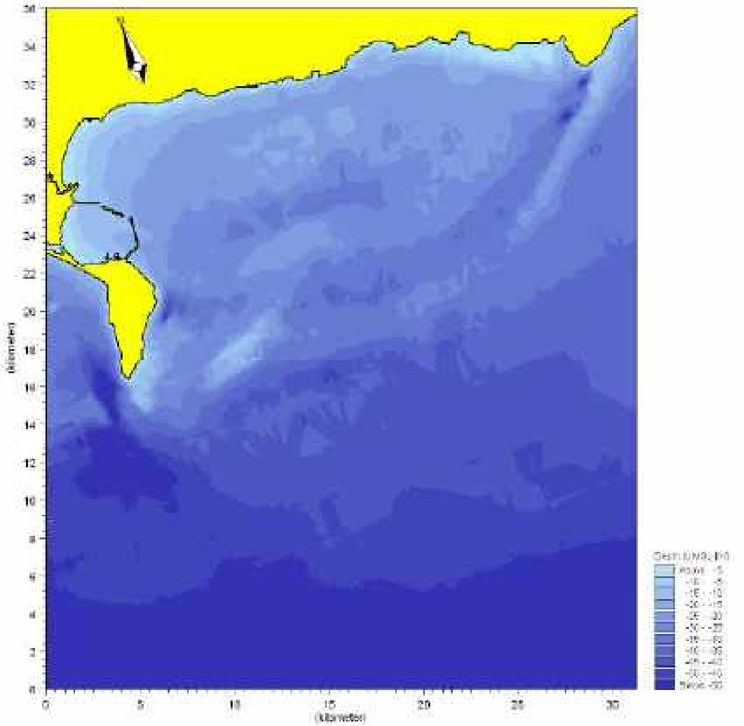


Figure 6 **25m x 100m NSW wave model bathymetry of Weymouth and Portland**

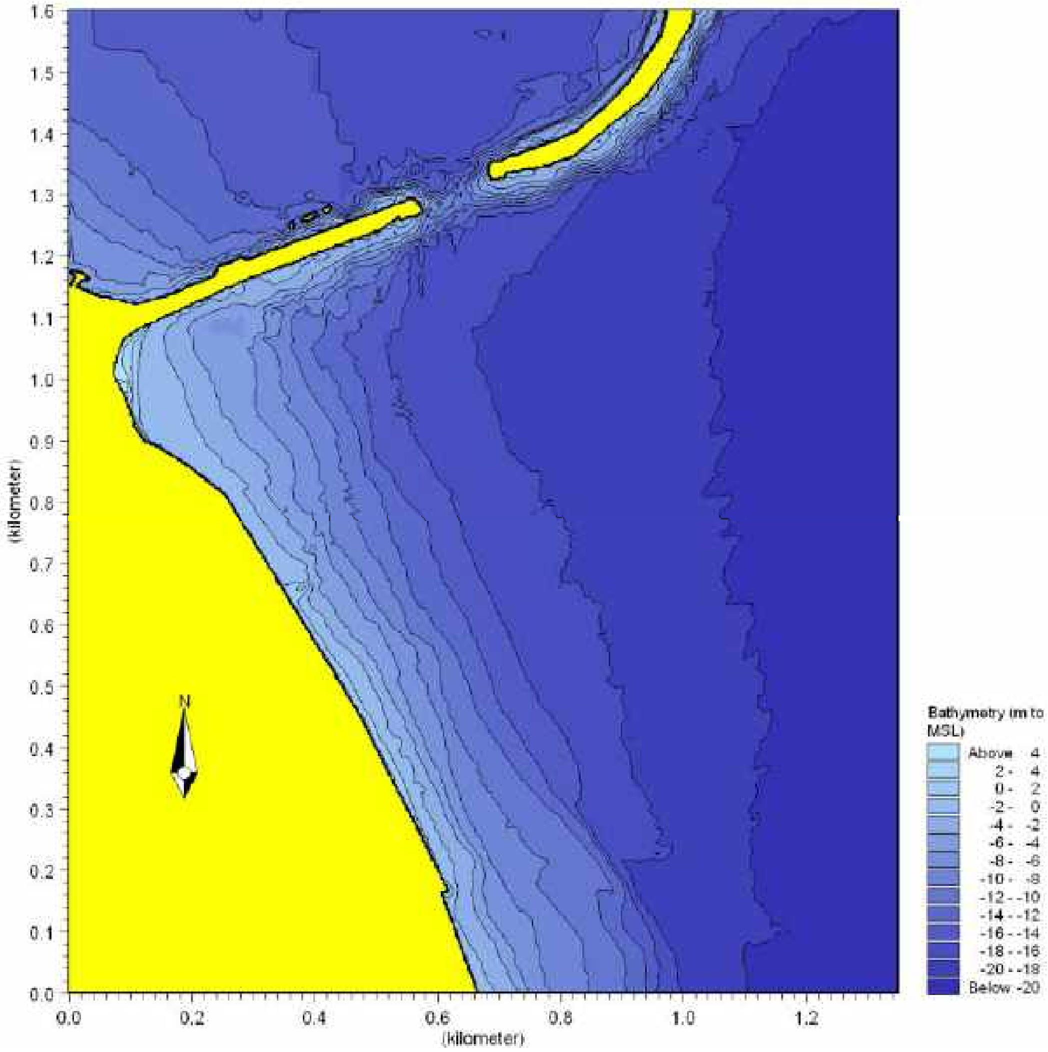


Figure 7 **Fine 2.5m x 10m wave model bathymetry of approaches to the site**

2.4.2 Effect of Climate Change and Subsidence

The effect of the predicted climate change by 2109 on the design wave climate was simulated for the range of critical wave directions identified from the transformation of the present wave conditions. In these simulations the water levels were increased by 1.056 m to take account of climate change in accordance with the DEFRA recommendation of October 2006. The offshore wave heights and wind speeds were also increased by 10% and the wave periods by 5% to cater for possible increased storminess by 2109. Although there may be some increase in storm surges, it is not clear what effect, if any, these will have on current flows. Thus the tidal currents used in the climate change simulations were those generated by a large spring tide.

The construction and operation of the proposed gas storage caverns will result in a gradual subsidence in the area of Portland around the storage cavern site. The predicted subsidence around the area after 100 years is shown in Figure 8 below.

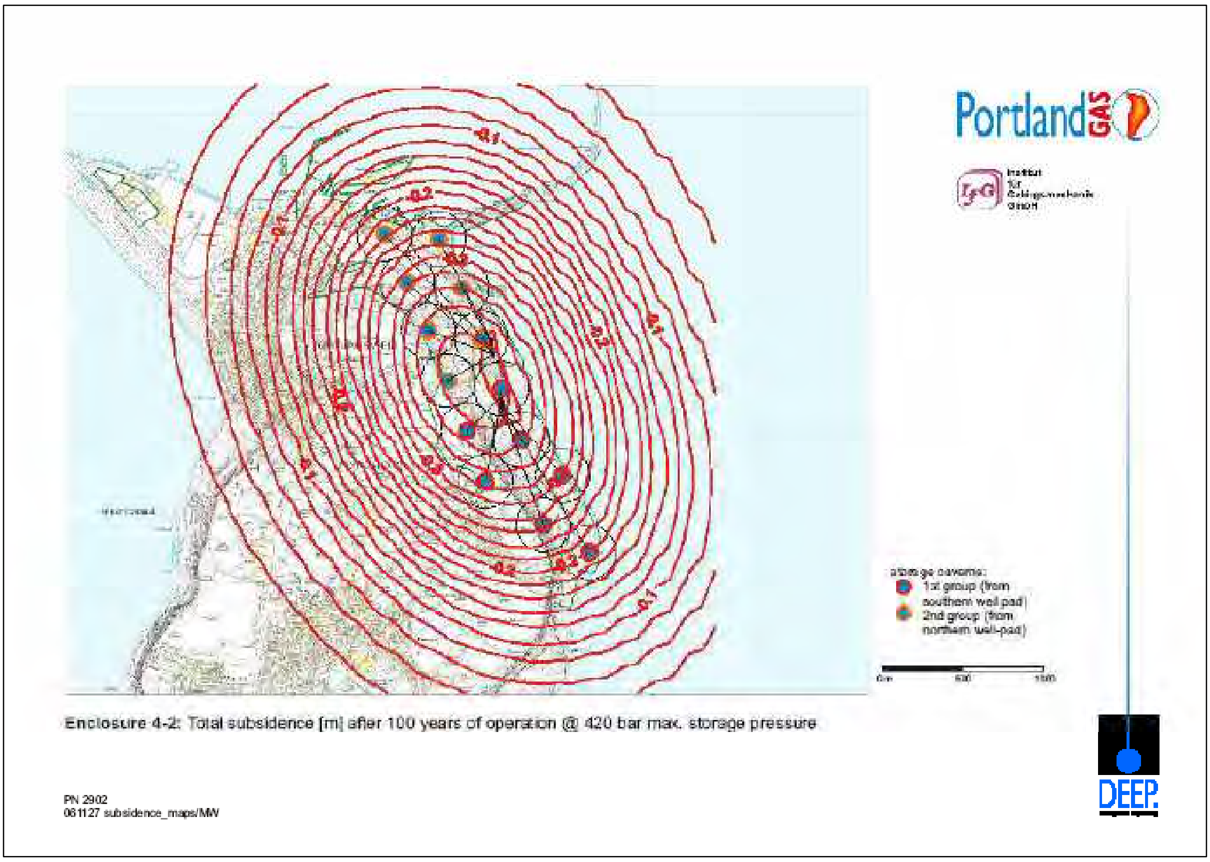


Figure 8 Subsidence contours after 100 years of operation

It will be seen from Figure 8 that the coastal frontage of the site is expected to subside by about 0.280m over the 100 year period. This subsidence effectively increases the sea level relative to today's water levels and along with sea level rise due to climate change will increase the size of the waves that can approach the beach and attack the sea defences at the back of the beach.

In the simulations for the inshore wave climate in 2109, the water levels have therefore been increased by 1.336m (1.056+0.28) to take account of both global warming and subsidence.

2.4.3 Inshore wave conditions

The wave conditions approaching the site were simulated for the range of waves and water levels given by the joint probability analysis as noted in section 2.3.2 above. The largest waves which approach the site were found to come from the 133° and 165° offshore storm directions. However, due to the longer period of the storm waves from 180° storms from this direction produced greater overtopping at the site.

Figure 9 shows the significant wave height and mean wave direction for a 1 in 200 year storm from 133° at high tide, water level 2.042m above OD. Figure 10 shows the wave heights and directions for a 1 in 200 year storm from 133° at high tide, water level 1.881m above OD. It will be noted that although the waves offshore are larger for this latter combination the reduced water depths in the approaches to the site reduce the height of the waves which can attack the site frontage. As the waves which approach the sea defences at the site are depth limited, the larger waves which approach the nearshore area during periods when the tide is south going (at mid tide levels) are reduced at the approaches to the site due to the reduced water depth in front of the defences. Thus the critical conditions for flood risk are during the period around high tide.

