

Kinmel Bay Environmental Statement Appendices

Volume 2: Appendices and Technical Reports (Part 2: Appendices E to H)

Final

November 2022

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This report describes work commissioned by Amey Consulting, on behalf of Conwy County Borough Council. JBA Consulting carried out this work.

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Purpose

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- *EIA Content*
- *EIA Presentation*
- *Improving EIA practice*



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E Hydrology and Hydrogeology

E.1 Water Framework Directive Assessment

Kinmel Bay Coastal Defence Improvements Scheme

Water Framework Directive Assessment

November 2022

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Carbon footprint

JBA is aiming to reduce its per capita carbon emissions.

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Abbreviations

AOD	Above Ordnance Datum
CCBC	Conwy County Borough Council
CEMP	Construction Environmental Management Plan
CMU	Coastal Management Units
DIN	Dissolved Inorganic Nitrogen
DO	Dissolved Oxygen
DrWPA	Drinking Water Protected Area
EQSD	Environmental Quality Standards Directive
GEP	Good Ecological Potential
GES	Good Ecological Status
HMWB	Heavily Modified Water Body
HTL	Hold The Line
INNS	Invasive Non-Native Species
LDP	Local Development Plan
MAGIC	Multi-Agency Geographic Information for the Countryside
MHWS	Mean High Water Spring
RBMP	River Basin Management Plan
SMP2	Shoreline Management Plan 2

SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
WFD	Water Framework Directive

1 Introduction

1.1 Background

This Water Framework Directive (WFD) assessment has been prepared to inform the development and design of the Kinmel Bay Coastal Defence Improvements Scheme.

The report has been prepared following a range of guidance for WFD assessment:

- Guidance for assessing activities and projects for compliance with the Water Framework Directive, OGN72, Version 1.1, May 2017, Natural Resources Wales.
- Water Framework Directive assessment: estuarine and coastal waters – How to assess the impact of your activity in estuarine (transitional) and coastal waters for the Water Framework Directive (WFD), 9 November 2017, Environment Agency. Available at: <https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters>
- Advice Note 18: The Water Framework Directive, Version 1, June 2017. The Planning Inspectorate. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf
- Local Authority services and the water environment: Advice note on the Water Framework Directive, Natural Resources Wales. Available at: <https://naturalresources.wales/media/2627/wfd-docs-eng.pdf>

It includes key elements of the Scoping Template provided within the Environment Agency Guidance (2017), which clearly sets out all potential risks to the WFD receptors associated with the proposed development. The Scoping Template has been modified to enable consideration of WFD groundwater waterbodies in addition to surface waterbodies. Data on the status of WFD waterbodies has been obtained from the Water Watch Wales website¹ and the Multi-Agency Geographic Information for the Countryside (MAGIC) website².

1.2 Project description

The proposed development seeks to improve the coastal defences along the 2.5 km coastal frontage between Towyn and Kinmel Bay, on the North Wales coast (Figure 1-1). The study area for this Water Framework Directive (WFD) report encompasses coastal waters (North Wales waterbody) transitional and river waterbodies including the River Clwyd.

The local planning authority has considered the proposal and concludes that it constitutes Environmental Impact Assessment (EIA) development, under The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

The existing coastal defences comprise a combination of rock revetments, shingle beaches, flood gates and seawalls. The coastal frontage at Towyn and Kinmel Bay has been subject to historic coastal flooding leading to inundation of properties and impacting on local infrastructure. The proposed defence scheme aims to provide an improved standard of protection (SoP) against current and future coastal storm events associated with climate change.

¹ Water Watch Wales website. Available at: <http://waterwatchwales.naturalresourceswales.gov.uk/en/> [Accessed 4 July 2018]

² Multi-Agency Geographic Information for the Countryside (MAGIC) website. Available at: <http://www.magic.gov.uk/> [Accessed 29 August 2018]



Figure 1-1: Scheme location

The original objectives of the Llanddulas to Kinmel Bay Scheme, that subsequently apply to the revised Kinmel Bay Coastal Defence Improvements Scheme are (as stated in the Outline Business Case, 2021):

- Reduce flood damages to residential and non-residential properties;
- Ensure community and stakeholder 'buy-in' for the Scheme;
- Develop a scheme that is deliverable within engineering time constraints;
- Develop a scheme that is adaptable to change; and
- Sustain and/or improve the tourist and amenity benefits through continued operation of the beach and the North Wales Coastal route.

The design life of the scheme is 100 years.

1.2.1 Proposed development

The proposed development will improve the standard of the coastal flood protection and provide an amenity area as requested by Conwy County Borough Council (CCBC).

The proposed scheme will comprise the following activities:

- Employ coastal, shoreline protection to the frontage at Towyn and Kinmel Bay (east and west) by constructing and modifying rock revetments, seawalls and the replacement of existing flood gates.
- The scheme also includes associated public realm enhancements that are detailed in the relevant chapters of the Environmental Statement documentation.

Figure 1-2 provides an overview of the scheme area and respective coastal management units (CMU).

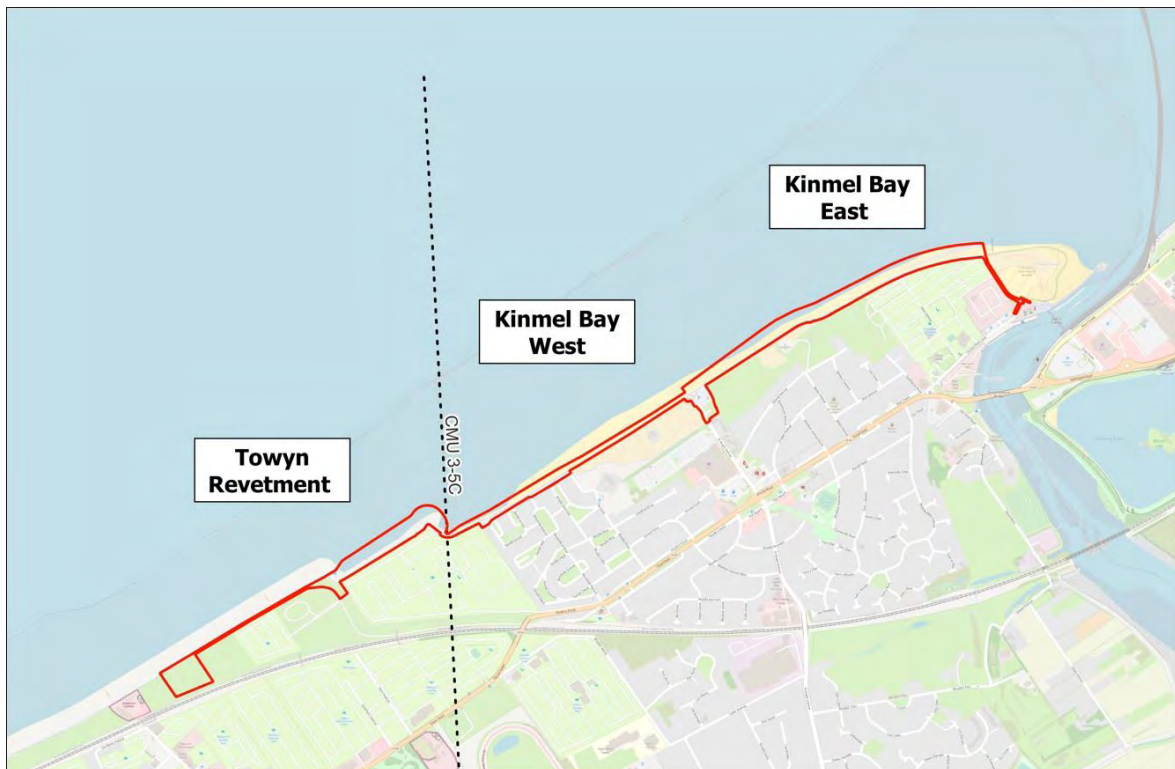


Figure 1-2: Overview of the coastal management units (CMU) relevant to the scheme and the revised scheme footprint.

1.2.2 Construction methodology

The construction methodology is currently being considered and has yet to be finalised. However, the scheme will adopt the appropriate working practices to limit the impact on the immediate footprint of the scheme and the wider receptors that may be affected by the construction works. Good practice generally follows construction of the rock armour revetment being conducted in 10 m to 20 m sections per tidal cycle. All site material (rock armour and precast concrete units) will be delivered to the site by designated road access routes. Vehicle access to the beach for construction works is possible via the following:

- Sloped slipway fronting the Golden Sands caravan Park and adjacent to the Towyn rock revetment - approximately 3 m wide access (SH 97683 80196).
- Retractable flood gate at Kinmel Bay Promenade Car Park - approximately 4 m wide access (SH 98640 80655).

Temporary storage and sorting of rock will take place on the beach adjacent to where the rock will be placed in the revetment.

Construction of the rock revetment toe will require removal of the existing beach material (sand and shingle). Excavated sediments will be temporarily stockpiled next to the excavation. A geotextile membrane will then be laid directly over the excavated area, which will then be covered by a thin filter layer of stone. Graded rock armour will then be placed one-at-a-time onto the filter layer using an excavator with a grab attachment. Once the 10 m to 20 m section of revetment toe is complete, the previously excavated sand/shingle material will be reused to cover over the toe rock to the existing beach level. Construction of the remainder of the rock revetment section to the required crest level will then take place using the excavator positioned either at the toe area or from the rear of the beach. The works will progress in this fashion until revetment works are complete.

Further details are to be submitted once the construction methodology has been finalised.

1.2.3 Breakdown of proposed development aspects

Table 1.1 provides a breakdown of the individual components of the proposed scheme relative to the areas identified in Figure 1-2. These aspects will be assessed to determine whether they could cause or contribute to the deterioration in status of a waterbody or inhibit a waterbody from achieving its status objective.

Table 1.1: Breakdown of individual components of the proposed development

Components of the proposed development
CMU 3-5B - Towyn Revetment
The proposed upgrade will significantly increase the level of coastal flood protection offered by the current rock armour unit at Towyn. The new design will keep the 1 in 4 slope angle of the current rock armour unit but will increase the crest width and height so that a SoP is achieved for a 1 in 200-year event up to the year 2041. The new design will reuse and repurpose the current rock armour material. Furthermore, the existing sea wall is being raised by 0.75 m.
CMU 3-5C - Kinmel Bay Beach
This section requires several actions comprising an increase in the height of the seawall crest by 500 mm along the entire unit, and upgrade/replacement of the existing flood gate at the car park. The level of the seawall crest will be increased to provide improved wave overtopping flood protection to Kinmel Bay, accounting for Sea Level Rise (SLR) up to 2041. The section also includes re-profiling the level of the entrance to the car park located at the end of St Asaph Avenue. This localised change in elevation will provide flood protection landwards by preventing water entering the main town, with any flood water returned to the sea by flap gates. The existing rock revetment at the eastern end of Kinmel Bay will be enhanced and upgraded. The existing seawall behind the rock armour will be raised by 500 mm and new rock armour installed in front. The rock armour will have the same crest level as the wall, a crest width of 5.6 m and a slope angle of 1 in 3. The length of the new rock armour unit will be approximately 420 m. In addition to the coastal flood protection offered by the rock armour design, ecological enhancements are being provided with the creation of artificial rock pools to provide new habitats and texture to the surface of the rock armour to encourage colonisation by marine invertebrates. The rock pools will be placed at different levels on the cross section of the rock armour to provide habitat opportunities relative to sea level associated with differing tidal cycles. Re-instate sand dunes where necessary along the stretch to the east of the car park at the end of St Asaph Avenue where gaps exist along the landward side of the foot/cycle path. The reduction of the overtopping along this CMU is characterised by the enhancement of the existing revetment at the eastern end. The benefit of this action is in the reduced risk of siltation problems at the mouth of River Clwyd.

1.3 Purpose of the report

1.3.1 Scope of this assessment

The WFD (2000/60/EC) is implemented in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, which revoke and replace the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The framework for delivering requirements of the WFD is through the River Basin Management Plan (RBMP).