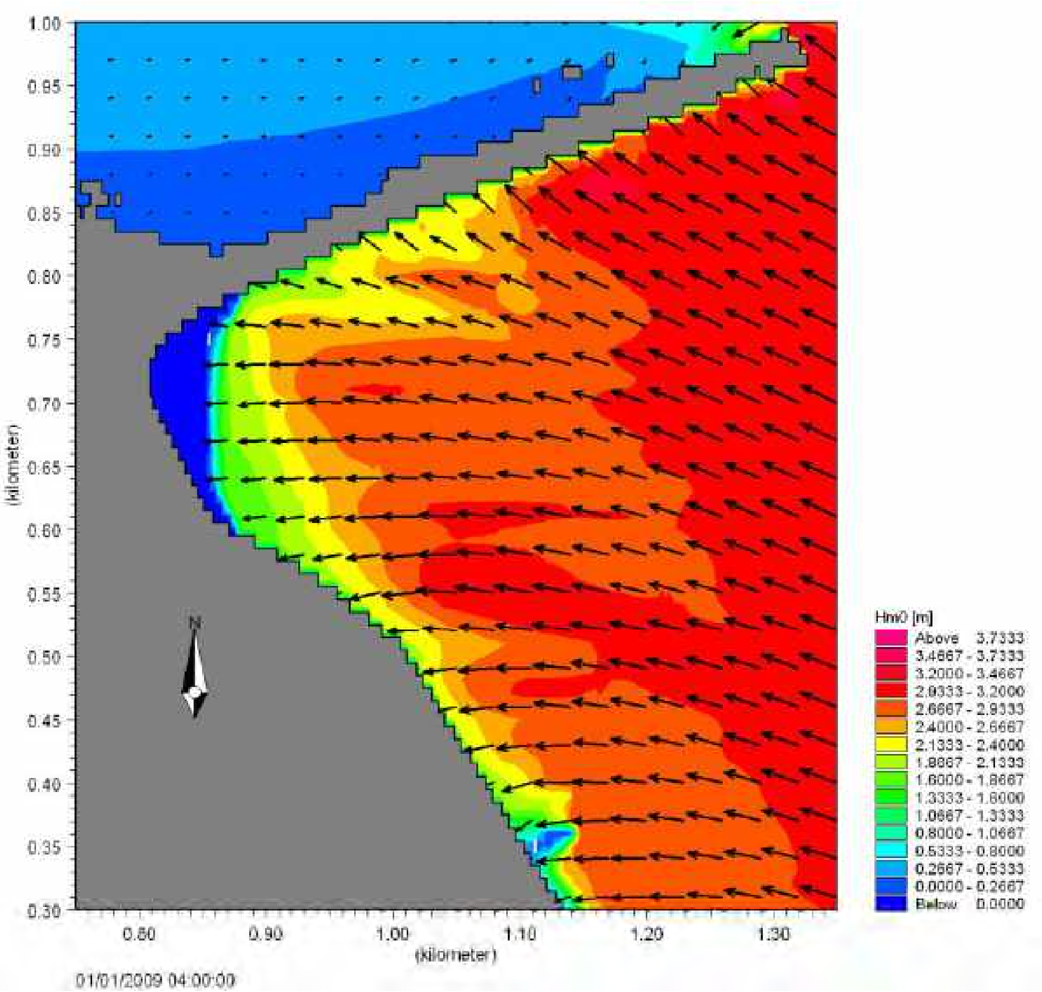


Figure 9 **Significant wave height and mean wave direction**
1 in 200 year storm from 133° at a high tide of +2.042m OD

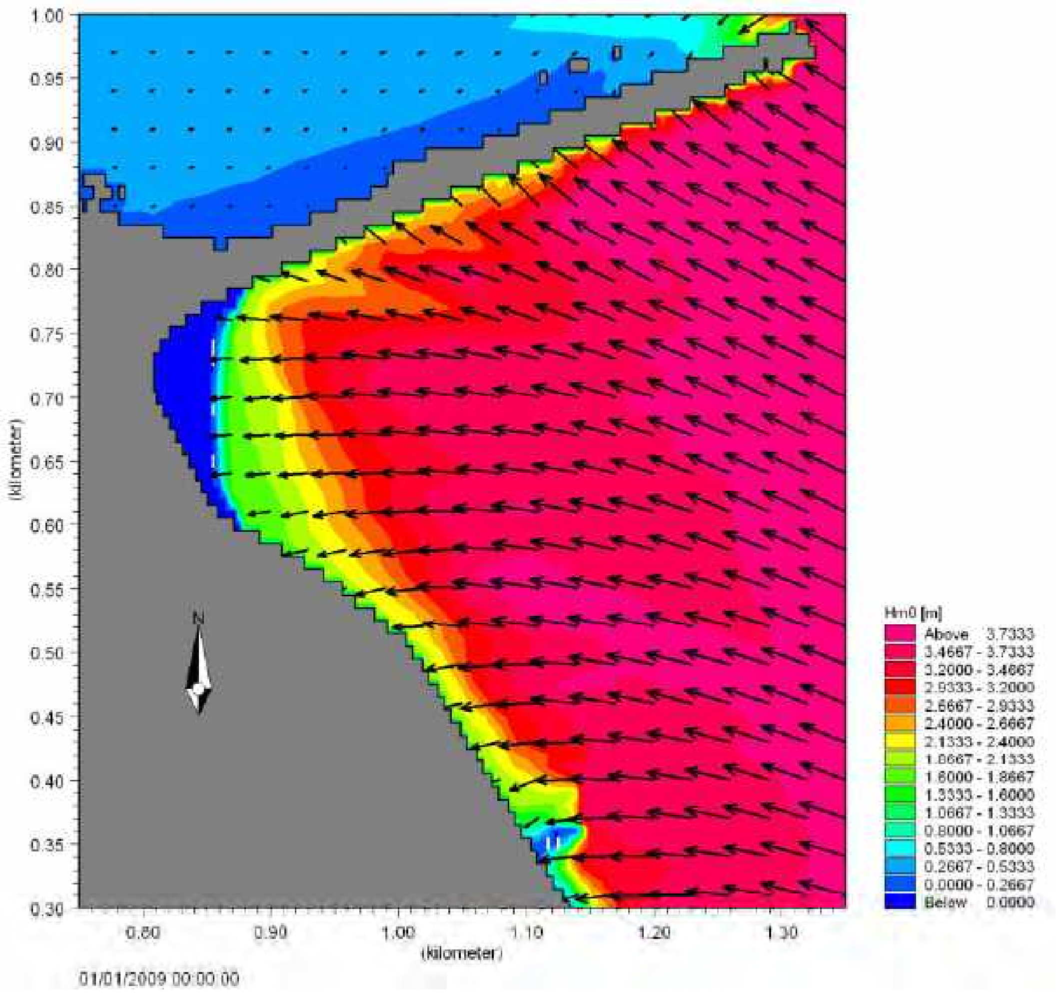


Figure 10 **Significant wave height and mean wave direction 1 in 200 year storm from 133° at a high tide of +1.881m OD**

The wave climate and overtopping analysis was undertaken for a series of 4 cross sections across the beach at locations shown in Figure 11 below and noted on the photograph of the sea defences, Figure 12. Examples of the wave conditions at these cross sections are shown in Figures 13 and 14. It will be noted that the storm waves break at the toe of the shingle/rock beach thus the design wave conditions are dependant on the water level which occurs during the particular storm.