The Regulations require that Environmental Objectives are set for all surface (including river, lake, coastal and transitional waters and groundwaters in England and Wales) to enable them to achieve a 'Good' status by a defined date. These Environmental Objectives are listed below:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- Aim to achieve at least Good status for all waterbodies by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve Good status by 2021 or 2027;
- Meet the requirements of WFD Protected Areas;
- Promote sustainable use of water as a natural resource;
- Conserve habitats and species that depend directly on water;
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Contribute to mitigating the effects of floods and droughts.

Surface waterbody status is made up of its ecological status and its chemical status. Ecological status is defined by a series of biological 'quality elements' and physico-chemical, hydromorphological, and chemical 'supporting elements' (which support the biological elements). Chemical status comprises a series of priority substances and other pollutants listed in the Environmental Quality Standards Directive (EQSD). These quality elements are taken from Annex V of the Directive.

The status of all relevant quality elements is classified according to five categories: 'High', 'Good', 'Moderate', 'Poor' and 'Bad'. The overall status of a waterbody is determined by the lowest elements status e.g., if all biological quality elements and supporting elements are at 'Good' status, except for one, which is at 'Moderate' status, then the ecological status is 'Moderate' and the overall status is 'Moderate'. Published guidance requires that all quality elements need to be considered as part of a WFD assessment.

Groundwater waterbody status is defined by its 'quantitative status' and its 'chemical status'. Two classes are attributed to both quantitative and chemical status: 'Good' and 'Poor'. Both elements need to be at good status before the waterbody can be classified as 'Good'.

Under the WFD, Heavily Modified Waterbodies (HMWB) are bodies of water that are substantially changed in character due to physical alterations by human activity and cannot meet 'Good Ecological Status' (GES). Therefore, mitigation measures are set for the waterbody so that it achieves 'Good Ecological Potential' (GEP). This assessment therefore must consider whether the proposed scheme will conflict with the measures in place now or planned for the future, and whether this could affect the status of the hydromorphological quality elements (and ultimately the status of the waterbody).

1.3.2 Small non-reportable waterbodies

All waterbodies are protected under WFD. This includes stretches of water considered too small to be a formal WFD waterbody, such as ditches, small streams, and brackish lagoons. As such, deterioration of such water should be prevented. In the absence of any classification data relating to these waterbodies, it should be assumed that they are at 'Good' status. Therefore, any proposed development that could affect such a waterbody should be assessed to determine whether it could cause deterioration from good status. There are no known non-reportable waterbodies within the scheme area.

1.3.3 Protected areas, priority habitats and invasive non-native species

Published guidance states that the WFD assessment must also consider the potential impacts on the following:

- Protected areas – these are defined under Article 6 of the Directive and include the following:
 - o Areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas);
 - o Areas designated for the protection of economically significant aquatic species (Freshwater Fish and Shellfish);
 - o Bodies of water designated as recreational waters, including areas designated as Bathing Waters;
 - o Nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive (UWWTD); and
 - o Areas designated for the protection of water-dependent habitats or species, including relevant Natura 2000 sites.
- Priority Habitats – these are “habitats of principal importance for the conservation of biodiversity”, which are defined under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 in England and Section 7 of the Environment (Wales) Act 2016 in Wales. Detailed assessment is required if a proposed development would significantly impact on a priority habitat that is critical to the ecological health of a waterbody i.e., directly impacts habitats that are critical to the individual biological quality elements.
- Invasive non-native species (INNS) – assessment of INNS is required if a development could cause the introduction or spread of INNS into a waterbody.

1.3.4 Approach to WFD Assessment

All new activities in the water environment need to take account of the requirements of the WFD. For a project or activity to be compliant with the WFD, it should demonstrate that:

- There is no risk of it causing a deterioration in the status of any element; in addition for groundwater, it will limit or prevent the input of pollutants;
- There is no risk of it preventing WFD protected areas from achieving their objectives;
- It will not jeopardise any waterbody from achieving good status/potential; and
- It will contribute to the protection, enhancement, and restoration of waterbodies.

Therefore, this WFD assessment aims to determine whether the proposed development would have the potential to cause or contribute to the deterioration in status of a WFD waterbody or inhibit a waterbody from achieving its status objective. It also assesses the potential for the development to contribute to the objectives of the WFD.

The assessment identifies all activities that will take place as part of the proposed development, during both construction and operation, and where risks of an impact on the WFD quality elements might arise due to these activities.

This assessment follows published good practice guidance and has been undertaken following a staged approach:

- Stage 1: screening – to determine whether any activities associated with the proposed development do not require further consideration i.e., do not need to go through the scoping or impact assessment stages because there is no more than a low risk of a potential impact on a waterbody;
- Stage 2: scoping – identifies the potential risks associated with the proposed activities and the WFD receptors that are at risk i.e., those risks that need impact assessment; and
- Stage 3: impact assessment – a detailed assessment of the potential impacts of each activity, including consideration of ways to avoid or minimise impacts, and possible enhancement opportunities, to determine whether an activity may cause deterioration or jeopardise the waterbody from achieving good status.

This staged approach is summarised in Figure 1-3Error! Reference source not found., which reproduces an assessment flow checklist taken from the Natural Resources Wales WFD guidance (2017). The NRW guidance also includes detailed screening criteria that can be used to determine whether a proposed activity is not likely to cause a deterioration in the status of a waterbody. This includes a list of activities that in general will not cause a deterioration, such as 'temporary' works that do not normally last more than six months and are not likely to have a residual impact on a waterbody. The guidance also lists other physical works and defines screening thresholds for each; these thresholds help to determine whether any activity presents a risk to a waterbody and any requirements for further assessment. However, these thresholds are for guidance only and expert judgement is required to determine if a proposed activity may have an impact on a waterbody.

A more detailed WFD assessment would be required if it cannot be concluded that the proposed development would not cause deterioration or inhibit the objective status of a waterbody. Further to this and in line with WFD requirements, there would be a need to apply the Article 4.7 test to seek approval for progression of the development if, after the full WFD assessment (including the implementation of mitigation measures), it cannot be determined that the development would not cause deterioration to a waterbody or prevent it from achieving its status objectives.

1.3.5 Cumulative and in-combination impacts

Good practice guidance published by NRW (2017) requires that the proposed development is also assessed for potential cumulative and in-combination impacts.

Cumulative impacts are multiple impacts on the same waterbody quality element that arise from the proposed development together with those from all developments that have been built and are operational.

In-combination impacts are those impacts that may arise from the proposed development in-combination with other plans and projects proposed/consented but not yet built and operational i.e., those developments that are separate from the baseline. These include:

- Activities started but not yet completed;
- Activities consented but not started;
- Ongoing activities subject to repeated authorisations (e.g., annual licenses);
- Application submitted but not yet determined; and
- Activities not requiring consent, but which have been approved by the relevant competent authority.

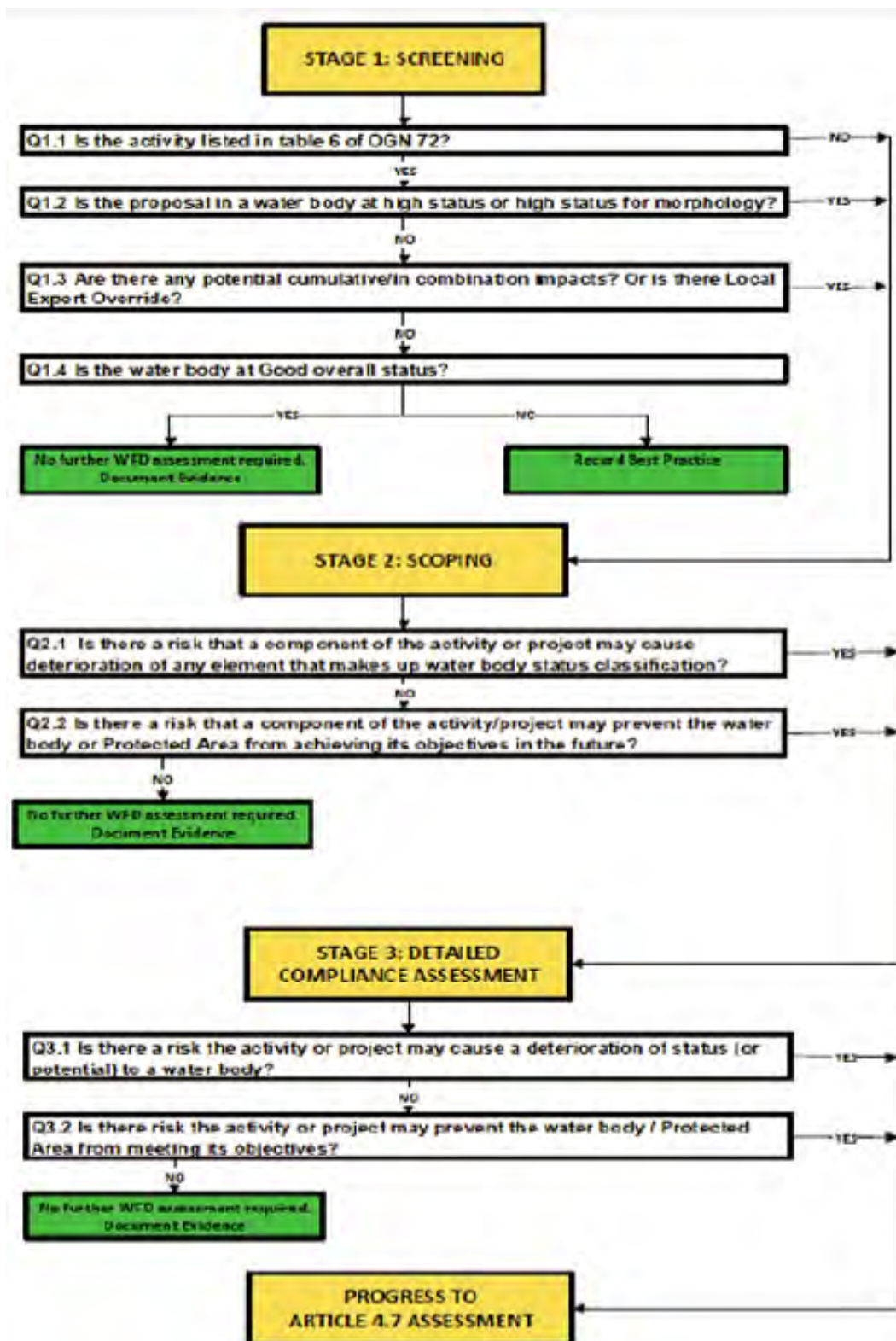


Figure 1-3: WFD assessment process flowchart obtained from Natural Resources Wales WFD guidance (2017).

2 Baseline conditions

2.1 Relevant WFD waterbodies

The Water Watch Wales website indicates that the proposed scheme lies within the 'North Wales coastal waterbody' (WFD Ref: GB641011650000).

2.2 North Wales coastal waterbody

The North Wales coastal waterbody encompasses a 45 km stretch of the North Wales coast from Great Ormes Head to the Wales/England border, equating to an area of 146.25 km². The waterbody is designated as a Heavily Modified Waterbody (HMWB) due to modification associated with coastal protection.

The waterbody is currently assessed as having an overall status of 'Moderate', with 'Moderate' ecological potential, whilst its chemical status is currently 'Fail'. The quality elements that are contributing to the failing status of the waterbody include mercury (and its compounds) from an unknown source and Dissolved Inorganic Nitrogen (DIN) from dairy and beef farming and non-mains domestic sewage. Table 2.1 provides a summary of the previous RBMP Cycle 2 (2015) and RBMP Cycle 3 (2021) status of the WFD quality elements for the waterbody.

Table 2.1: WFD quality elements and status for North Wales coastal waterbody

Waterbody criteria		RBMP Cycle 2 (2015)	RBMP Cycle 3 (2021)
Ecological quality elements			
Phytoplankton		High	Moderate
Invertebrates		Good	Good
Physico-chemical supporting elements			
Flow		Pass	Pass
Dissolved Oxygen		High	High
Dissolved Inorganic Nitrogen		Moderate	Good
Annex 8 Chemicals		High	High
Chemical quality elements			
Arsenic		Good	High
Copper		Good	High
Iron		Good	High
Zinc		Good	High
Annex 10 Chemicals	Benzo(a)pyrene	Good	High
	Cadmium	Good	High
	Fluoranthene	Good	High
	Hexachlorobenzene	Good	High
	Hexachlorobutadiene	Good	High
	Lead and its compounds	Good	High
	Mercury and its compounds	Fail	Moderate (Fail)
	Nickel and its compounds	Good	High

2.3 The current site WFD status

Within the vicinity of the Kinmel Bay Coastal Defence Improvements scheme there are various waterbodies that are subject to status classifications under the Water Framework Directive. These waterbodies and the associated status from the most recent assessment Cycle (2021) is listed in Table 3.

Table 2.2: Summary of WFD Waterbodies

Waterbody Type	Name	WFD Reference	Status (2021)
Coastal	North Wales	GB641011650000	Moderate
Transitional	River Clwyd	GB541006608000	Moderate
Groundwater (chemical)	Clwyd Permo-Triassic Sandstone and Clwyd Silurian	GB41001G202100	Good
River (within 5 km radius of scheme area)	River Clwyd	GB110066059960	Moderate
	River Elwy - Clwyd to Melai	GB110066060020	Good
	River Gele	GB110066059980	Moderate
	Pont Robin Cut (Bodelwyddan)	GB110066059970	Poor
	Glanfyddion Cut	GB110066059990	Moderate
River (outside 5 km radius of scheme area)	River Bach	GB110066059950	Bad
	River Dulas (lower)	GB110066059860	Poor
	River Dulas (upper)	GB110066059810	Good
	Nant y Fedw (Dulas)	GB110066059830	Moderate

2.3.1 River water status

Figure 2-1 identifies the river Water Framework Directive waterbody status of the site. This includes the following waterbodies:

- The River Clwyd marks the boundary between Kinmel Bay and Rhyl. The transitional (between riverine and coastal) water body near the river mouth has "Moderate" status under the Water Framework Directive's classifications.
- The river waterbody of the River Clwyd has "Moderate" status and the tributaries feeding into it range from "Poor" (Pont Robin Cut) to "Good" (River Elwy).
- The River Bach joins the River Clwyd, approximately 10 km from the scheme area, and is currently of "Bad" status.
- The lower River Dulas, in Llanddulas also has "Poor" status while the upper is "Good".
- The Nant y Fedw (Dulas) River is designated "Moderate".

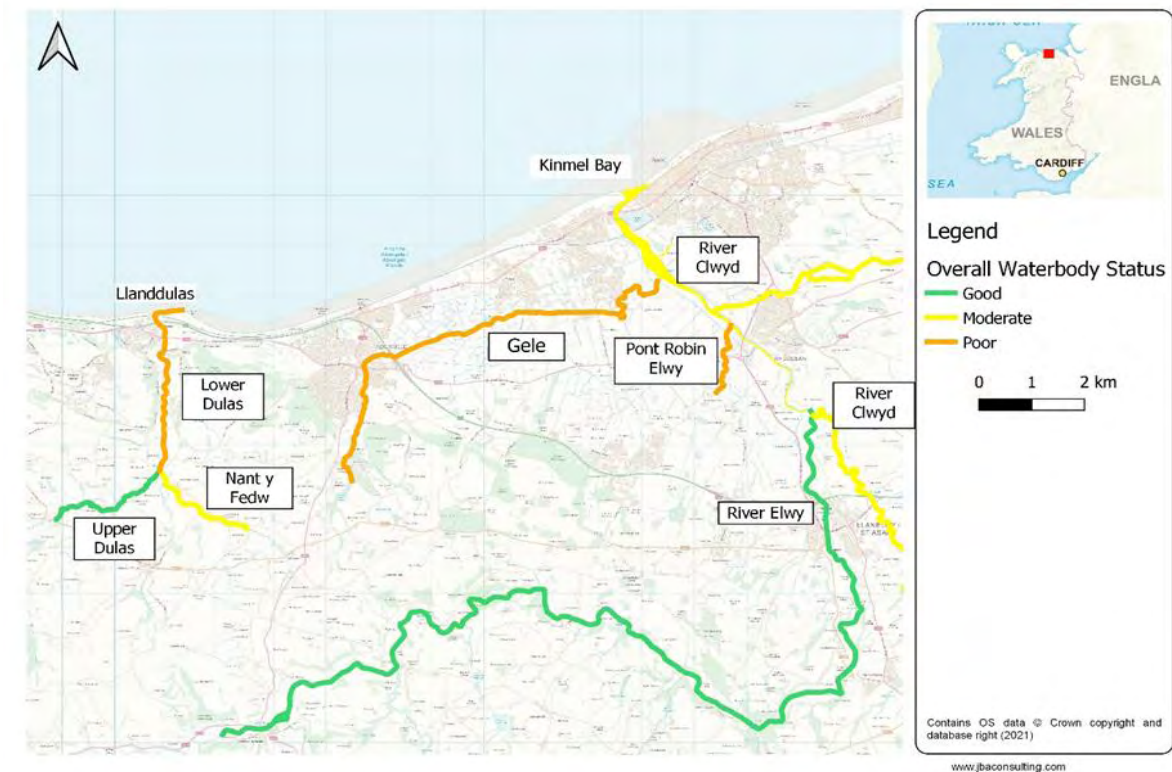


Figure 2-1: Water Framework Directive - River Waterbody Status

2.3.2 Groundwater Status

The status of the Clwyd Permo-Triassic Sandstone groundwater body is "Good" for the Groundwater (Quantitative) and Groundwater (Chemical) classification. The adjacent Groundwater bodies of Conwy (GB41002G203000) and the Dee Carboniferous Coal Measures (GB41102G204800) are classified as "Good" for Groundwater (Quantitative) and "Poor" for Groundwater (Chemical) status. However, both these groundwater bodies are located approximately 10 km from the scheme area and are not expected to be impacted by the proposed defence scheme, Figure 2-2.



Figure 2-2: Water Framework Directive - Groundwater (chemical) status

2.3.3 Coastal Waterbody

The North Wales Coastal Waterbody is designated as a Heavily Modified Water Body and has an overall status classification of "moderate" based on the 2015 assessment, Figure 2-3. It is classified as "moderate" ecological status and "fail" for chemical status, as of 2015.

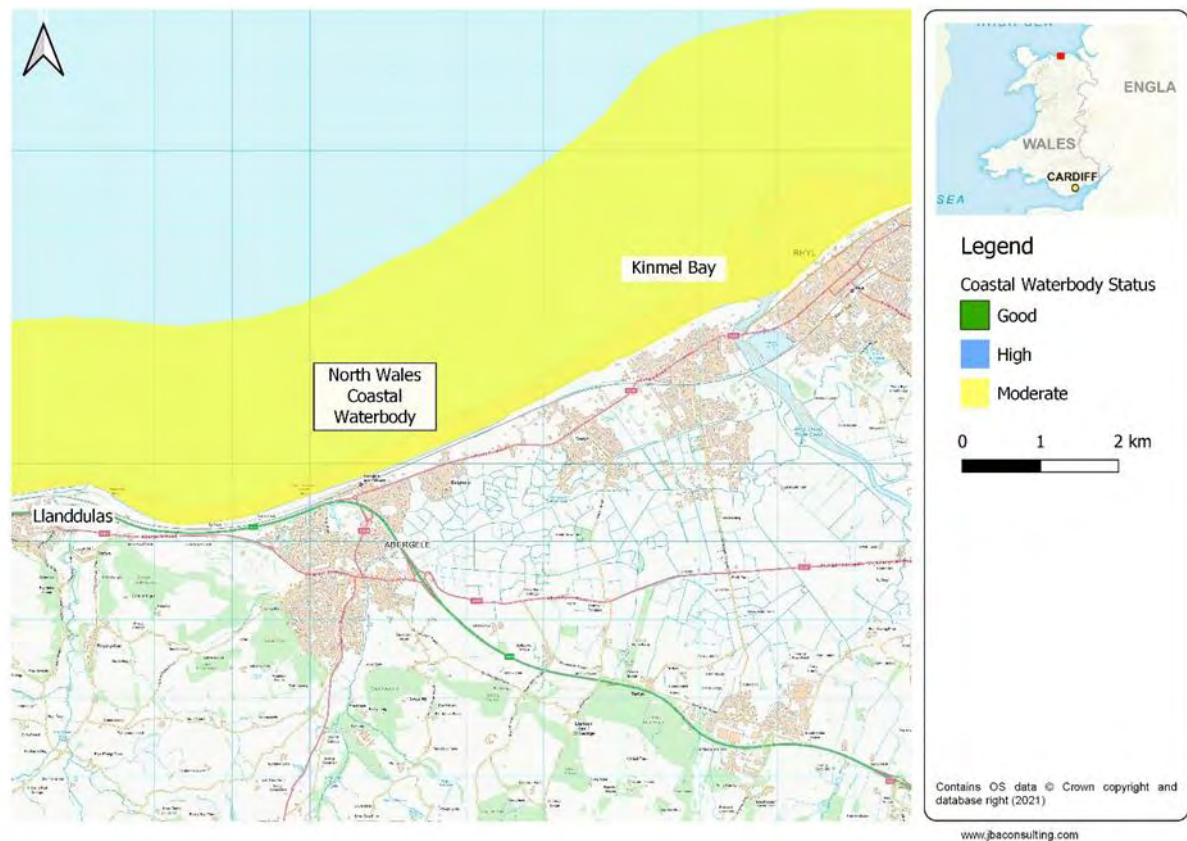


Figure 2-3: Water Framework Directive - North Wales Coastal waterbody

2.3.4 Mitigation measures

For each HMWB, mitigation measures are set within the RBMP to ensure the hydro-morphological characteristics of a waterbody are consistent with GEP.

For the North Wales coastal waterbody, a series of mitigation measures are identified. Many of these measures are related to the control of dredging activities and disposal of dredged materials; as such the proposed scheme will not affect these activities or decision-making relating to the control of these activities. Therefore, these measures are not considered further. The following mitigation measures are relevant to the proposed scheme:

- Indirect mitigation
- Reduce sediment resuspension
- Manage disturbance
- Retain habitats
- Enhance ecology
- Realign flood defence
- Preserve or restore habitats

Typically, for a waterbody to be able to achieve GEP all mitigation measures must be in place and functioning. An assessment of the mitigation measures for the North Wales coastal waterbody (see Water Watch Wales website) identifies that the status of these mitigation measures is "Good" and that the measures listed are 'not currently applicable – not required in this waterbody'. This indicates that the hydromorphological characteristics of the waterbody are consistent with GEP and that implementation of further mitigation measures is not required at this time.

2.4 Clwyd Permo-Triassic Sandstone groundwater body

The Clwyd Triassic Sandstone groundwater body spans a broad area along the North Wales Coast, from Llanddulas to Prestatyn, and south to Llysfas. It encompasses an area of 237.32 km² in size.

The waterbody has a quantitative status of "Good" and a chemical status of "Good", giving it an overall status of "Good".

2.5 Protected areas, priority habitats and invasive non-native species

The coastline is of high biodiversity value based on the variety and importance of ecological designations. The MAGIC website identifies that there are several WFD Protected Areas within 2 km of the proposed scheme. These comprise:

Within scheme area

- Clwyd Permo-Triassic Sandstone Drinking Water Protected Area
- Kinmel Bay (Sandy Cove) Designated Bathing Water

Within 500m of the scheme area

- Liverpool Bay Special Protection Area (SPA)
- Marine Lake Bathing Water

Within 2km of the scheme area

- Rhyl Designated Bathing Water
- Rhyl East Designated Bathing Water

Within 5km of the scheme area

- Abergele (Pensarn) Designated Bathing Water

The following coastal habitat (as defined by Section 7 of the Environment (Wales) Act 2016) is present within 500 m of the proposed scheme:

- Saline lagoon (Marine Lake, Rhyl)
- Saltmarsh (along the River Clywd)
- Sand dunes (Hortons Nose)

The following WFD Higher Sensitivity Habitats are present within 500 m of the proposed scheme:

- Saltmarsh (A2.5) within and immediately adjacent to the scheme area
- Mussel Beds (*Modiolus modiolus*, *Mytilus edulis* & others) (A1.22, A2.72, A5.62, A4.24, A3.361)

However, the ecology surveys of the scheme area undertaken in May 2022 did not identify the presence of this habitat and concluded that the habitat may be ephemeral, with the potential to return in the future.