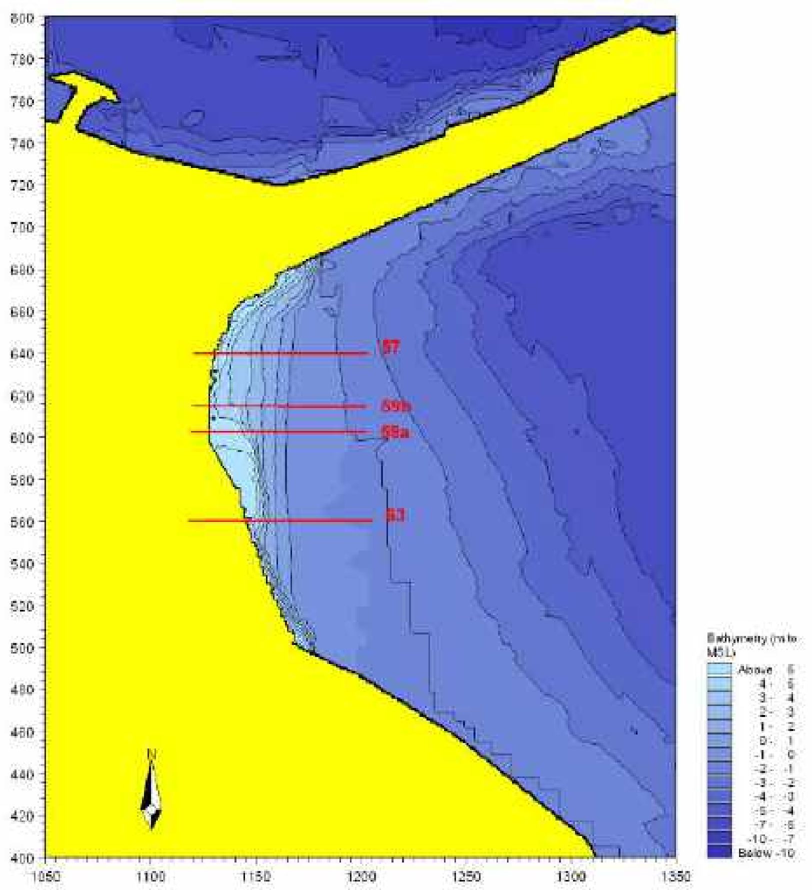


Figure 11 Location of beach cross sections

Figure 12 Location of beach cross sections at the site

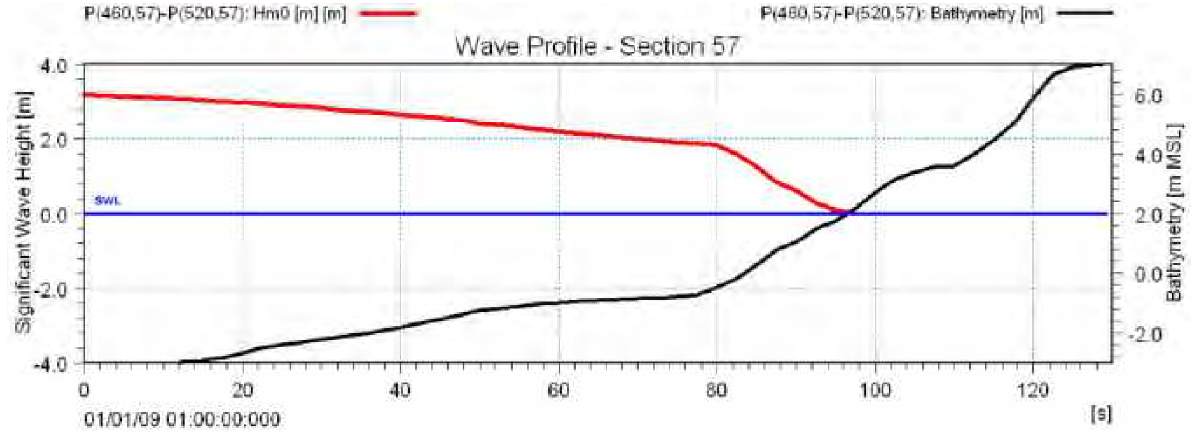


Figure 13 Wave height profile across the approaches to the site – Section 57

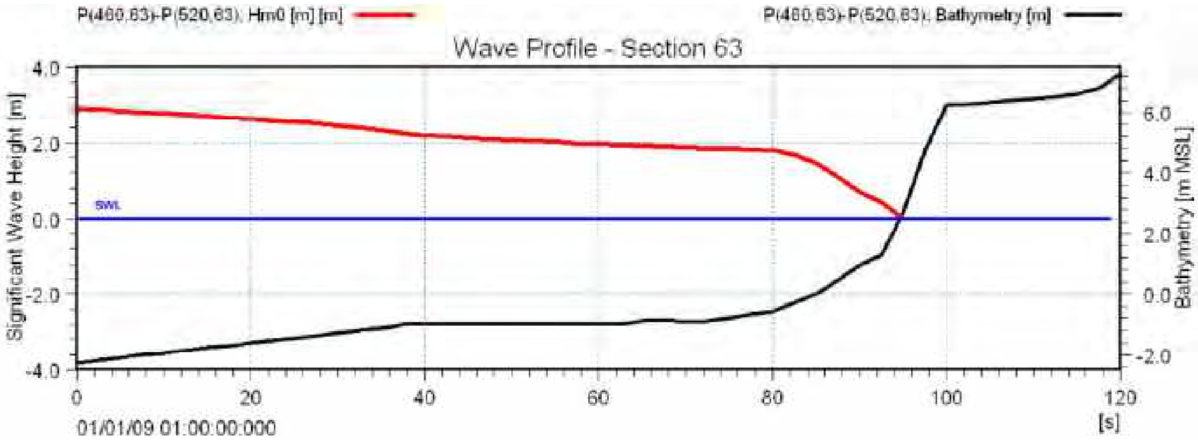


Figure 14 Wave height profile across the approaches to the site – Section 63

2.4.4 Wave climate at the site

Examples of the 1 in 200 year event inshore wave climate at the toe of the shingle\rock beach as established by the wave transformation simulations for the various combinations of wave heights and water levels derived from the joint probability analysis are shown for section 57 in tables 2.1 and 2.2 below. The values for the other sections are given in the Appendix

Inshore Wave Data - Return Period 1 in 200 years - Year 2009

Section 57

Storm Direction	Water level m [OD]	Significant Wave Ht Hm0	Mean Wave Period Tm [s]	Mean Wave Direction
105	1.881	1.796	8.65	86
	1.938	1.822	8.42	86
	1.986	1.822	8.22	86
	2.042	1.817	8.02	86
	2.080	1.780	7.72	87
	2.116	1.739	7.47	87
	2.148	1.675	7.18	87
133	1.881	1.797	8.95	87
	1.938	1.841	8.82	87
	1.986	1.878	8.65	87
	2.042	1.892	8.45	87
	2.080	1.871	8.18	88
	2.116	1.846	7.93	88
	2.148	1.798	7.65	88
165	1.881	1.798	9.12	88
	1.938	1.842	9.09	89
	1.986	1.879	8.94	89
	2.042	1.887	8.74	89
	2.080	1.858	8.47	90
	2.116	1.823	8.24	90
	2.148	1.766	7.94	90
180	1.761	1.706	9.70	88
	1.826	1.757	9.60	88
	1.881	1.800	9.50	88
	1.938	1.844	9.34	89
	1.986	1.880	9.15	89
	2.042	1.884	8.96	90
	2.080	1.844	8.62	90
	2.116	1.794	8.32	90
	2.148	1.719	7.98	91
200	1.761	1.705	9.42	89
	1.826	1.755	9.34	89
	1.881	1.765	9.17	89
	1.938	1.753	8.95	90
	1.986	1.734	8.78	90
	2.042	1.712	8.63	90
	2.080	1.648	8.34	91
	2.116	1.566	7.99	91
	2.148	1.448	7.60	92
230	1.532	1.498	8.28	88
	1.651	1.534	8.19	88
	1.761	1.544	8.09	89
	1.826	1.527	7.97	89
	1.881	1.487	7.91	90
	1.938	1.431	7.79	90
	1.986	1.384	7.58	90
	2.042	1.300	7.44	91
	2.080	1.170	7.18	92
	2.116	1.057	6.98	92
	2.148	0.919	6.70	93

Table 2.1 Wave climate - 1 in 200 year return period storm Year 2009 – Section 57

Inshore Wave Data - Return Period 1 in 200 years - Year 2109

Section 57

Storm Direction	Water level m [OD]	Significant Wave Ht Hm0	Mean Wave Period Tm [s]	Mean Wave Direction
105	3.217	2.585	9.01	88
	3.274	2.551	8.77	89
	3.322	2.515	8.56	89
	3.378	2.465	8.35	89
	3.416	2.355	8.03	89
	3.452	2.252	7.76	89
	3.484	2.096	7.46	90
133	3.217	2.660	9.32	90
	3.274	2.662	9.19	90
	3.322	2.645	9.01	90
	3.378	2.617	8.80	90
	3.416	2.543	8.51	91
	3.452	2.466	8.25	91
	3.484	2.351	7.95	91
165	3.217	2.609	9.47	92
	3.274	2.629	9.47	92
	3.322	2.599	9.29	92
	3.378	2.555	9.09	93
	3.416	2.463	8.80	93
	3.452	2.355	8.54	93
	3.484	2.208	8.24	94
180	3.097	2.599	10.09	91
	3.162	2.623	10.05	92
	3.217	2.623	9.91	92
	3.274	2.613	9.76	92
	3.322	2.577	9.55	92
	3.378	2.518	9.35	93
	3.416	2.398	9.01	93
	3.452	2.267	8.70	94
	3.484	2.081	8.32	94
200	3.097	2.383	9.96	92
	3.162	2.360	9.68	92
	3.217	2.327	9.55	93
	3.274	2.261	9.33	93
	3.322	2.196	9.15	93
	3.378	2.092	8.94	94
	3.416	1.933	8.60	94
	3.452	1.791	8.29	95
	3.484	1.614	7.91	95
230	2.868	2.020	8.51	91
	2.987	1.999	8.43	92
	3.097	1.933	8.32	92
	3.162	1.869	8.21	92
	3.217	1.691	8.15	93
	3.274	1.605	8.04	94
	3.322	1.524	7.82	94
	3.378	1.412	7.68	94
	3.416	1.256	7.40	95
	3.452	1.123	7.20	96
	3.484	0.987	6.90	97

Table 2.2 Wave climate - 1 in 200 year return period storm Year 2109 – Section 57

Visual inspection of the results of the analysis of 1 in 200 year return period wave climate at the site showed that the most arduous conditions occurred with storms from 133°, 165° and 180°. The analysis for the 1 in 1000 year return period events were therefore only undertaken for these storm directions. Examples of the wave climate at the site for section 57 are shown in tables 2.3 and 2.4 below. The data for the other sections is given in the Appendix.

Inshore Wave Data - Return Period 1 in 1000 years - Year 2009

Section 57

Storm Direction	**Water level m [OD]**	**Significant Wave Ht Hm0**	**Mean Wave Period Tm [s]**	**Mean Wave Direction**
133	1.938	1.843	9.26	87
	1.986	1.881	9.19	87
	2.042	1.924	9.05	87
	2.080	1.952	8.84	87
	2.116	1.965	8.69	87
	2.149	1.953	8.48	88
	2.221	1.904	7.95	88
165	1.938	1.844	9.44	88
	1.986	1.882	9.45	88
	2.042	1.925	9.33	89
	2.080	1.954	9.12	89
	2.116	1.960	8.98	89
	2.149	1.947	8.80	89
	2.221	1.882	8.28	90
180	1.826	1.758	10.02	88
	1.881	1.801	9.94	88
	1.938	1.846	9.85	88
	1.986	1.883	9.78	89
	2.042	1.926	9.58	89
	2.080	1.955	9.35	89
	2.116	1.953	9.19	90
	2.149	1.930	8.95	90
	2.221	1.836	8.33	91

Table 2.3 Wave climate - 1 in 1000 year return period storm Year 2009 – Section 57

Inshore Wave Data - Return Period 1 in 1000 years - Year 2109

Section 57

Storm Direction	**Water level m [OD]**	**Significant Wave Ht Hm0**	**Mean Wave Period Tm [s]**	**Mean Wave Direction**
133	3.274	2.758	9.66	89
	3.322	2.770	9.58	90
	3.378	2.771	9.43	90
	3.416	2.743	9.21	90
	3.452	2.718	9.05	90
	3.485	2.671	8.83	90
	3.557	2.521	8.28	91
165	3.274	2.711	9.83	91
	3.322	2.729	9.82	91
	3.378	2.729	9.71	92
	3.416	2.700	9.50	92
	3.452	2.652	9.33	92
	3.485	2.598	9.14	93
	3.557	2.414	8.59	93
180	3.162	2.698	10.50	91
	3.217	2.712	10.43	91
	3.274	2.716	10.28	92
	3.322	2.725	10.21	92
	3.378	2.712	10.02	92
	3.416	2.667	9.78	92
	3.452	2.611	9.57	93
	3.485	2.526	9.37	93
	3.557	2.285	8.70	94

Table 2.4 Wave climate - 1 in 1000 year return period storm Year 2109 – Section 57

3 WAVE OVERTOPPING

3.2 Existing Sea Defences

The storm wave climate established from the transformation of the various waves and water levels identified by the joint probability analysis, showed that the waves approaching the existing sea defences would be depth limited and therefore significantly affected by the water level at the beach during storm conditions.

Although the largest waves in the nearshore area occurred during conditions of surges with south going tides, the wave height at the toe of the shingle beach was greatest during storms which occurred at extreme high waters.

Figure 15, overleaf, shows the survey of the beach and sea defences which are shown in the photograph in Figure 12 above. The toe of the shingle/rock beach is generally at about -0.6m OD which is a typical low tide value. The general beach slope is about 1 in 7 with various bits of the rock revetments and banks having a typical slope of about 1 in 1.5. The top of sea defence is generally at a level of about +6.5m to +6.8m OD with the site level behind the defences at about +7.0m.

3.3 Overtopping

An overtopping analysis has been undertaken using the techniques and procedures recommended the EA/ENW/KFKI EurOtop "Wave Overtopping of Sea Defences and Related Structures: Assessment Manual", August 2007.

The overtopping volumes were calculated for the each of the sea defence profiles 57, 59a, 59b and 63. The overtopping calculations were undertaken for the various wave and water level combinations for both 1 in 200 and 1 in 1000 year return period events. Examples of the distribution of the overtopping quantities for the various waves and water levels for the defences at section 59b are given in tables 3.1 to 3.4 below. The values for all the sections of the defences are given in the Appendix

Under the 2009 design wave climate the mean rate of water overtopping the sea defences will be between 0 and 0.02 litres/sec/m, for a 1 in 200 year event and be between 0 and 0.04 litres/sec/m for a 1 in 1000 year event. These values are extremely low and will not produce any flooding.

With global warming and subsidence giving the design wave climate at 2109, the mean rate of water overtopping the defences would rise to be between 0.33 and 3.3 litres/sec/m, for a 1 in 200 year return period storm and to be between 0.67 and 5.9 litres/sec/m for a 1 in 1000 year return period storm event. The total discharge over the all the sea defences during 1 in 200 year storms at high tide would be about 240 litres/second and about 440 litres per second during a 1 in 1000 year return period storm at high tide.

As the level of the site is well above the highest predicted water levels, there should be little difficulty in arranging in the future for drainage behind the sea walls to carry the overtopping water back to the sea at Portland Harbour. A single 450mm pipe would be sufficient to carry the flows generated by overtopping during a 1 in 1000 year return period event in 2109.

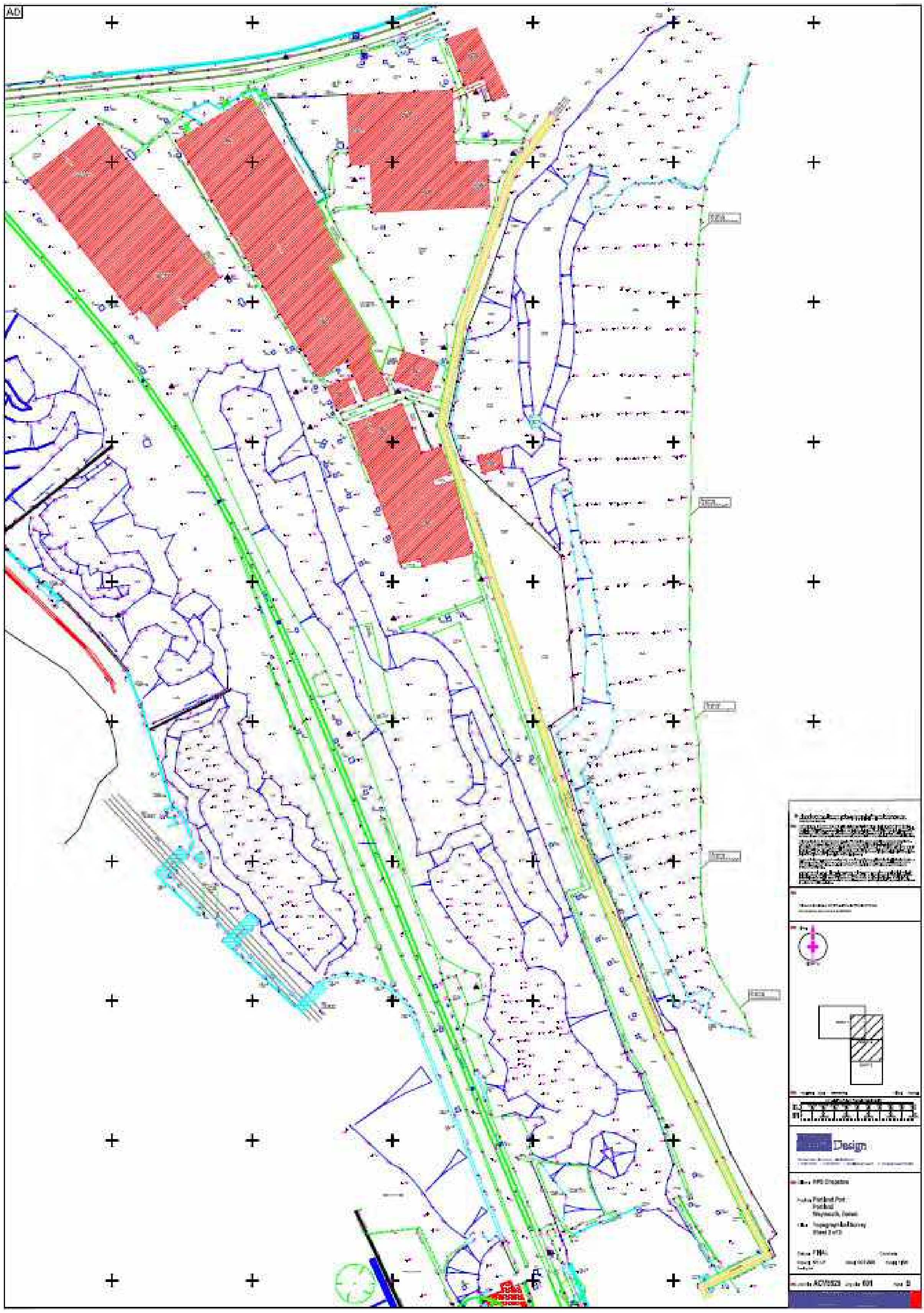


Figure 15 Beach and Sea Defence Topographical Survey

Inshore Wave Data & Overtopping - Return Period 1 in 200 years - Year 2009

Section 59b

Storm Direction	**Water level m [OD]**	**Significant Wave Ht Hm0**	**Mean Wave Period Tm [s]**	**Mean Wave Direction**	**Overtopping lt/s/m seawall** (at high tide)
133	1.881	1.770	8.94	84	0.006
	1.938	1.804	8.82	84	0.007
	1.986	1.827	8.65	84	0.007
	2.042	1.852	8.45	84	0.006
	2.080	1.843	8.18	85	0.004
	2.116	1.827	7.93	85	
	2.148	1.795	7.65	85	
165	1.881	1.787	9.14	86	0.009
	1.938	1.825	9.12	86	0.012
	1.986	1.848	8.97	86	0.012
	2.042	1.857	8.77	87	0.010
	2.080	1.838	8.50	87	0.007
	2.116	1.812	8.27	88	
	2.148	1.766	7.98	88	
180	1.761	1.727	9.70	85	0.011
	1.826	1.769	9.60	85	0.013
	1.881	1.804	9.50	86	0.015
	1.938	1.837	9.34	86	0.016
	1.986	1.855	9.15	87	0.015
	2.042	1.857	8.96	87	0.013
	2.080	1.828	8.62	88	0.008
	2.116	1.788	8.32	88	
	2.148	1.726	7.98	89	

Table 3.1 Overtopping rates - 1 in 200 year return period storm 2009 – Section 59b

Inshore Wave Data & Overtopping - Return Period 1 in 200 years - Year 2109

Section 59b

Storm Direction	**Water level m [OD]**	**Significant Wave Ht Hm0**	**Mean Wave Period Tm [s]**	**Mean Wave Direction**	**Overtopping lt/s/m seawall** (at high tide)
133	3.217	2.648	9.32	87	2.163
	3.274	2.656	9.19	87	2.204
	3.322	2.647	9.01	88	2.048
	3.378	2.628	8.80	88	1.846
	3.416	2.568	8.51	88	
	3.452	2.505	8.25	88	
	3.484	2.409	7.95	89	
165	3.217	2.605	9.50	90	2.325
	3.274	2.628	9.49	90	2.688
	3.322	2.603	9.31	90	2.443
	3.378	2.567	9.11	91	2.169
	3.416	2.485	8.82	91	
	3.452	2.389	8.57	92	
	3.484	2.251	8.26	92	
180	3.097	2.592	10.09	89	2.866
	3.162	2.618	10.05	90	3.285
	3.217	2.621	9.91	90	3.297
	3.274	2.616	9.76	90	3.252
	3.322	2.586	9.55	91	2.877
	3.378	2.534	9.35	91	2.496
	3.416	2.426	9.01	92	
	3.452	2.305	8.70	92	

Table 3.2 Overtopping rates - 1 in 200 year return period storm 2109 – Section 59b

Inshore Wave Data & Overtopping - Return Period 1 in 1000 years - Year 2009

Section 59b

Storm Direction	**Water level m [OD]**	**Significant Wave Ht Hm0**	**Mean Wave Period Tm [s]**	**Mean Wave Direction**	**Overtopping lt/s/m seawall** (at high tide)
133	1.938	1.823	9.26	84	0.014
	1.986	1.853	9.19	84	0.016
	2.042	1.885	9.05	84	0.017
	2.080	1.900	8.84	84	0.015
	2.116	1.916	8.69	84	0.014
	2.149	1.921	8.48	85	
	2.221	1.889	7.95	85	
165	1.938	1.839	9.47	85	0.019
	1.986	1.872	9.48	86	0.025
	2.042	1.907	9.36	86	0.028
	2.080	1.922	9.15	86	0.024
	2.116	1.929	9.01	87	0.023
	2.149	1.921	8.84	87	
	2.221	1.873	8.31	88	
180	1.826	1.783	10.02	85	0.024
	1.881	1.819	9.94	85	0.028
	1.938	1.856	9.85	86	0.033
	1.986	1.887	9.78	86	0.038
	2.042	1.919	9.58	86	0.038
	2.080	1.932	9.35	87	0.032
	2.116	1.926	9.19	87	0.028
	2.149	1.910	8.95	88	
	2.221	1.835	8.33	88	

Table 3.3 Overtopping rates - 1 in 1000 year return period storm 2009 – Section 59b

Inshore Wave Data & Overtopping - Return Period 1 in 1000 years - Year 2109

Section 59b

Storm Direction	**Water level m [OD]**	**Significant Wave Ht Hm0**	**Mean Wave Period Tm [s]**	**Mean Wave Direction**	**Overtopping lt/s/m seawall** (at high tide)
133	3.274	2.739	9.66	87	3.707
	3.322	2.754	9.58	87	3.914
	3.378	2.761	9.43	87	3.927
	3.416	2.741	9.21	88	3.442
	3.452	2.723	9.05	88	3.151
	3.485	2.685	8.83	88	
	3.557	2.563	8.28	89	
165	3.274	2.702	9.85	89	4.023
	3.322	2.723	9.85	89	4.553
	3.378	2.727	9.73	90	4.661
	3.416	2.702	9.53	90	4.146
	3.452	2.661	9.36	91	3.645
	3.485	2.614	9.16	91	
	3.557	2.448	8.61	92	
180	3.162	2.687	10.50	89	5.070
	3.217	2.704	10.43	89	5.476
	3.274	2.712	10.28	90	5.545
	3.322	2.723	10.21	90	5.863
	3.378	2.714	10.02	90	5.616
	3.416	2.675	9.78	91	4.775
	3.452	2.625	9.57	91	4.033
	3.485	2.549	9.37	91	
	3.557	2.325	8.70	92	

Table 3.4 Overtopping rates - 1 in 1000 year return period storm 2109 – Section 59b

4 CONCLUSIONS

The flood risk assessment for coastal flooding at W4BRE's Green Energy proposed site at Balaclava Bay, Portland has been carried out using statistical analysis of 16 years of offshore wave and tidal data combined with computational hydraulic modelling. The study established the predicted overtopping rates for the existing sea defences for present day 1 in 200 and 1 in 1000 year return period wave and water level events and for these return period events with an allowance for sea level rise and land settlement up to the year 2109.

The present day overtopping rates were found to be very low and there is no significant risk of coastal flooding of this site due to storm events at present day sea levels. Even taking account of 100 year of sea level rise due to climate change and land settlement due to the proposed Gas Storage project at Portland, the amount of overtopping of the existing defences during storm events is predicted to be relatively low. A simple drainage system behind the sea wall would be able to return the overtopping water to the sea and prevent any risk of salt water flooding into the main site.