The following WFD Lower Sensitivity Habitats are recorded within 500 m of the proposed scheme:

- Gravel and Cobbles (intertidal & subtidal coarse sediment A2.1, A5.1) within and immediately adjacent to the scheme area.
- Intertidal Soft Sediment (Sand, Mud & Mixed A2.2, A2.3, A2.4) within and immediately adjacent to the scheme area.
- Subtidal Soft Sediment (Sand, Mud & Mixed A5.2, A5.3 A5.4) within and immediately adjacent to the scheme area.
- Rocky shore (Intertidal rock A1) within and immediately adjacent to the scheme area.

An Ecological Impact Assessment (EcIA) of the proposed development confirmed that there are no historic records of INNS within 2 km of the development site.

2.6 Assessment of other activities (plans and projects) requiring assessment for potential cumulative and in-combination impacts

The following plans and projects have been reviewed to identify the potential for cumulative or in combination impacts.

Welsh National Marine Plan

The Draft Welsh National Marine Plan ended its consultation period in March 2018. This is directly informed by High Level Marine Objectives set out in the Marine Policy Statement (2011)³. The Plan will guide decision-making on the sustainable use and management of the Welsh coastline.

The Plan sets out the following Plan Objectives that are relevant to the WFD:

- Plan Objective 6: Support enjoyment and stewardship of our coast and seas and their resources by encouraging equitable and safe access to the marine environment, whilst protecting and promoting valuable landscapes, seascapes and heritage assets.
- Plan Objective 7: Improve understanding and enable action supporting climate change adaptation and mitigation
- Plan Objective 8: Support the achievement and maintenance of Good Environmental Status (GES).
- Plan Objective 9: Protect, conserve, restore and enhance marine biodiversity to halt and reverse its decline.
- Plan Objective 10: Maintain and enhance the resilience of marine ecosystems and the benefits they provide in order to meet the needs of present and future generations.

The objectives of the draft Plan are consistent with those of the WFD and the policies it proposes seek to ensure clean, healthy, and biologically diverse seas. As such, there should be no cumulative or in-combination effects with the draft Marine Plan.

Western Wales River Basin Management Plan (Natural Resources Wales, December 2015)

The measures contained within this plan aim to improve the ecological and chemical status of the waterbody. These measures are not likely to cause an adverse effect on the waterbody and may deliver significant benefits. As such, there would be no cumulative or in-combination effects with the proposed development.

³ Welsh Government, 2015. The Welsh National Marine Plan Initial Draft. [Online] Available at: <https://beta.gov.wales/sites/default/files/consultations/2018-02/draft-plan-en.pdf>

Great Orme's Head to Scotland Shoreline Management Plan (SMP2) (North West England and North Wales Coastal Group, 2018)

The SMP2 sets out the long term (100 year) strategic policies to manage coastal flood and erosion risk in the strategy area, which encompasses Towyn, Kinmel Bay and the wider North Wales coastline. It informs decision-making at project level and coastal flood defence activities should be taken in-accordance with the overarching strategic policies as defined by the SMP2.

The scheme area is located within SMP2 sub-cell 11a; the strategic policy to manage coastal flood and erosion risk is Hold the Line (HTL) for the next 100 years (to 2105). The policy states that maintaining and improving/raising the existing defences is required. This is justified in the SMP due to the commercial, residential and amenity assets, infrastructure, cycle routes and footpaths that are vulnerable to flooding under a do nothing scenario. The proposed scheme is therefore consistent with the strategic flood risk management policies for this coastline.

Conwy Local Development Plan 2007-2022 (Conwy County Council, October 2013)

The adopted Local Plan includes policy provisions for the protection of the water environment in-accordance with national policy. This includes Policy NTE/5, which protects important statutory and locally designated coastal sites from adverse impacts from development, and NTE/3 which seek to safeguard biodiversity (e.g., protected species and nature conservation sites) and NTE/4, which aims to conserve special landscape areas from future development. These elements of the Local Plan require any proposed development to integrate mitigation and minimise impacts as part of any scheme.

In addition, the LDP includes policy provisions promoting other aspects of the Plan area and identifies the Kinmel Bay area as an important local tourism/recreation centre that has the potential to contribute to the growth of the local economy. The LDP supports this through a range of policy provisions including Policy DP/1 (Sustainable Development Principles), DP/5 (Infrastructure and New Developments), TOU/1 (Sustainable Tourism), CFS/1 (Community Facilities and Services) and CFS/3 (Primary Shopping Areas).

Implementation of these and other associated environmental policies will deliver benefits to the water environment and support achievement of WFD objectives. In addition, permission for development allocated in the LDP should only be granted if these developments are in-accordance with these environmental policies; these developments should include adequate safeguards to ensure no adverse impact on the water environment and should support deliver of WFD objectives. As such, there will be no cumulative or in-combination effects with the proposed development.

Local development projects

A review of other local development projects has been undertaken to determine the potential for significant cumulative and in-combination effects. These are documented in Table 2.3.

Table 2.3: Proposed development projects which may cause cumulative and in-combination effects, impacting on the status of WFD waterbodies.

Application number	Location	Description	Status
0/49272	Old Colwyn Coastal Defence & Active Travel Improvements: Porth Eirias in the west to Splash Point	Coastal and storm defence scheme including construction of a rock revetment and improved pedestrian and cycle access with associated public realm improvement works along Colwyn Bay. Construction and completion of works based on period of 20 months (two	Registered 04/01/2022

	(By Old Colwyn Arches) in the east	phases of 10 months). Material may be delivered by road and barge.	
0/49274	Penrhyn Bay Coastal Defence and Public Realm Improvements: Penrhyn Bay Conwy	Construction of coastal defences including a T-shaped rock groyne, eastern groyne raising, repairs to the existing seawall, beach nourishment and public realm improvements including pedestrian/cycle crossing, beach access ramp, re-located and extended car parking, street furniture, promenade resurfacing and soft landscaping.	Registered 04/01/2022
0/49306	Beach and Promenade at Colwyn Bay between Colwyn Bay Station and Abbey Road	The Colwyn Bay Phase 2B: coastal works, public realm promenade improvements, and landscaping works.	
-	Central Rhyl Coastal Defence Scheme	New concrete stepped revetment and wall wave, with promenade raising/widening, and section with rock scour protection and concrete repairs to the existing sea defence structures. Construction works to commence in late 2022 for a period of 2.5 years. The eastern section will take place over 1.5 years at the start of the main construction period and finishing first, while the western works will be ongoing throughout the construction period.	
-	Awel-y-Mor (AyM) Offshore Windfarm	An 78km ² offshore wind farm 10.5 km off the Welsh coast. Construction works are expected to start after 2025. AyM export cables will be installed using trenchless technology to pass under existing coastline infrastructure including North Wales Coast Line railway, Robin Hood Holiday Park, Rhyl Coast Road A548, Rhyl golf club fairway and the promenade. Construction period will be 7 months in total.	PAC period ended 11 th October 2021

The developments described have the potential to create cumulative and/or in-combination effects when considered in addition to the Kinmel Bay scheme. Any such effects may have a detrimental impact on the associated WFD waterbodies, namely, the North Wales coastal waterbody. The developments with the exception of Awel-y-Mor Offshore Windfarm, are located adjacent to the North Wales coastal waterbody; any impacts arising from these proposed works whilst not considered significant, are expected to result in increased construction related activities. This may result in increased sediment entrainment into the waterbody potentially increasing turbidity. However, the scale of these works (approximately 0.2 km²) relative to the area of the waterbody (146.25 km²) are considered to not be significant.

A review of planning applications and permissions submitted to the online planning portal in 2020 – 2022 has been undertaken for electoral districts Kinmel Bay, Towyn, Pensarn,

Pentre Mawr, Gele, Llanddulas and Llysfaen. Those applications received are not considered to create a significant cumulative impact on any WFD waterbodies.

3 Stage 1: Screening assessment

Published guidance states that a WFD assessment is not required if an activity is assessed as being low risk, i.e., all criteria set out in stage 1 screening are met (see Figure 1-3) or where there is no (adverse) impact pathway to a WFD waterbody. Maintenance, repair, and changes to the operation of existing structures still in use for their original design purpose, where the design and the footprint of the structure remain the same, and the same or equivalent materials are used, can in most cases be screened out.

In relation to the Clwyd Permo-Triassic Sandstone groundwater body, no aspect of the proposed works would include abstraction of water, or excavation of land large enough to impact upon this groundwater body. No hazardous chemicals would be used during construction or operation of this structure, and no pathway would be created linking any construction materials to the groundwater waterbody. Therefore, no impact upon the quantitative or chemical status of the waterbody is anticipated and no further assessment upon this waterbody is undertaken.

The outcomes of the screening assessment in relation to the North Wales coastal waterbody are summarised in Table 3.1.

Table 3.1: Screening assessmentError! Reference source not found.

On the basis of the above screening assessment, potential risks to the North Wales coastal waterbody are limited to the following activities:

- Construction of rock armour revetment.
- Operation of the completed flood defence scheme.

These aspects will be taken forward to the next stage (Stage 2) of the assessment process, impact scoping, to further assess the potential for an adverse impact on the status on the North Wales coastal waterbody and its associated WFD objectives.

4 Stage 2: Scoping assessment

The purpose of the Scoping Assessment is to identify whether aspects of the proposed development not screened out during Stage 1 could present a significant risk to any of the WFD quality element receptors. In doing so, it assesses whether these activities may cause deterioration in the status of a quality element or prevent the waterbody (or protected area) from achieving its WFD objectives in the future, Table 4.1. to Table 4.6.

It utilises the Scoping Template provided within the Environment Agency guidance (2017), which comprises a series of scoping tables that aim to identify the need for a further, more-focussed impact assessment (Stage 3). Such a detailed impact assessment draws upon more in-depth evidence to determine whether the risks identified for each quality element could cause a deterioration in the status of a waterbody or prevent a waterbody from achieving its WFD objectives.