Appendix

Joint Probability Tables
Wave Climate Tables
Overtopping Tables

Joint exceedence return period (years)

Marginal return period (years) for Waves

Marginal return period (years) for tidal component

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000
0.1	0.057	0.157	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.00
0.2	#N/A	0.078	0.299	0.823	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.00
0.5	#N/A	#N/A	0.120	0.329	0.907	3.462	9.535	20.000	50.000	100.000	200.000	1000.00
1	#N/A	#N/A	#N/A	0.165	0.454	1.731	4.767	13.130	50.000	100.000	200.000	1000.00
2	#N/A	#N/A	#N/A	#N/A	0.227	0.865	2.384	6.565	25.052	68.997	190.026	1000.00
5	#N/A	#N/A	#N/A	#N/A	#N/A	0.346	0.953	2.626	10.021	27.599	76.010	798.8731
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.477	1.313	5.010	13.799	38.005	399.4366
20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.656	2.505	6.900	19.003	199.7183
50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.002	2.760	7.601	79.8873
100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.380	3.801	39.9437
200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.900	19.9718
1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.9944

MSL	CD	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000
1.4260	2.4660	#NUM!	1.71601	2.571912	2.971739	3.328227	3.753841	4.050228	4.329443	4.677135	4.926659	5.166303	5.690967
1.5450	2.5850	#N/A	0.686473	2.233121	2.864849	3.328227	3.753841	4.050228	4.329443	4.677135	4.926659	5.166303	5.690967
1.6550	2.6950	#N/A	#N/A	1.440448	2.300554	2.918571	3.588313	4.030443	4.329443	4.677135	4.926659	5.166303	5.690967
1.7200	2.7600	#N/A	#N/A	#N/A	1.761497	2.511067	3.256776	3.732738	4.161777	4.677135	4.926659	5.166303	5.690967
1.7750	2.8150	#N/A	#N/A	#N/A	#N/A	2.028485	2.892569	3.413275	3.872557	4.417	4.794385	5.148926	5.690967
1.8320	2.8720	#N/A	#N/A	#N/A	#N/A	#N/A	2.334475	2.945835	3.459411	4.051097	4.454192	4.829174	5.620133
1.8800	2.9200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.542315	3.116077	3.754767	4.181887	4.575336	5.396822
1.9360	2.9760	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.735346	3.437051	3.893914	4.309352	5.165825
1.9740	3.0140	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.972875	3.482914	3.935192	4.846972
2.0100	3.0500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.141809	3.630934	4.593936
2.0430	3.0830	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.303077	4.32889
2.1160	3.1560	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.653486

Joint Probability waves and water levels storms from 90° to 134°

Joint exceedence return period (years)

Marginal return period (years) for Waves

		0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
Marginal return period (years) for tidal component	0.1	0.092	0.200	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
	0.2	#N/A	0.131	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
	0.5	#N/A	#N/A	0.211	0.604	1.729	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
	1	#N/A	#N/A	#N/A	0.302	0.864	3.473	9.945	20.000	50.000	100.000	200.000	1000.0000
	2	#N/A	#N/A	#N/A	#N/A	0.432	1.736	4.973	14.241	50.000	100.000	200.000	1000.0000
	5	#N/A	#N/A	#N/A	#N/A	#N/A	0.695	1.989	5.696	22.889	65.547	187.711	1000.0000
	10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.995	2.848	11.444	32.774	93.855	1000.0000
	20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.424	5.722	16.387	46.928	540.0021
	50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.289	6.555	18.771	216.0008
	100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.277	9.386	108.0004
	200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.693	54.0002
	1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	10.8000

		0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
1.4260	2.4660	#NUM!	#NUM!	2.377623	3.10966	3.635218	4.186515	4.539311	4.85482	5.229766	5.488785	5.730847	6.2415
1.5450	2.5850	#N/A	#NUM!	2.377623	3.10966	3.635218	4.186515	4.539311	4.85482	5.229766	5.488785	5.730847	6.2415
1.6550	2.6950	#N/A	#N/A	#NUM!	2.611121	3.534708	4.186515	4.539311	4.85482	5.229766	5.488785	5.730847	6.2415
1.7200	2.7600	#N/A	#N/A	#N/A	1.33937	2.979383	3.98129	4.536689	4.85482	5.229766	5.488785	5.730847	6.2415
1.7750	2.8150	#N/A	#N/A	#N/A	#N/A	2.165503	3.537906	4.18355	4.70421	5.229766	5.488785	5.730847	6.2415
1.8320	2.8720	#N/A	#N/A	#N/A	#N/A	#N/A	2.764786	3.631529	4.256303	4.91274	5.333171	5.709328	6.2415
1.8800	2.9200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.104934	3.862421	4.603297	5.062077	5.46584	6.2415
1.9360	2.9760	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.393786	4.258703	4.767331	5.205102	6.0535
1.9740	3.0140	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.724477	4.329546	4.827233	5.7568
2.0100	3.0500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.947128	4.508758	5.5164
2.0430	3.0830	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.151917	5.2595
2.1160	3.1560	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.5760

Joint Probability waves and water levels storms from 135° to 179°

Joint exceedence return period (years)

Marginal return period (years) for Waves

Marginal return period (years) for tidal component

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.1	0.020	0.051	0.181	0.472	1.233	4.382	10.000	20.000	50.000	100.000	200.000	1000.0000
0.2	#N/A	0.025	0.090	0.236	0.616	2.191	5.719	14.927	50.000	100.000	200.000	1000.0000
0.5	#N/A	#N/A	0.036	0.094	0.247	0.876	2.288	5.971	21.223	55.392	144.574	1000.0000
1	#N/A	#N/A	#N/A	0.047	0.123	0.438	1.144	2.985	10.611	27.696	72.287	670.6155
2	#N/A	#N/A	#N/A	#N/A	0.062	0.219	0.572	1.493	5.306	13.848	36.144	335.3078
5	#N/A	#N/A	#N/A	#N/A	#N/A	0.088	0.229	0.597	2.122	5.539	14.457	134.1231
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.114	0.299	1.061	2.770	7.229	67.0616
20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.149	0.531	1.385	3.614	33.5308
50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.212	0.554	1.446	13.4123
100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.277	0.723	6.7062
200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.361	3.3531
1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.6706

		0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
1.4260	2.4660	#NUM!	1.799469	3.779869	4.642153	5.332971	6.098552	6.536629	6.877671	7.297959	7.596588	7.881072	8.4962
1.5450	2.5850	#N/A	#NUM!	2.93641	4.043855	4.846794	5.696563	6.244218	6.736408	7.297959	7.596588	7.881072	8.4962
1.6550	2.6950	#N/A	#N/A	#NUM!	2.998542	4.084446	5.101148	5.7226	6.267376	6.905883	7.343053	7.74952	8.4962
1.7200	2.7600	#N/A	#N/A	#N/A	1.549161	3.348666	4.582296	5.283124	5.880288	6.566719	7.030657	7.458655	8.3488
1.7750	2.8150	#N/A	#N/A	#N/A	#N/A	2.272203	3.971806	4.790267	5.457323	6.203603	6.699564	7.152682	8.0850
1.8320	2.8720	#N/A	#N/A	#N/A	#N/A	#N/A	2.889075	4.013366	4.822814	5.677132	6.226954	6.720741	7.7187
1.8800	2.9200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.255165	4.258516	5.23266	5.836395	6.368887	7.4263
1.9360	2.9760	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.572186	4.732855	5.408956	5.990259	7.1186
1.9740	3.0140	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.940572	4.765915	5.436782	6.6838
2.0100	3.0500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.191334	4.963965	6.3293
2.0430	3.0830	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.423659	5.9474
2.1160	3.1560	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.9092

Joint Probability waves and water levels storms from 180° to 224°

Joint exceedence return period (years)

Marginal return period (years) for Waves

Marginal return period (years) for tidal component

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.05	0.030	0.070	0.211	0.487	1.121	3.375	7.771	17.892	50.000	100.000	200.000	1000.0000
0.1	0.015	0.035	0.106	0.243	0.560	1.687	3.885	8.946	26.942	62.035	142.836	990.4611
0.2	#N/A	0.018	0.053	0.122	0.280	0.844	1.943	4.473	13.471	31.018	71.418	495.2306
0.5	#N/A	#N/A	0.021	0.049	0.112	0.337	0.777	1.789	5.388	12.407	28.567	198.0922
1	#N/A	#N/A	#N/A	0.024	0.056	0.169	0.389	0.895	2.694	6.204	14.284	99.0461
2	#N/A	#N/A	#N/A	#N/A	0.028	0.084	0.194	0.447	1.347	3.102	7.142	49.5231
5	#N/A	#N/A	#N/A	#N/A	#N/A	0.034	0.078	0.179	0.539	1.241	2.857	19.8092
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.039	0.089	0.269	0.620	1.428	9.9046
20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.045	0.135	0.310	0.714	4.9523
50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.054	0.124	0.286	1.9809
100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.062	0.143	0.9905
200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.071	0.4952
1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.0990

		0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
1.3100	2.3500	2.427658	3.100151	3.86903	4.396803	4.892565	5.51075	5.956063	6.385581	6.896401	7.230947	7.558344	8.2944
1.4260	2.4660	1.733405	2.54961	3.397545	3.96084	4.482534	5.126492	5.587181	6.02964	6.591321	7.001306	7.400196	8.2901
1.5450	2.5850	#N/A	1.893134	2.883133	3.4963	4.051483	4.72693	5.205727	5.663095	6.241034	6.661401	7.069414	7.9769
1.6550	2.6950	#N/A	#N/A	2.086175	2.818224	3.438802	4.169624	4.678336	5.159506	5.76268	6.198817	6.620497	7.5539
1.7200	2.7600	#N/A	#N/A	#N/A	2.222469	2.928741	3.719593	4.257796	4.761346	5.387395	5.83745	6.270987	7.2264
1.7750	2.8150	#N/A	#N/A	#N/A	#N/A	2.35237	3.235939	3.813418	4.344992	4.998454	5.464688	5.911751	6.8917
1.8320	2.8720	#N/A	#N/A	#N/A	#N/A	#N/A	2.516208	3.175672	3.758758	4.458841	4.951257	5.419593	6.4370
1.8800	2.9200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.635209	3.278405	4.026452	4.543945	5.031895	6.0825
1.9360	2.9760	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.750604	3.566654	4.116292	4.628216	5.7176
1.9740	3.0140	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.898359	3.50983	4.063932	5.2166
2.0100	3.0500	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.006953	3.606765	4.8209
2.0430	3.0830	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.113115	4.4074
2.1160	3.1560	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.3514

Joint Probability waves and water levels storms from 225° to 269°

Joint exceedence return period (years)

Marginal return period (years) for Waves

Marginal return period (years) for surge component

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000
0.1	0.078	0.200	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.00
0.2	#N/A	0.131	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.00
0.5	#N/A	#N/A	0.262	0.887	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.00
1	#N/A	#N/A	#N/A	0.444	1.500	5.000	10.000	20.000	50.000	100.000	200.000	1000.00
2	#N/A	#N/A	#N/A	#N/A	0.750	3.753	10.000	20.000	50.000	100.000	200.000	1000.00
5	#N/A	#N/A	#N/A	#N/A	#N/A	1.501	5.076	17.162	50.000	100.000	200.000	1000.0000
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.538	8.581	42.942	100.000	200.000	1000.0000
20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.290	21.471	72.592	200.000	1000.0000
50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	8.588	29.037	98.172	1000.0000
100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	14.518	49.086	830.4984
200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	24.543	415.2492
1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	83.0498