4.1 Hydromorphology

Table 4.1: Hydromorphology assessment

Could any activity:	Yes/No	Hydromorphology risk issue(s)
Impact on the hydromorphology of a waterbody at High status?	No	The North Wales coastal waterbody is not at High status for its hydromorphological supporting elements.
Is in a waterbody that is heavily modified for the same use as the activity?	Yes	The North Wales coastal waterbody is a HMWB due to modifications associated with existing coastal protection.
Significantly impact the hydromorphology of any waterbody?	No	A detailed coastal processes assessment has been undertaken to determine whether the proposed scheme could have a significant impact on sedimentary processes, beach morphology and hydromorphology. The assessment considers potential impacts in relation to the storage of rock along the beach frontage, excavation of the rock revetment area, and as a result of operation of the completed scheme. It concludes that potential impacts are not likely to be significant. Excavation of the rock revetment toe will require the temporary storage of excavated materials on the beach. The expectation is that this material will be excavated, stored, and returned to the excavated area as backfill within a single tidal cycle; as such, all works will be undertaken in dry conditions and the risk of entrainment of material will be significantly reduced. However, in a worst-case scenario, if excavated materials are mobilised, the impact on the existing sediment regime and near shore turbidity is assessed as being slight. Operation of the finished flood defence scheme is not likely to significantly affect sediment supply or longshore drift processes. The primary sediment supply mechanism along this section of coastline is considered to be via onshore movement of sand ridges. Sediment distribution continues to extend

		alongshore and is subsequently moved onshore through wave action. The presence of the rock revetment has the potential to retain sediment and thereby remove it from the longshore transport budget. However, the total footprint of the rock revetment is small in relation to the available intertidal area and therefore any impact on the sediment regime is likely to be no more than slight. As such, no significant impact on waterbody status is likely.
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4.2 Physico-chemical

Table 4.2: Physico-chemical scoping assessment

Could any activity:	Yes/No	Physico-chemical risk issue(s)
Affect water clarity, temperature, salinity, oxygen levels, nutrients, or microbial patterns continuously?	No	Extensive earthworks are required adjacent to the existing defences to enable construction of the rock armour revetment. These works are temporary in nature. The rock armour will be installed in short sections. For each section, all excavated beach material will be temporarily stockpiled adjacent to the excavation and then returned to the excavated area once the rock armour is in place and before it is inundated by the incoming tide. Notwithstanding this, the impact of beach sediment entrainment has been assessed as part of a wider coastal processes chapter. This assessment concludes that should excavated beach material be entrainment, the effect on the sediment regime and near shore turbidity would be moderate at worst. However, this risk is mitigated by the phased approach to the excavations, significantly reducing the amount of material available for entrainment at any one time. As such, the risk of a significant impact on water quality as a result of sediment mobilisation is assessed as being low. No impacts on water quality are anticipated as a result of operation of the proposed scheme.
Is in a waterbody with a phytoplankton status of moderate, poor or bad?	No	The phytoplankton status of the waterbody is High.
Is in a waterbody with a history of harmful algae?	No	There is no evidence to indicate that the waterbody has a history of harmful algae.

4.3 Biology

4.3.1 Habitats

Table 4.3: Biology (habitats) scoping assessment

Is the footprint of any activity:	Yes/No	Biology (habitats) risk issue(s)
0.5 km ² or larger?	No	The area of works associated with construction of the rock armour revetment is significantly less (0.02km ²) than 0.5km ² .
1% or more of the waterbody's area?	No	
Within 500 m of any higher sensitivity habitat?	Yes	The nearest higher sensitivity habitat (mussel bed) is located approximately 150 m to the north of the rock revetment at Kinmel Bay east. However, no evidence of this habitat was identified during ecology surveys of the beach area and it is possible that the habitat is ephemeral. Priority habitats within 500 m include <i>Sabellaria alveolata</i> reef, which has historically been recorded on the timber groynes at Rhyl, on the opposite side of the River Clywd training wall. These habitats were not recorded during the 2017 and 2018 surveys – the nearest extent was located approximately 300 m north of the Rhyl rock revetment at the low tide mark. WFD sensitive habitats are to be found in the area of the scheme including: Subtidal sands and gravels located approximately 200 – 300 m to the north of the scheme area. Intertidal soft sediments found along the beach frontage. Small areas of intertidal rocky shore and gravels and cobbles are also found on the beach front. Higher sensitivity saltmarsh habitats are also found in areas adjacent to the lower reaches of the tidal influenced River Clywd. An EcIA of the proposed scheme (see ES Chapter 5) concludes that the proposals are not likely to have a significant impact on these habitats. No impact on subtidal habitats is anticipated, whilst in relation to <i>Sabellaria alveolata</i> reef, the potential for significant smothering is assessed as being low.
1% or more of any lower sensitivity habitat?	No	The habitats within the scheme are classified as WFD higher/lower sensitivity habitat. However, some of these habitats extend along the entire North Wales coast from the Little Orme to the Dee Estuary (Intertidal Soft Sediment). Therefore, the proposed scheme will result in limited temporary and permanent impacts on only a very small proportion of this habitat.
Impact on macrophyte or phytoplankton community diversity,	No	No adverse impacts on macrophyte or phytoplankton communities are anticipated. Construction of the rock

condition, or distribution?		armour has the potential to provide new habitat opportunities for a range of marine fauna and flora.
Impact on invertebrate community diversity, condition or distribution?	No	Within the footprint of the scheme (excavated rock revetment area), the invertebrate community is assessed as being relatively impoverished. However, species living in this area will be directly affected by the excavation of beach material and installation of the rock armour. Notwithstanding this, the significance of any impacts on the invertebrate community are very low given the abundance of similar adjacent habitats and likely rapid re-colonisation of the works area. As such, no adverse impacts on invertebrates are predicted; conversely, construction of the rock armour has the potential to provide new habitat opportunities for a range of marine fauna and flora.

4.3.2 Fish

Table 4.4: Biology (fish) scoping assessment

Could any activity:	Yes/No	Biology (fish) risk issue(s)
Impact on normal fish behaviour, such as movement, migration or spawning?	No	Impacts on fish foraging behaviour during construction (due to rock armour stockpiling reducing available sand foraging habitat) are not likely to be significant due to the abundance of similar habitat in the wider area. Additionally, the expectation is that storage of rock armour will be outside the intertidal area thus not impacting on fish foraging. The risk of sediment mobilisation or chemical contamination affecting fish during construction is considered to be low. No significant impacts on fish are anticipated as a result of operation of the proposed scheme.
Could cause entrainment or impingement of fish?	No	Construction and operation of the proposed scheme does not include any aspects that could cause entrainment or impingement of fish.

4.4 Chemical

Table 4.5: Water quality (pollutants) scoping assessment

Could any activity use or release chemicals:	Yes/No	Water quality risk issue(s)
That are on the Environmental Quality Standards Directive (EQSD) list?	No	Beach sediments along the coastal frontage are generally coarse in nature and as such do not provide a favourable substrate for contaminants. Subsequent Ground Investigation works are to be carried out which will involve sediment sampling to determine concentrations of contaminants in accordance with Cefas Action Levels.
That disturbs sediment with contaminants above Cefas Action Level 1?		

Table 4.6: Water quality (mixing zone) scoping assessment

If your activity has a mixing zone consider if:	Yes/No	Water quality risk issue(s)
The chemicals released are on the EQSD list?	No	The proposed scheme will not create a mixing zone.

4.5 WFD Protected Areas

Table 4.7: WFD Protected Areas scoping assessment

Is any activity:	Yes/No	Protected Area risk issue(s)
Within 2km of any WFD protected area?	Yes	There are several WFD Protected Areas within 2km of the proposed scheme. However, no significant impacts on these designated areas are anticipated. Designated Bathing Waters are also present in the area however, the construction and operation of the scheme are not expected to present a detrimental impact on bathing water quality. In addition, a EclA confirms that the proposed scheme is not likely to have a significant adverse effect on the features of the Liverpool Bay SPA. No impacts on the Clwyd Permo-Triassic Sandstone Drinking Water Protected Area or Nitrate Vulnerable Zone (NVZ) 135 are anticipated.

4.6 Invasive non-native species

Table 4.8: Invasive non-native species scoping assessment

Could any activity:	Yes/No	INNS risk issue(s)
Introduce or spread INNS?	No	The invasive barnacle <i>Austrominius modestus</i> has been recorded in the wider area, these were found to be present on some of the timber groynes in Rhyl. This species was not recorded during surveys at Kinmel. However, appropriate biosecurity and good construction practise can be implemented throughout

		construction to effectively minimise the risk of its spread.
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4.7 Scoping summary and requirement for impact assessment

The preceding sections provide the scoping assessment of the potential risks to WFD quality element receptors as a result of the proposed scheme. The outcomes of this work are summarised in Table 4.9.

Table 4.9: Scoping summary and further assessment

WFD receptor	Potential risk to WFD receptor?	Risk issue(s) for impact assessment
Hydromorphology	No	The proposed scheme is in a waterbody that is heavily modified for the same use as the activity (coastal protection). However, the most recent WFD status information for the waterbody (taken from the Water Watch Wales website) indicates that the status of mitigation measures is "Good" and confirms that the identified measures are "not currently applicable – not required in this waterbody". In addition, detailed assessment of coastal processes has shown that construction and operation of the proposed scheme is not likely to have a significant effect on sediment supply or longshore drift processes. Therefore, no significant impacts on the hydromorphology quality elements are predicted.
Biology (habitats)	No	The proposed scheme will cause limited temporary and permanent impacts on beach habitats (WFD Lower Sensitivity Habitat), flora and fauna. However, these impacts are not likely to be significant given the availability of this habitat in the wider area. No impacts on designated sites or WFD Higher Sensitivity Habitats/Priority Habitats are anticipated. Conversely, construction of the rock armour has the potential to provide new habitat opportunities for a range of marine fauna and flora.
Biology (fish)	No	No impacts on fish as a result of construction or operation of the proposed scheme are anticipated.
Physico-chemical	No	The proposed scheme is not likely to have an adverse effect on physico-chemical conditions in the waterbody. Any potential risks to water quality during construction of the scheme will be carefully managed through implementation of good construction practice and closely monitored throughout construction.
Chemical	No	Sediment particle size is not considered favourable for adsorption by contaminants. Future ground investigation and sample analysis are expected to confirm this.

WFD receptor	Potential risk to WFD receptor?	Risk issue(s) for impact assessment
Invasive non-native species (INNS)	No	Whilst the invasive barnacle <i>Austrominius modestus</i> is present on some of the timber groynes in the wider area (Rhyl), appropriate biosecurity good practise can be implemented throughout construction to effectively minimise the risk of its spread.
Protected Areas	No	No significant, detrimental impacts to designated areas are anticipated.

4.8 Discussion

4.8.1 Hydromorphology

Assessment undertaken at Stage 1 (screening) and Stage 2 (scoping) has identified that the proposed scheme is not likely to present a significant risk to hydromorphology of the North Wales coastal waterbody.

The temporary storage of rock material on the beach has the potential to create a layer of turbulent flow in and around any rock pile, which could cause localised beach erosion. However, this is not likely to have more than a localised effect within the immediate vicinity of the rock pile. Following construction of the rock revetment the beach profile will be reinstated using excavated beach materials and no permanent effects are anticipated.

The primary sediment supply mechanism along the coastline is the onshore movement of sand ridges and sediment entrainment from west to east through longshore drift. The presence of the rock revetment has the potential to retain sediment and thereby remove it from the longshore transport budget. However, the total footprint of the rock revetment is very small in relation to the available intertidal area and therefore any impact on the sediment regime is likely to be limited.

The Western Wales RBMP identifies a series of mitigation measures for the North Wales coastal waterbody. Many of these measures focus on the management of dredging activities; however, a number are relevant to the proposed scheme, particularly those that seek to improve the ecological value of defence structures and preserve or enhance habitats.

The Water Watch Wales website confirms that the measures listed for this waterbody are “not currently applicable – not required in this waterbody” and that the mitigation measures are at “Good” status. This means that the hydromorphological characteristics of the waterbody are consistent with GEP and that implementation of further mitigation measures is not required. This conclusion is supported by the “reasons for failure” data, which identifies that the waterbody is failing to achieve its status objectives due to issues with DIN and mercury (and its compounds).

Notwithstanding this, the proposed scheme is not likely to conflict with the identified mitigation measures (should they be required in the future). The scheme is consistent with the SMP2 HTL policy and so realignment of flood defences is not appropriate in this location. The scheme does support implementation of measures that seek to improve the ecological value of coastal habitats. These are to be addressed with the creation of planted and grassed areas along the frontage that will provide benefits in terms of landscape and recreational amenity as well as ecological benefits.

The proposed rock revetments also have the potential to provide new habitat opportunities for a range of (rocky shore) fauna and flora. However, further ecological enhancements could be included in the design of the rock revetment to provide additional opportunities for rocky shore species to colonise.

4.8.2 Biology

The proposed scheme will cause limited temporary and permanent impacts on beach habitat (these habitats are classified as a WFD Lower Sensitivity Habitat), flora and fauna. No impacts on designated sites (including the Liverpool Bay SPA, Section 7 Priority Habitats, or WFD Higher Sensitivity Habitats) are anticipated.