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000
0.2560	#NUM!	1.928153	2.571912	2.971739	3.328227	3.753841	4.050228	4.329443	4.677135	4.926659	5.166303	5.6909674
0.4500	#N/A	1.540658	2.571912	2.971739	3.328227	3.753841	4.050228	4.329443	4.677135	4.926659	5.166303	5.6909674
0.6130	#N/A	#N/A	2.139051	2.906396	3.328227	3.753841	4.050228	4.329443	4.677135	4.926659	5.166303	5.6909674
0.7100	#N/A	#N/A	#N/A	2.49708	3.184579	3.753841	4.050228	4.329443	4.677135	4.926659	5.166303	5.6909674
0.8030	#N/A	#N/A	#N/A	#N/A	2.812126	3.62527	4.050228	4.329443	4.677135	4.926659	5.166303	5.6909674
0.9080	#N/A	#N/A	#N/A	#N/A	#N/A	3.185021	3.76051	4.269107	4.677135	4.926659	5.166303	5.6909674
0.9810	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.443245	3.986391	4.620889	4.926659	5.166303	5.6909674
1.0540	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.685699	4.35719	4.812663	5.166303	5.6909674
1.1440	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.986756	4.473603	4.92015	5.6909674
1.2070	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.202336	4.670344	5.6324308
1.2680	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.409071	5.4095245
1.4000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.8608253

Joint Probability waves and surges storms from 90° to 134°

Joint exceedence return period (years)

Marginal return period (years) for Waves

Marginal return period (years) for surge component

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.1	0.097	0.200	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
0.2	#N/A	0.175	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
0.5	#N/A	#N/A	0.382	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
1	#N/A	#N/A	#N/A	0.689	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
2	#N/A	#N/A	#N/A	#N/A	1.241	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
5	#N/A	#N/A	#N/A	#N/A	#N/A	2.704	9.745	20.000	50.000	100.000	200.000	1000.0000
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.873	17.564	50.000	100.000	200.000	1000.0000
20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	8.782	47.830	100.000	200.000	1000.0000
50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	19.132	68.963	200.000	1000.0000
100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	34.481	124.290	1000.0000
200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	62.145	1000.0000
1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	244.0104

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.2560	#NUM!	#NUM!	2.377623	3.10966	3.635218	4.186515	4.539311	4.85482	5.229766	5.488785	5.7308474	6.2415
0.4500	#N/A	#NUM!	2.377623	3.10966	3.635218	4.186515	4.539311	4.85482	5.229766	5.488785	5.7308474	6.2415
0.6130	#N/A	#N/A	1.952632	3.10966	3.635218	4.186515	4.539311	4.85482	5.229766	5.488785	5.7308474	6.2415
0.7100	#N/A	#N/A	#N/A	2.755644	3.635218	4.186515	4.539311	4.85482	5.229766	5.488785	5.7308474	6.2415
0.8030	#N/A	#N/A	#N/A	#N/A	3.287796	4.186515	4.539311	4.85482	5.229766	5.488785	5.7308474	6.2415
0.9080	#N/A	#N/A	#N/A	#N/A	#N/A	3.830246	4.526911	4.85482	5.229766	5.488785	5.7308474	6.2415
0.9810	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.172484	4.798051	5.229766	5.488785	5.7308474	6.2415
1.0540	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.476381	5.212528	5.488785	5.7308474	6.2415
1.1440	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.835544	5.352239	5.7308474	6.2415
1.2070	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.082679	5.5664033	6.2415
1.2680	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.3130492	6.2415
1.4000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.7976

Joint Probability waves and surges storms from 135° to 179°

Joint exceedence return period (years)

Marginal return period (years) for Waves

Marginal return period (years) for surge component

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.1	0.037	0.116	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
0.2	#N/A	0.058	0.258	0.800	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
0.5	#N/A	#N/A	0.103	0.320	0.990	4.411	10.000	20.000	50.000	100.000	200.000	1000.0000
1	#N/A	#N/A	#N/A	0.160	0.495	2.206	6.828	20.000	50.000	100.000	200.000	1000.0000
2	#N/A	#N/A	#N/A	#N/A	0.248	1.103	3.414	10.568	47.066	100.000	200.000	1000.0000
5	#N/A	#N/A	#N/A	#N/A	#N/A	0.441	1.366	4.227	18.826	58.278	180.404	1000.0000
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.683	2.114	9.413	29.139	90.202	1000.0000
20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.057	4.707	14.570	45.101	621.7913
50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.883	5.828	18.040	248.7165
100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.914	9.020	124.3583
200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.510	62.1791
1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	12.4358

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.2560	#NUM!	3.273399	4.686788	5.192292	5.640831	6.171233	6.536629	6.877671	7.297959	7.596588	7.881072	8.4962
0.4500	#N/A	2.138886	4.127972	5.036676	5.640831	6.171233	6.536629	6.877671	7.297959	7.596588	7.881072	8.4962
0.6130	#N/A	#N/A	3.122798	4.319359	5.185752	6.102194	6.536629	6.877671	7.297959	7.596588	7.881072	8.4962
0.7100	#N/A	#N/A	#N/A	3.648724	4.679313	5.700538	6.338804	6.877671	7.297959	7.596588	7.881072	8.4962
0.8030	#N/A	#N/A	#N/A	#N/A	4.088341	5.258651	5.957706	6.564635	7.271167	7.596588	7.881072	8.4962
0.9080	#N/A	#N/A	#N/A	#N/A	#N/A	4.587568	5.399869	6.078457	6.848776	7.365286	7.839572	8.4962
0.9810	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.922384	5.674621	6.505791	7.054146	7.553103	8.4962
1.0540	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.22987	6.138028	6.724531	7.252195	8.3205
1.1440	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.603534	6.254352	6.828302	7.9679
1.2070	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.866151	6.483927	7.6875
1.2680	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.11447	7.3935
1.4000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.6463

Joint Probability waves and surges storms from 180° to 224°

Joint exceedence return period (years)

Marginal return period (years) for Waves

Marginal return period (years) for surge component

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.05	0.088	0.200	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
0.1	0.044	0.137	0.500	1.000	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
0.2	#N/A	0.069	0.312	0.978	2.000	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
0.5	#N/A	#N/A	0.125	0.391	1.228	5.000	10.000	20.000	50.000	100.000	200.000	1000.0000
1	#N/A	#N/A	#N/A	0.196	0.614	2.784	8.737	20.000	50.000	100.000	200.000	1000.0000
2	#N/A	#N/A	#N/A	#N/A	0.307	1.392	4.369	13.711	50.000	100.000	200.000	1000.0000
5	#N/A	#N/A	#N/A	#N/A	#N/A	0.557	1.747	5.484	24.875	78.071	200.000	1000.0000
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.874	2.742	12.438	39.035	122.513	1000.0000
20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.371	6.219	19.518	61.256	871.9817
50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	2.488	7.807	24.503	348.7927
100	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	3.904	12.251	174.3963
200	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.126	87.1982
1000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	17.4396

	0.1	0.2	0.5	1	2	5	10	20	50	100	200	1000.0000
0.0500	3.262774	3.832618	4.413274	4.826447	5.222001	5.72276	6.087505	6.441866	6.896401	7.230947	7.558344	8.2944
0.2560	2.733118	3.580152	4.413274	4.826447	5.222001	5.72276	6.087505	6.441866	6.896401	7.230947	7.558344	8.2944
0.4500	#N/A	3.084031	4.119126	4.813389	5.222001	5.72276	6.087505	6.441866	6.896401	7.230947	7.558344	8.2944
0.6130	#N/A	#N/A	3.512931	4.261944	4.945149	5.72276	6.087505	6.441866	6.896401	7.230947	7.558344	8.2944
0.7100	#N/A	#N/A	#N/A	3.817826	4.537558	5.405412	6.017335	6.441866	6.896401	7.230947	7.558344	8.2944
0.8030	#N/A	#N/A	#N/A	#N/A	4.109556	5.017168	5.650402	6.250071	6.896401	7.230947	7.558344	8.2944
0.9080	#N/A	#N/A	#N/A	#N/A	#N/A	4.4787	5.146204	5.772076	6.551439	7.112323	7.558344	8.2944
0.9810	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4.747481	5.397111	6.200081	6.775046	7.327563	8.2944
1.0540	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.008547	5.838752	6.429549	6.995184	8.2329
1.1440	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.343335	5.958502	6.543887	7.8163
1.2070	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.589699	6.192325	7.4942
1.2680	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.830765	7.1654
1.4000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.3726

Joint Probability waves and surges storms from 225° to 269°

Wave Climate	**Excel Files**	**Inshore Wave data_200.xls** **Inshore Wave data_1000.xls**
Overtopping Rates	**Excel Files**	**Inshore Wave data and Overtopping_200.xls** **Inshore Wave data and Overtopping_1000.xls**

Appendix C Existing Brownfield Site Runoff Calculation

Modified Rational Method equation (HR Wallingford, 1990)

Project No.	*0979*
Project Title	*Portland ERF*
Client	*Powerfuel Portland Limited*
Sheet Ref	*P:\0979 Portland Port ERF\D Design and Analysis\SPREADSHEETS\01 Drainage\03 Sewer Design\[Modified Rational Method.xlsx]Colebrook-White*

Calcs by	*AJH*
Checked by	*CPY*
Approved by	*CPY*
Date	*27.08.2020*
Revision	*B*

Catchment area analysis based on Modified Rational Method equation (HR Wallingford, 1990);

$$Q_{BAR} = 2.78 \cdot i \cdot A$$

Hydrological Region: 7 *see map

Where:

Q_{BAR} *Average discharge (l/s)*

i *Rainfall intensity (mm/hr)*

A *Catchment area (m^2)*

i **43.2** mm/hr *see map

Return Period	2yr	30yr	100yr	
Growth Factor (Q/QBAR)	**0.88**	**2.4**	**3.19**	
Critical Area (ha)	**0.1680**	**0.0616**	**0.0463**	(area that can freely drain)

Brownfield flow rate analysis based on Modified Rational Method (HR Wallingford, 1990);

Area (ha): **2.140**

	2yr	30yr	100yr	QBAR
BF flow (l/s):	**226.16**	**616.81**	**819.85**	**257.01**

Appendix D Proposed Masterplan

Portland ERF
Powerfuel Portland Ltd

0 10 20 30 40 50 M
Scale to be used for planning purposes only

Proposed Site Plan

262701B - TOR - XX-XX-DR-A-P004 -
Scale 1:500 @ A1 / 1:1000 @ A3 PLANNING
Aug 2020