Construction of the rock armour revetment will require excavation of beach materials and the installation of rock armour; this will cause habitat damage and disturbance to the affected beach areas and the addition of a new habitat type (rock armour). Excavated beach material will be backfilled in the same area once the rock armour has been installed. The damage to this habitat will be largely temporary and no significant impacts on WFD Lower Sensitivity Habitat is anticipated, particularly given the abundance of this habitat type in the immediate vicinity of the scheme and likely rapid re-colonisation of the scheme area by marine fauna.

The addition of new rock armour habitat has the potential to provide an ecological benefit by providing opportunities for existing and new flora and fauna to colonise the scheme area, potentially increasing biodiversity. This includes providing new roosting opportunities for waterbirds and the rock armour may encourage establishment of WFD Higher Sensitivity Habitats, including mussel beds and polychaete reefs, which are already present in the wider area.

4.8.3 Water chemistry

The North Wales coastal waterbody is currently assessed as having an overall status of "Moderate", with a chemical status currently at "Fail". The quality elements that are contributing to the failing status include (i) Dissolved Inorganic Nitrogen (DIN) from dairy and beef farming and non-mains domestic sewage and, (ii) mercury (and its compounds).

The source of mercury (and its compounds) within the waterbody are currently unknown. Whilst it is a naturally occurring element, much of the mercury currently found in the environment results from historic industrial activity. Excessive levels of mercury contamination have been reported from adjacent coastal sub-cells on the western coast of England.⁴

Ground investigation and subsequent sediment sampling and analysis are due to be conducted in the future in accordance with Cefas Action Levels. Chemical analysis may provide insight to establish if the source of pollution lies within the footprint of the scheme. If levels of mercury are found to be above the stipulated Cefas Action Levels remediative action will be required to mitigate any impacts to the waterbody and wider environmental and ecological receptors.

4.8.4 Protected Areas

The proposed scheme is located within the Bathing Waters at Kinmel Bay (Sandy Cove), designated under the Bathing Water Regulations 2013 (2013/1675), and the Clwyd Permo-Triassic Sandstone Drinking Water Protected Area (DrWPA), which encompasses the underlying groundwater body.

Previous monitoring of the designated bathing water dating from 2017 to 2021 suggests periodic episodes of bacterial contamination to bathing water quality. The bathing waters are subject to short term pollution caused when heavy rainfall washes faecal material into the sea from livestock, sewage and urban drainage via rivers and streams. The proposed scheme will not alter existing sewerage infrastructure or surface runoff patterns or result in the direct release of foul water/faecal matter into the bathing water. Therefore, no impacts on the designated bathing waters are anticipated.

⁴ Environment Agency (2019), Mercury: sources, pathways and environmental data

Notwithstanding this, it is recommended that visual monitoring of the construction area is undertaken daily during the construction period to identify any signs of sewage debris, animal faeces, litter, and oil or tar that has been discharged into the area, particularly after storm or heavy rainfall events. If any such debris is identified, it should be removed from site to a suitable waste disposal facility. This will minimise the risk of bacterial contamination adversely affecting both users of the beach/bathing waters and construction personnel.

No impacts on the groundwater DrWPA are anticipated because the scheme does not include any significant abstraction of water or discharge to ground and does not require use of any hazardous chemicals.

5 Conclusion and recommendations

The proposed scheme is not likely to have a significant impact on any WFD receptors. No significant long-term impact on existing coastal processes is predicted, whilst impacts on beach habitats, including damage and disturbance during construction, will be limited and temporary in nature, these are not considered to be significant. Furthermore, construction of the rock armour revetment may provide an ecological benefit. No impacts on WFD Protected Areas are anticipated.

The following recommendations are made to support the delivery of the proposed scheme and compliance with the requirements of the WFD:

- It is recommended that the proposed scheme seeks to contribute to any future requirement for additional mitigation measures. This should principally focus on opportunities to provide further ecological enhancement of the rock armour revetment.
- Proposed ground investigation works, and subsequent sediment analysis should be used to determine the presence of any existing contamination within the footprint of the scheme. Should sampling analysis highlight the presence of contaminants of concern at concentrations above the stipulated Cefas Action Levels then mitigation measures will be required to reduce the potential mobilisation of any harmful contaminants which may be detrimental to the current and/or future WFD status.
- A Construction Environmental Management Plan (CEMP) should be prepared, which sets out the actions that will be implemented to control construction of the proposed scheme so as to avoid adverse impacts on the environment. The CEMP should form part of the construction contract. It should adhere to construction best practice for works on the coast so as to reduce the risk of environmental contamination during construction and include biosecurity procedures to prevent the spread of INNS (see below).
- Visual monitoring of the construction area should be undertaken daily during the construction period to identify any signs of sewage debris or any other contaminated materials, which should be removed offsite for disposal. This will minimise the risk of bacterial contamination adversely affecting beach users and construction personnel and potentially impacting on Bathing Water status.
- Where construction works coincide with the development of future proposed coastal defence and infrastructure projects within the wider sub-cell, caution should be employed to limit any potential cumulative, in-combination effects.

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E.2 Flood Consequences Assessment

Kinmel Bay Coastal Defence Improvement Scheme - Flood Consequences Assessment

Version 1

November 2022

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Version 1, November 2022	First Issue	Lee Selway, Amey

Contract

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Purpose

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1 Introduction

1.1 Terms of reference

JBA Consulting were commissioned by Amey Consulting on behalf of Conwy Council to support the detailed design of sea defences along the North Wales coastline at Kinmel Bay. The project forms part of the Welsh Government's Coastal Risk Management Programme. It provides an opportunity to address the current issues of the condition of the existing sea defences and address medium term flood risk issues affecting surrounding communities. The proposed coastal protection project is to be submitted for planning approval. This Flood Consequences Assessment (FCA) was prepared in support of the planning application.

1.2 FCA requirements

This FCA follows Welsh Government guidance on development and flood risk set out in the Technical Advice Note 15: Development and Flood Risk (TAN15). Where appropriate the following aspects of flood risk will be addressed in all planning applications over its expected lifetime in flood risk areas:

- The likely mechanisms of flooding
- The likely source of flooding
- The depths of flooding through the site
- The speed of inundation of the site
- The rate of rise of flood water through the site
- Velocities of floodwater across the site
- Overland flow routes
- The effect of access and egress and infrastructure, for example public sewer outfalls, combined sewer outfalls, surface water sewers and effluent discharge pipes from wastewater treatment works
- The impacts of the development in terms of flood risk on neighbouring properties and elsewhere on the floodplain

2 Site description

2.1 Site description

The Kinmel Bay Coastal Defence Improvements Scheme covers a 2.5km stretch of North Wales coastline in Conwy. There are proposed works between Towyn Revetment along the coastline to Kinmel Bay East, as shown in Figure 2-1. The stretch of coastline at Kinmel Bay is characterised by sandy and pebble beaches, with a continuous path that forms part of the North Wales Coastal Route. It is bound to the north by the Denbighshire coastline and to the south by a mix of residential, commercial industry and holiday homes.

Conwy County Borough Council have proposed the Kinmel Bay Coastal Defence Improvements Scheme to improve and extend flood defences, upgrade the public realm, and provide ecological enhancements at various locations along 2.5km section of this North Wales coastline.



Figure 2-1 Site Location Plan

2.2 Soils, geology, and watercourses

The Soil Landscape online viewer indicates that the site is exclusively covered by loamy and clayey medium carbon soils of coastal flats, with naturally high groundwater which drains to local groundwater. The landcover is arable with some grassland. The soils are mostly drained. Given the nature of the site, formed of sand dunes and the coastal frontage for Kinmel Bay, soil depth is likely to be minimal, and/or comprised of coastal sands and marine beach deposits. No Ground Investigations have yet been undertaken to determine underlying geology of the site.

The British Geological Survey (BGS) Geology of Britain Viewer indicates that bedrock at the site is Kinnerton Sandstone formation. The superficial deposits are identified mostly as marine beach deposits, with areas also comprised of storm beach deposits and blown sand.

Kinmel Bay is surrounded by a complex network of NRW Main Rivers and associated drains, as shown in Figure 2-2. The River Clwyd is the most significant NRW Main River present in the area and flows in a northerly direction within close proximity to the eastern boundary of the site. Significant tributaries of the River Clwyd include the River Gele and Ffynnon Y Ddod.

A series of drainage channels and small watercourses are located near to the site which include Kinmel Bay Drain, Green Avenue Drain, as well as Sarn Cut and Bodoryn Cut which converge with the River Gele.



Figure 2-2 Watercourses around the site

2.3 Development proposal

Background

The coastal community of Kinmel Bay is currently threatened by increasing flood risk. Conwy County Borough Council (CCBC) are proposing to construct coastal flood protection works along the coastline at Kinmel Bay to reduce the risk of flooding from the sea. The proposed works form part of an adaptive approach which aims to manage flood risk in the medium term, with future works required to address longer term climate change effects. The interventions are collectively referred to as the proposed scheme.

There is an extensive system of existing flood defences built along the 2.3km stretch of coastline, composed of rock revetments, cobbled beaches, sea walls and floodgates. However, as a consequence of climate change, the number of properties and critical infrastructure at risk of flooding is increasing. In 2021, the number of properties at risk from a 1 in 200-year flood event is 892, which increases to 3,335 properties in 2121.

The proposed coastal protection project seeks to improve the standard of flood protection along the Kinmel Bay section of coastline.

Existing defences

Existing flood defences along this stretch of coastline are made up of rock revetment, cobbled beaches, sea walls and flood gates.

The existing defences are located along much of the coastline, with some dating back to the 19th Century. Previous erosion and coastal flood events have resulted in a range of schemes which include timber and rock groynes, revetments, seawalls, and floodgates to help protect the area.

In this region it has been found that the shingle deposits along the coastline are diminishing which affects the ability of the existing shingle berm to effectively provide flood protection. In some locations the drop in shingle levels also results in risks of undermining to the existing sea wall.

In more recent years storm damage has resulted in reactionary interventions. The existing beach and defence arrangements were implemented as part of a scheme to provide improved coastal defences in 1999 and 2000 following major flooding in the Towyn Flood event in the 1990s. Furthermore, the 2013/14 storms resulted in emergency works to replenish the depleted shingle beach and repair the existing defences. However, these interventions are considered short term and as such, a medium and long-term solution is required to provide improved coastal defences along this section of coastline.

A summary of coastal defences and a timeline of recent interventions is presented in Figure 2-3.