N

TERENCE O'ROURKE

Appendix E Dorset Council Flood Risk Management Comments

Consultee Type	Comment Date	Comment
Flood Risk Management	06/02/2020	We write in response to your consultation / scoping opinion request of 13/01/2020 to Dorset Council's (DC) Flood Risk Management (FRM) team, as relevant Lead Local Flood Authority (LLFA) and statutory consultee for surface water management associated with major development, in accordance with the Town & Country Planning, Development Management Procedure, England Order 2015. Given the scale of the proposed development and construction of a new Energy Recovery Facility (ERF) within the Portland Port complex, we understand that the scheme is regarded as major and therefore requires our ongoing involvement as a technical consultee. By way of context we confirm that this Brownfield / previously developed site falls largely within Flood Zone 1 (low risk of fluvial / tidal flooding) in accordance with the Environment Agency's (EA) published modelling, although it is seen to adjoin coastal waters. Equally, it is seen to be unaffected by available mapping of theoretical surface water flood risk, other than some isolated ponding which is shown to develop during extreme rainfall events (1:1000yr). BGS data indicates that the site is underlain by a dominate bedrock of a Sedimentary Mudstone (Kimmeridge Clay Formation) with no recorded superficial overburden. Ground water levels are anticipated to have close connectivity to adjacent tidal levels. Therefore, the potential incorporation of infiltration methodologies within the proposed (re)development scheme are unlikely to be viable at this location. All (major) development proposals are to be supported by a site-specific drainage strategy in accordance with the recommendations of the revised National Planning Policy Framework (July 2018 -NPPF), relevant technical guidance and best practice. Accordingly, the management of surface water runoff must demonstrate that the proposed development is not to be placed at risk and that no off-site worsening is to result. Whilst we acknowledge that the current consultation is a request for a scoping opinion in respect of the required Environmental Impact Assessment (EIA) and would not ordinarily include a detailed design, a proportionate conceptual drainage strategy should be provided in support of the proposed (re)development. We note that section 16 (Water Environment) of the supporting EIA Scoping Report (ref: Terence O'Rourke – 262701 Portland Energy Recovery Facility, dated Jan 2019) acknowledges the requirement of a surface water management strategy and states the introduction of a new surface water drainage system will affect runoff rates from the site. It also confirms that the site is currently impermeable and the proposed surface water drainage system will discharge into the sea. However, sub-section 16.8 and tables 16.1/2 of the report clarify that a flood risk assessment will be submitted in support of the planning application to address flooding and drainage and not to be included within the EIA. We (DC/FRM) would contest this assumption and confirm that a conceptual strategy of surface water management is to be included within the necessary EIA document, on grounds of flood risk and potential contamination. We must be confident that a viable and deliverable scheme of surface water management is to be incorporated within the proposed (re)development of this site and prior to recommending appropriate planning conditions in respect of detailed design & maintenance considerations. The necessary EIA document should include a viable & deliverable conceptual strategy for the management of surface water runoff generated by the proposed development, on grounds of flood risk and potential contamination. It would not be appropriate for us (DC/FRM) to dispense with the need for a strategy of surface water management within the required EIA, pending a subsequent application for planning permission, in accordance with the Ministerial statement 'Sustainable Drainage System' 2014, the NPPF (July 2018) and the revised Planning Policy Guidance. Should you require further clarification of our position or indeed the scope of the conceptual drainage strategy that has been requested, please do not hesitate to contact me. Yours Sincerely, Gary Cleaver Flood Risk Engineer.

EHO, Weymouth & Portland Borough Council	10/02/2020	Environmental Protection at Dorset Council have reviewed the EIA scoping report dated January 2020 provided by the applicant. We would raise the following points for inclusion in any EIA associated with this proposed development: • Air Quality – The use of a 'worst case' scenario for increase in vehicle movements as a result of the proposed development (80 two-way vehicle movements per day) is noted, and that this is anticipated to be supplemented and thus reduced by use of Portland Port to bring RDF in by ships. The following matters should be considered: o The methodology proposed for the air quality assessment – Land-Use Planning & Development Control: Planning for Air Quality (2017) – is considered appropriate, however Dorset Council has more up-to-date data than that given in the EIA scoping report. This will be gladly shared with the applicant for the purposes of this assessment. o The scoping report refers only to consideration of the road network in the vicinity of the site and A354 Weymouth. Dorset Council would require a wider consideration for potential impacts on air quality. There are a number of other areas of concern within Dorset Council that may be adversely affected by the additional traffic movements, i.e. AQMA within Chideock (A35). The routes for waste movements may not be fully confirmed at this time, however the 'worst-case' scenario may be used in the wider considerations which need to be addressed. The source of the RDF is as yet unknown, so the impact on Dorset Council's roads needs to be addressed. o The applicant has already acknowledged poor air quality within the Boot Hill area. They may therefore consider a traffic management plant for the area, and reduce their operations' impact on congestion. o The proposed air quality assessment will address NO2, PM10 and PM2.5. As it is indicated that ships may be used to transport RDF to site, it would be good practice to extend this assessment to ship movements and SO2. o The Environment Agency may wish to have a further understanding with regards to the chimney stack height calculation as part of permitted process applications. o A Construction Environmental Management Plan (CEMP) is proposed. Dust management is mentioned within the ERF and further details should be provided. Information regarding hours of operation and proposals should unexpected contamination be discovered on site should form part of this submission. o It is agreed that an odour assessment will not be required, however it would be beneficial to understand if the unloading of the RDF would be odorous or not. This may include operating practices for unloading at the facility. • Noise assessment – the applicant has suggested to not include a noise assessment within the EIA, but will with any subsequent planning application to be made. This is agreeable, however the assessment should conform to BS4142:2014, and assess vehicle noise. The HSE should be consulted on this also. • Permitted processes – the Environment Agency will be the regulatory body for this activity. • Contaminated land – it is noted that a site investigation was undertaken in 2009, and this is likely to still be relevant. An updated conceptual site model is proposed which demonstrates good practice. o Particular regard should be given to the discharge of surface water to the sea due to contaminants identified within the 2009 site investigation. Details of the interceptor should be submitted (if known at this time). o The council's contaminated land consultant sight of the EIA with regards to any specific contaminated land conditions required in future. o Potential for human health effects from contact with ground gases post-construction must be considered in the EIA due to potential chronic effects for employees. • Other considerations – these are suggestions based on wider considerations by environmental health: o Due to shellfish and aquaculture activities within the vicinity, it is advised that Centre for Environment Fisheries and Aquaculture Science (CEFAS), and Southern Association of Inshore Fisheries and Conservation Authorities (IFCA) are consulted on the proposals. o Due to bathing waters and leisure activities the position of discharge should be carefully considered. o Proposals to reduce traffic are reliant on capacity for berthing at Portland Port. The capacity for additional vessel should be confirmed and contingencies provided. o The Environment Agency should be consulted on the waste management proposals. Should you have any further questions or matters that you would like us to review, please do not hesitate to ask. Yours sincerely Ben Jones Technical Officer

Environment Agency	10/02/2020	Thank you for consulting the Environment Agency on the above scoping opinion. We have reviewed the scoping document submitted and are satisfied with the areas that they have identified for inclusion in the Environmental Statement. We note that technical information for those areas scoped out may still be submitted to support the planning application in accordance with National Planning Policy (i.e. flood risk). NOTES TO LPA / APPLICANT Biodiversity The National Planning Policy Framework is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.. In regards to any planning application and proximity to designated sites then we would expect Natural England to lead on this. Contaminated Land If historic use of the site may have caused contamination then National Planning Policy Framework (NPPF) states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to, or being put at risk from unacceptable levels of water pollution. Government policy also states that planning policies and decisions should ensure that adequate site investigation information, prepared by a competent person, is presented. Further guidance on what should be contained in the assessment and issues associated with groundwater protection can be found in our Groundwater Protection which can be found at: https://www.gov.uk/government/collections/groundwater-protection Flood Risk We note that site specific flood risk has been scoped out of the Environment Statement. We have no objection to this given the site is shown in the low risk zone. However, we note that the application will be supported by a site specific flood risk assessment to demonstrate that the site is located outside of the current and future tidal flood zones. Further advice on the production of a FRA can be found on our website at: https://www.gov.uk/planning-applications-assessing-flood-risk and https://www.gov.uk/guidance/flood-risk-and-coastal-change#Site-Specific-Flood-Risk-Assessment-checklist-section Environmental Permitting The proposed development will require a bespoke permit under the Environmental Permitting (England & Wales) Regulations. We do not currently have enough information to know if the proposed development can meet our requirements to prevent, minimise and/or control pollution and therefore the applicant is recommended to submit all the necessary information, and to parallel tracking the planning and permitting. Parallel tracking planning and environmental permit applications offers the best option for ensuring that all issues can be identified and resolved, where possible, at the earliest possible stages. This will avoid the potential need for amendments to the planning application post-permission. The environmental permit will not consider the following, which are all considered as part of the planning permission ; - Alternative locations and sizes for this proposed facility - Operational hours - The transport of waste to and from the site - Traffic, access and road safety issues - Visual impacts e.g. stack height - Construction materials used in building Planning also has a role to play in managing amenity issues such as noise, dust, odour, pest control issues etc. A permit cannot always prevent, eliminate or eradicate such issues. Some issues need careful management and the use of Best Available Techniques (BAT) will ensure such issues are minimised. Under existing legislation we can only enforce companies to work to the standards set out in the Industrial Emissions Directive (IED). We can say ‘x’ amount of emissions are acceptable, but we cannot prevent them from creating any. Please contact us if you have any queries. Yours sincerely MICHAEL HOLM Planning Advisor - Sustainable Places

Appendix F Preliminary Drainage Layout Plan

Assumed route of existing surface water outfall from pre-development site (to be confirmed).

Highways & Yard Water Discharge
Development runoff to discharge via existing outfall to Portland Harbour (Exact point of connection and position to be confirmed).

Proposed oil interceptor (Full Retention Separator or similar approved) to treat highway and yard runoff prior to discharge to Portland Harbour.

14.2m x 1.5m diameter oversized sewer to provide pump station storage for 25cum/hr of Boiler startup discharge.

Shallow Swale to receive sheet flow runoff from highway and yard, to provide treatment before discharge to surface water network. Perforated pipe to be laid within permeable sub-base beneath to receive runoff and to convey flows to the surface water network.

Clean Water Discharge
Development runoff (clean roof only) to discharge via existing outfall to Balaclava Bay.

Assumed route of existing surface water outfall from pre-development site.

Foul Water Discharge
Pumped foul flows to discharge to existing Wessex Water combined sewer, via a new gravity break chamber as agreed with Wessex Water.