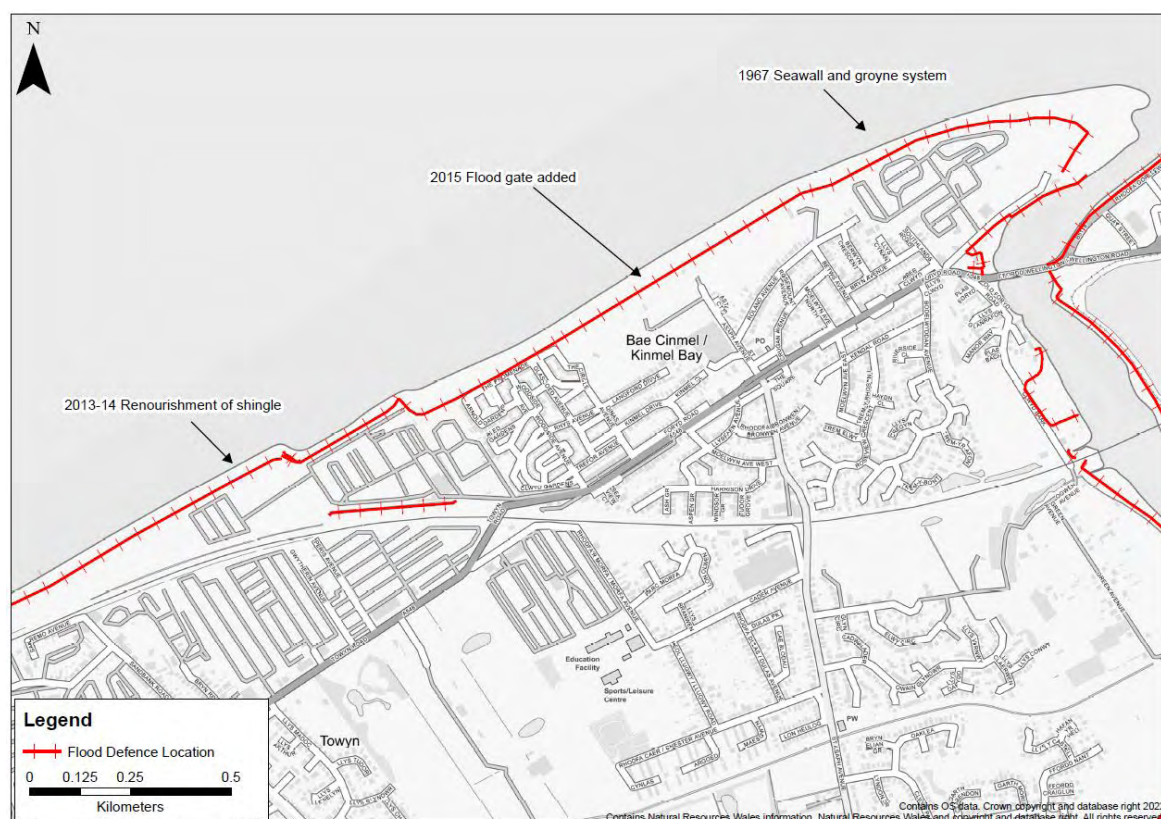


Figure 2-3 Site location and existing coastal defences

Proposed scheme

The proposed development will encompass raising the level of the existing sea wall, replacing the existing flood gate, and enhancing and extending rock armour to protect the properties and infrastructure behind. The aim of the proposals is to manage tidal flood risk in the medium term (to 2041) to a 1 in 200 year standard of protection. The scheme will also support future

works required to manage longer term tidal flood risk to the Kinmel Bay area. The design life of the structures constructed within these proposals is 100 years.

The key features of the new coastal defence scheme are as follows:

- Introducing and upgrading existing areas of rock armour to areas of the coastline
- Raising existing embankments and seawalls
- Constructing new flood walls
- Upgrades/replacement of existing flood gates
- Re-profiling of local ground levels to provide flood protection to the wider area
- Widening the coastal path at Kinmel Bay and Llandulais beach to create more space for pedestrians and cyclists
- Adding parklets, street furniture and new shelters with art displays
- Improving beach access
- Habitat enhancements and creation
- Upgraded car parks

3 Planning policy and flood risk

3.1 Planning context

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. These policies have the aim that all development in Wales is sustainable and improve the social, economic, environmental, and cultural wellbeing of Wales as set out in the Wellbeing of Future Generations Act 2015.

Technical Advice Note 15 (TAN-15), introduced by the Welsh Government in 2004, provides technical guidance relating to development planning and flood risk in Wales. The initial requirements of TAN-15 are to identify the vulnerability classification(s) and flood zones relevant to the proposed development, and to apply this information to the application of the justification tests.

An update for TAN-15 was released in October 2021 and was due to come in force on the 1st December 2021. However, Welsh Government have since suspended the implementation of the new TAN-15 until 1st June 2023. Although the new TAN-15 is not a material consideration, Welsh Government and NRW advise that some consideration is given to the draft Flood Map for Planning (FMfP) as best available information. Therefore, where a site is located in a FMfP flood risk zone it is recommended that an FCA is carried out.

As a result of the above, both the DAM and the FMfP are considered as part of this FCA.

3.2 Development Advice Map

The Development Advice Map shown in Figure 3-1 indicates that the site of the proposed coastal defence scheme is predominantly located in Zone C2, with some areas located in Zone C1. Zone A is also present within the red line boundary which is likely to be where existing flood defences form high ground.

Zone C1 is defined as "areas of the floodplain which are developed and served by significant infrastructure, including flood defences". Whereas Zone C2 describes "Areas of the floodplain without significant flood defence infrastructure". Zone A is "Considered to be at little or no risk of fluvial or coastal/tidal flooding".

Any proposed development located in Zones C1 and C2 must be supported by a Flood Consequence Assessment (FCA) prepared in line with TAN15.

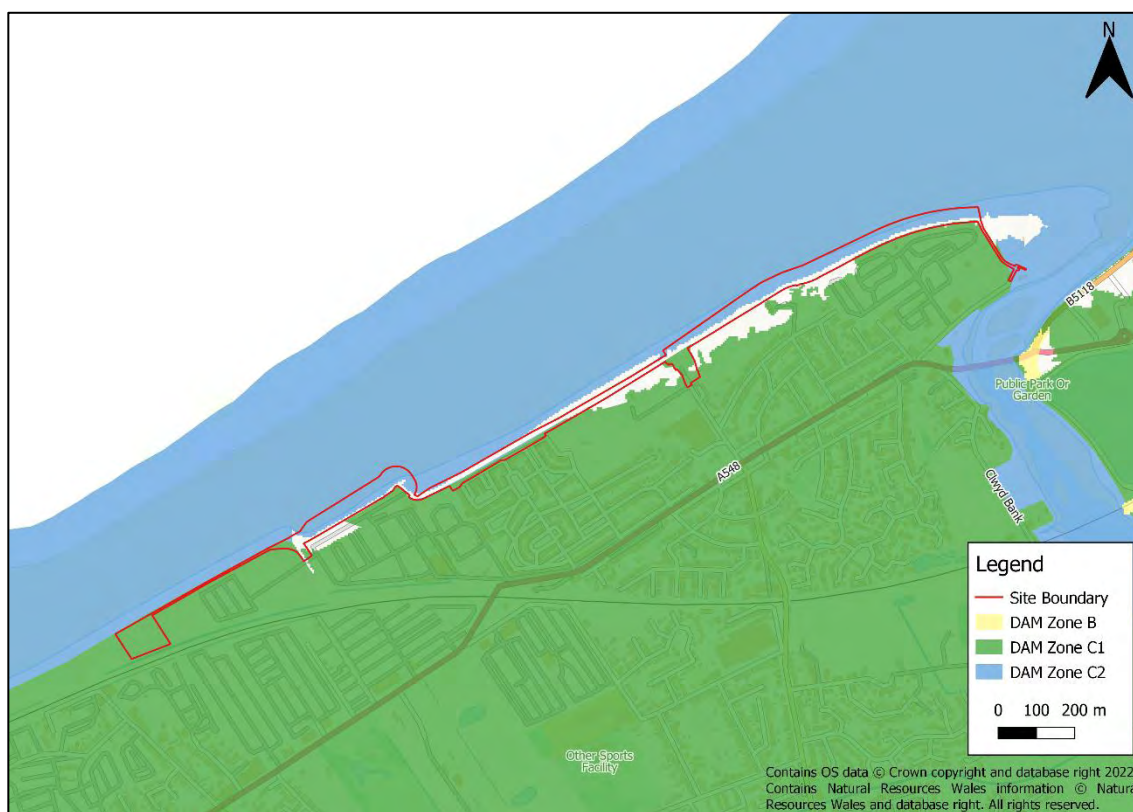


Figure 3-1 Development Advice Map

3.3 Flood Map for Planning Classifications

The new TAN15 will replace the DAM with the Flood Map for Planning (FMfP), which will be used to trigger different planning actions based on a precautionary assessment of flood risk. Whilst the new TAN15 is not a material consideration until implemented, it does illustrate the current policy thinking of Welsh Government and in some cases the FMfP may constitute best available information. Consequently, information on the FMfP is provided for information only.

The development site is largely located within Flood Zone 3 and the TAN-15 Defended Zone, with pockets of Flood Zone 1, as shown in Figure 3-2.

The Flood Zones are all entirely associated with flood risk from the sea. Flood Zone 3 represents areas which have greater than a 1 in 200 (0.5%) chance of flooding in a given year, including climate change. Flood Zones are based on undefended flood modelling.

The TAN-15 Defended Zones identify areas where flood risk management infrastructure provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard). Under the new TAN-15, all types of development will be permissible in the Defended Zone, subject to the Justification Test and assessment against acceptability of the consequences.



Figure 3-2 Flood Map for Planning

3.4 Development vulnerability

TAN15 assigns one of three flood risk vulnerability classifications to development. These are emergency services, highly vulnerable development, and less vulnerable development as shown in Table 3-1 below.

Table 3-1 Development categories defined by TAN15

Development category	Types
Emergency services	Hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and building used to provide emergency shelter in time of flood.
Highly vulnerable development	All residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable development (e.g. power stations, chemical plants, incinerators), and waste disposal sites.
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites.

TAN15 typically addresses the development of property as reflected in the three vulnerability classifications. The aim of the proposed engineering development works covered by this FCA are to provide flood mitigation to the coastline communities at Kinmel Bay. Therefore, the proposed engineering works do not fall into any of the three stated vulnerability categories.

However, this situation is recognised by paragraph 5.3 of TAN-15, which covers exceptions to the three vulnerability classifications, by virtue of their nature:

5.3 There are uses which are considered to be exceptions to the general rule, and have not been classified above, because they are required in fluvial, tidal, or coastal location by virtue of their nature. These include boatyards, marinas, essential works required at mooring basins, and development associated with canals. They will not be subject to the first part of the justification test in section 6 but will be subject to the acceptability of consequences part of the test as outlined in section 7 and the requirements of Appendix 1. Further consideration is given to minor development in section 11.

Clearly, the very nature of flood defences is such that they must be located in areas of flood risk, and therefore this FCA adopts the guidance of paragraph 5.3. Consequently, the Justification Tests have not been applied to the scheme, but the 'acceptability of consequences' has been thoroughly considered in line with TAN-15.

This situation is more clearly addressed in the new TAN-15, which specifically includes a new development vulnerability category for 'water compatible development'. The description of water compatible development includes 'Flood defences and management infrastructure'.

4 Flood risk assessment

This section assesses the risk to the proposed flood defence scheme from all sources of flooding, the risk of increasing flooding to others, and how flood risks can be managed. The primary objective of this FCA is to assess the scheme against the Acceptability Criteria of TAN15 (Section 7.3 & Appendix 1).

4.1 Review of existing flood risk data

The latest available information on flood risk at the site, published by NRW is summarised in Table 4-1.

Table 4-1 Summary of flood risk

Source of Flooding	Onsite Presence	Description
Fluvial	✓	The far eastern corner of the site is located in an area at high risk of fluvial flooding. The majority of the site is at very low risk of fluvial flooding.
Tidal	✓	The site is located in an area at risk of tidal flooding.
Surface water and small watercourses	✗	The site has a very low risk of surface water flooding.
Groundwater	✗	The site has a low risk of flooding from groundwater.
Reservoirs	✓	The site is considered to be at risk of flooding from reservoirs.
Sewers	✗	The site has a low risk of flooding from sewers.

4.2 Historical flooding

Kinmel Bay has an extensive history of coastal flooding. NRW recorded flood extents and the Conwy County Borough Council (CCBC) Local Flood Risk Management Strategy (LFRMS) were consulted to identify significant flood events across the area.

The recorded flood history includes the following notable events:

- In January 1964 a storm event resulted in significant overtopping of the coastal defences at Kinmel Bay.
- A storm event in February 1990 resulted in the sea defences being breached over a 400m section at Towyn, with a storm surge of 1.5m above the predicted high tide. The breach caused 10km² of land at Towyn and Kinmel Bay to be flooded, affecting nearly 2800 properties, and leaving nearly 6000 people temporarily displaced¹. The event is predicted to have had a return period greater than 1 in 200 resulted in the operational failure and breach of defences at Kinmel Bay. The NRW flood extent for this event is shown in Figure 4-1.
- At Kinmel Bay in 1998 high tides were reported to have caused water to spill over onto the slipway, down Foryd Road and resulted in flooding of the properties on Aber Clwyd.
- Tidal flooding in December 2013 as a result of overtopping of defences caused the flooding of 155 residential and 5 commercial properties, 6 of which were internally

¹ Conwy County Borough Council Local Flood Risk Management Strategy: <https://www.conwy.gov.uk/en/Resident/Crime-and-emergencies/Preparing-for-Emergencies/Flooding/documents/Conwy-Local-Flood-Risk-Management.pdf>
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flooded. It was stated that there was a gap present in the secondary defence at Woodside Avenue, as well as a flood gate failure at St Asaph Avenue.