Transformer pit sump with oil detection and pumped discharge

Notes:

1. The proposed development has been assessed in line with the NPPF and The Dorset Waste Plan, to allow the planning application to be progressed and to show that the development can be undertaken in an acceptable manner from a flood risk perspective.
2. The extent of built development within the ERF area is limited to 'Flood Zone 1' only and is not considered to be at risk of flooding from pluvial, groundwater, infrastructure, artificial sources or wave action.
3. The wider application boundary includes land inside Flood Zones 2 and 3 however these areas are being used to facilitate utility and highway enabling works and will not be impacted by or have an impact on existing flood risk.
4. To ensure the development is safe throughout its lifetime, the surface water strategy accounts for runoff in up to the 100 year return period.
5. The strategy also safeguards against the upper end allowances for climate change (40%), providing betterment over undeveloped conditions, where the rate and volume of runoff would continue to increase due to climate change.
6. Made ground from previous site uses and the potential for raised groundwater related to tidal ranges precludes the use of soakaway based drainage.
7. Surface water runoff will be captured and discharged directly to sea and will seek to re-use existing points of outfall.
8. The proposed development reduces the sites existing impermeable catchment and therefore provides betterment in terms of peak rates and volumes of discharge.
9. Runoff from roofs will drain directly to Balaclava Bay, whilst highway and yard areas will drain through a new SuDS swale and bypass separator prior to discharging to Portland Port.
10. During exceedance events runoff will be directed towards areas of green space or yard areas where flows can be temporarily stored above ground.
11. The reduction in peak runoff from the site and the inclusion of SuDS treatment drainage systems, will ensure provide betterment over existing site conditions and will therefore have no adverse negative impacts on committed development sites that are being assessed as part of the EIA.
12. Due to existing levels, foul flows generated by the development will be pumped to the existing WW combined network to the west of the site.
13. Any private drainage networks or features will be designed in accordance with Building Regulations Part H. The operation and maintenance of all private drainage will be the responsibility of a third party management company.
14. Any adoptable drainage networks will be designed in accordance with Sewers for Adoption and will be handed to to the respective Water Authority for adoption.
15. This Preliminary Drainage Layout does not attempt to present a final design of the proposed drainage systems. Detailed design of the systems and any inherent features will commence upon approval of the strategy and will include assessments due to site investigations, health and safety, CDM ect.

Area Summary Schedule

Existing Impermeable Area	1.679 ha
Proposed Roof Area	0.782 ha
Proposed Highway & Yard Area	0.681 ha
Total Proposed Imp. Area	1.463 ha

Key:

▬	Site Boundary

Existing Drainage:

→——→——	Wessex Water Combined Sewer
—— → — ——	Retained Surface Water Drainage

Proposed Catchment Areas:

▨	Clean Roof Area
▨	Yard Area
▨	Highway Area

Proposed drainage:

—— — ← ——	Clean Roof Surface Water Sewer
——— ≪ ——	Highway and Yard Surface Water Sewer
- - - - - -	Drainage Channel
//////////	Shallow Swale With Permeable Sub-Base
▥	Oil Interceptor
—·←·←	Foul Sewer (Will comprise multiple runs to separate trade and domestic waste)
——·—/——	Foul Raising Main
●	Foul Pumping Station
●	Foul Gravity Brake Chamber
- - - - - -	Foul Drain
⇨	Exceedance Flow
▦	Gabion Retaining Wall

REV	DATE	DESCRIPTION	BY	CHK	APD
C	27.08.2020	BACKGROUND LAYOUT AMENDED	TMR	AJH	CPY
B	07.08.2020	UPDATES TO SUIT LANDSCAPING PLAN	TMR	AJH	CPY
A	10.07.2020	INITIAL ISSUE	TMR	AJH	CPY

DRAWING STATUS:
PLANNING APPLICATION

CLIENT:
POWERFUEL LIMITED

PROJECT:
PORTLAND ERF

TITLE:
PRELIMINARY DRAINAGE LAYOUT

PROJECT No: 0979
DRAWING No: PDL-101
REV: C

SCALE @ A1: 0 1:500 25 metres

DESIGN BY:
awcockward partnership

Awcock Ward Partnership, Kensington Court, Woodwater Park, Pynes Hill, Exeter, EX2 5TY
Tel: 01392 409007 Web: www.awpexeter.com

Appendix G Wessex Water Correspondence

From:	Alison Kurobasa <Alison.Kurobasa@wessexwater.co.uk>
Sent:	23 April 2020 10:35
To:	Alex Hanks
Cc:	Chris Yalden
Subject:	WWDevRespSY67SE/ 20 Energy Recovery Facility - Portland Port
Attachments:	Portland - DRAFT Proposed Site Layout.pdf; Portland - Previously approved Foul Drainage Strategy.pdf; WWMap Portland Port.pdf
Categories:	To be Actioned, To be Saved Away

Hello Alex

Energy Recovery Facility
Portland Port, Dorset

Thank you for your foul drainage enquiry. Please find attached an extract from our records showing the approximate location of our apparatus within the vicinity of the site.

Foul Drainage – Domestic Type Flows
I confirm in principal that domestic type flows from the power plant can be accommodated in the public foul sewer.
A private pumped connection will require a break chamber and a gravity connection to the 700mm combined sewer. The private pumping station and rising main will be subject to septicity control. For details see; https://www.wessexwater.co.uk/services/building-and-developing/connecting-to-the-public-sewerage-system/other-sewerage-connections

Foul Drainage – Trade Effluent Discharge
In order to obtain permission to discharge trade effluent, you will need to contact your Water Retailer who will help you complete a G/02 Form. This will be submitted to Wessex Water by your retailer and, if fully completed, will initiate the consent application process.
As part of the consent application process, Wessex Water trade effluent team will assess the risk associated with your proposed discharge If the proposed discharge is suitable for discharge to public sewer, capacity is available, and we do not need to refer to a third-party agency then we will issue a Trade Effluent Consent within 2 months of receiving a fully completed application.
For more detailed trade effluent information and guidance please contact your water retailer and visit the trade effluent section of our website:
https://www.wessexwater.co.uk/services/businesses/trade-effluent

I trust that you find this information of use.

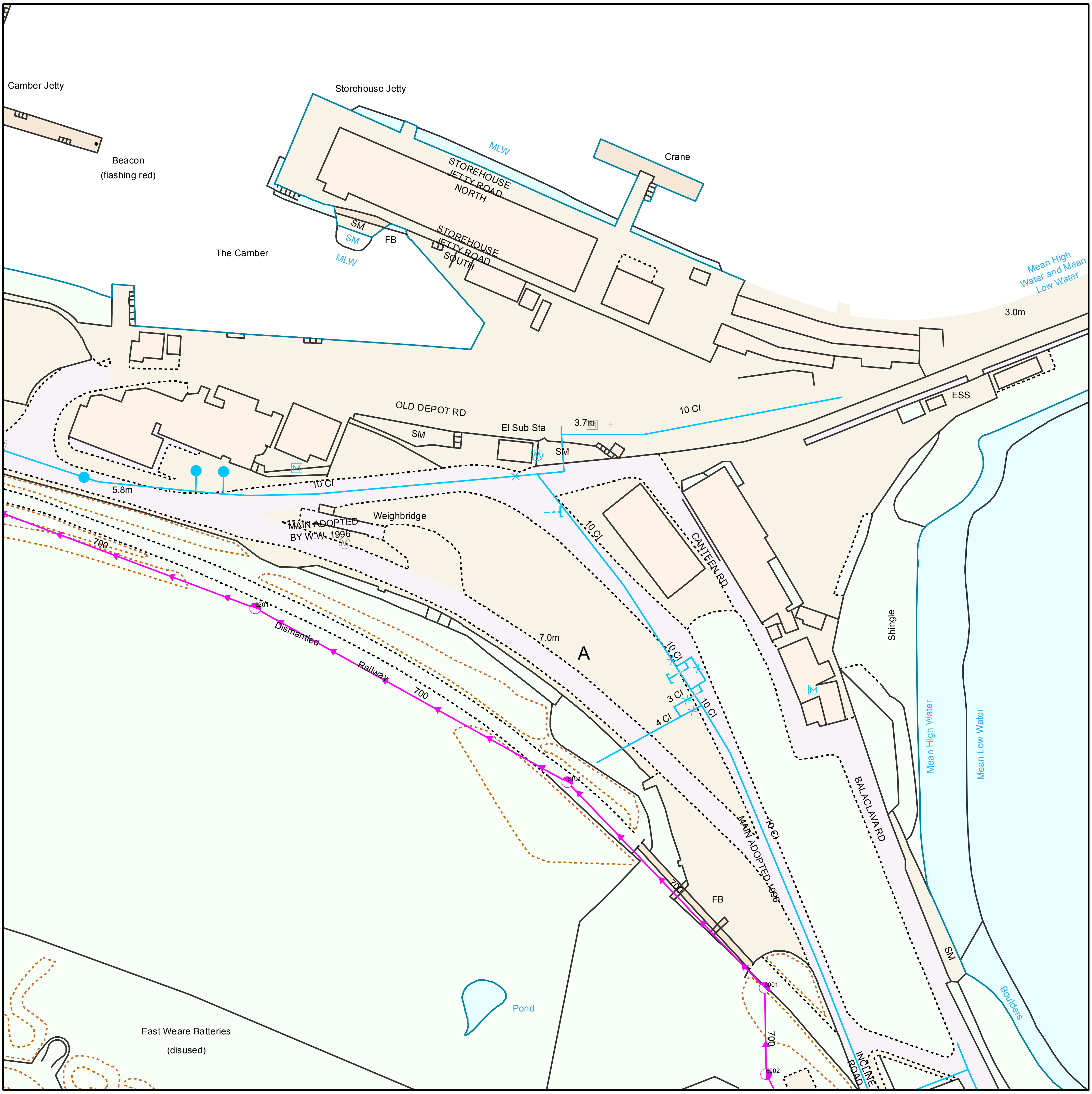
Regards

ALISON KUROBASA
PLANNING LIAISON

Wessex Water
Claverton Down Bath BA2 7WW
wessexwater.co.uk

These comments are based upon known circumstances prevailing at the time of writing. A review of the contents of this email is required where 18 months or more have elapsed since issue, or in the light of significant changes likely to impact on our response such as development numbers or phasing. Please email review requests to planning.liaison@wessexwater.co.uk

Portland Port - Energy Recovery Plant



WATER MAINS

Distribution Main
Washout Main
Raw Water Main
Abandoned Main
Private Main

SITES

Source
Reservoir
Pump
Treatment Works

FITTINGS

Valve - Open
Valve - Closed
Fire Hydrant
Pressure Reducing Valve
Meter

SEWERS PUBLIC PRIVATE SECTION 104

Foul
Surface
Combined
Abandoned

Colours generally indicate the use of the sewer/drain (i.e Red - Foul, Dark Blue - Surface, Magenta - Combined/Dual Use, Light Green - Highway Drain, Mid Green - Overflow) styles of line are shown on the key in sample/typical colours.

OTHER WESSEX PIPES

Rising Mains
EDM Effluent Disposal
Overflow
S Syphon

NON-WESSEX / UNKNOWN

Private Rising Mains
CW Culverted Watercourse
H Highway Drain
? Use Unknown
SU Status Unknown

STRUCTURES

Manhole - Foul
Manhole - Surface
Manhole - Combined
Outfall
Inlet
LH Lamphole
Bifurcation - Foul
Bifurcation - Surface
Bifurcation - Combined
CSO Combined Sewage Overflow
Pumping Station - Surface
Pumping Stn - Foul/Combined
Gully
VC Vent Column
RE Rodding Eye
C Catchpit
FC Flushing Chamber
SK Soakaway
Non Return Valve
X Washout
♦ Air Valve
HB Hatch Box

OTHER STRUCTURES

Attenuation Tank
Storage Tank
Chamber
Tunnel
Interceptor

a YTL company

Date: 23/04/2020 10:23:08
Scale: 1:1250
Centre: 369617, 74236