The LFRMS summarises the Catchment Flood Management Plan (CFMP) for the Conwy and Clwyd catchment. It identifies that the highest risk of flooding to the county is the risk of tidal flooding at Kinmel Bay, in combination with flows from the River Clwyd. Climate change is projected to substantially increase flood risk to the area. The CFMP recommends that further action is taken to reduce flood risk in Kinmel Bay.

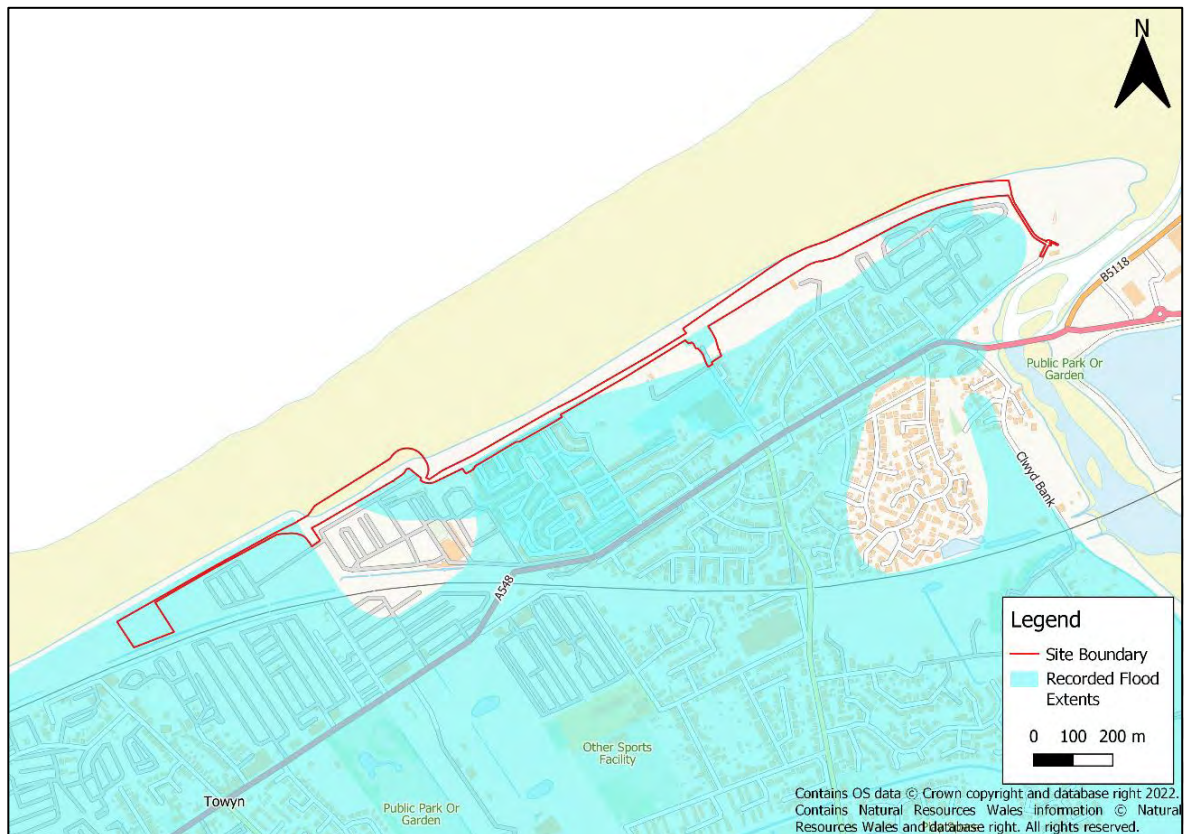


Figure 4-1 NRW Recorded flood extents

4.3 Fluvial flood risk

The NRW Flood Risk Assessment Wales (FRAW) data indicates that the site is predominantly at very low risk of flooding from rivers, as shown in Figure 4-2. This means that there is a less than 0.1% AEP chance of flooding in any given year.

An area of high fluvial flood risk encroaches into the south-eastern extent of the red line boundary. This means that there is a greater than 1 in 30 (>3.3% AEP) chance of flooding from fluvial sources in any given year. Proposed works to this area comprise public realm improvements to increase the width of the existing footpath. It is not envisaged that these works will have any impact of fluvial flood risk to the area and are water compatible in their nature.

Fluvial flood risk across the wider Kinmel Bay area is also shown to be very low, with an area of high fluvial flood risk, associated with the River Clwyd, generally confined to the river channel and immediate river corridor.

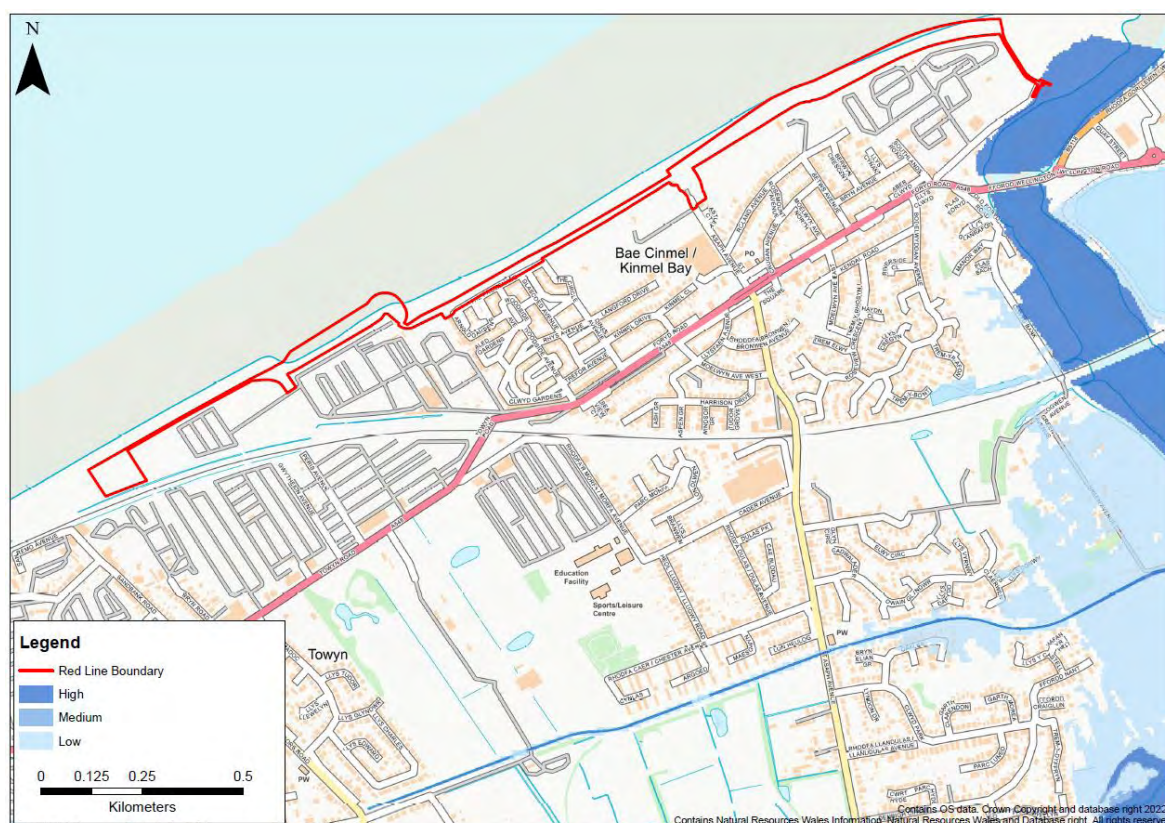


Figure 4-2 FRAW – Risk of flooding from Rivers

4.4 Tidal flood risk

The NRW FRAW data, as shown in Figure 4-3, indicates that a large proportion of the red line boundary area is at high risk of tidal flooding. This means that there is a greater than 1 in 30 (>3.3% AEP) risk of flooding from the sea.

A proportion of the site is at low risk of tidal flooding, meaning there is between a 1 in 1000 and 1 in 200 (0.1% and 0.5% AEP) chance of flooding. The remainder of the site is at very low risk of tidal flooding.

The wider Kinnel Bay area presently (without climate change) has a low risk of tidal flooding. To gain a better understanding of the flood risk associated with tidal flooding, further assessment of the tidal flood risk has been undertaken and is discussed in Chapter 5.

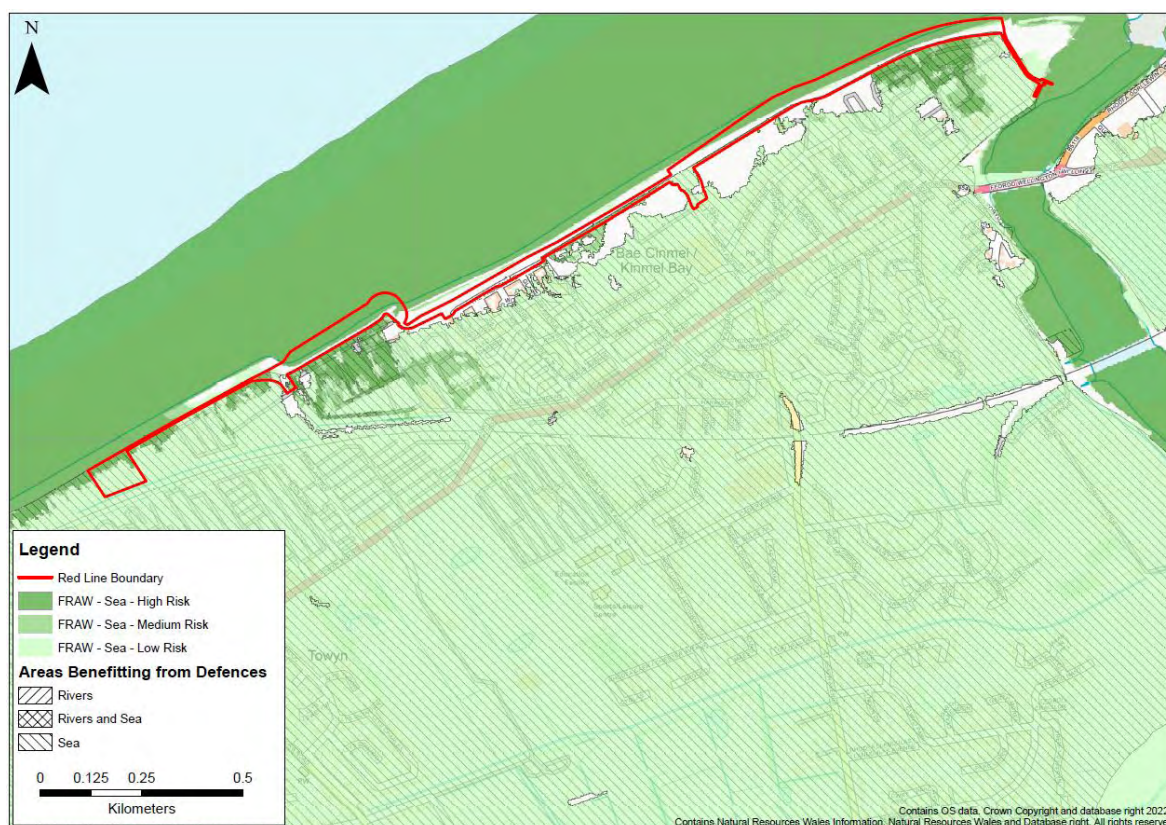


Figure 4-3 NRW FRAW - Flood risk from the Sea

4.5 Surface water and small watercourse flood risk

The NRW FRAW map showing the risk of flooding from Surface Water and Small Watercourses shows that the site is at very low risk of flooding, as presented in Figure 4-4. This means that there is a less than 0.1% AEP chance of flooding in any given year.

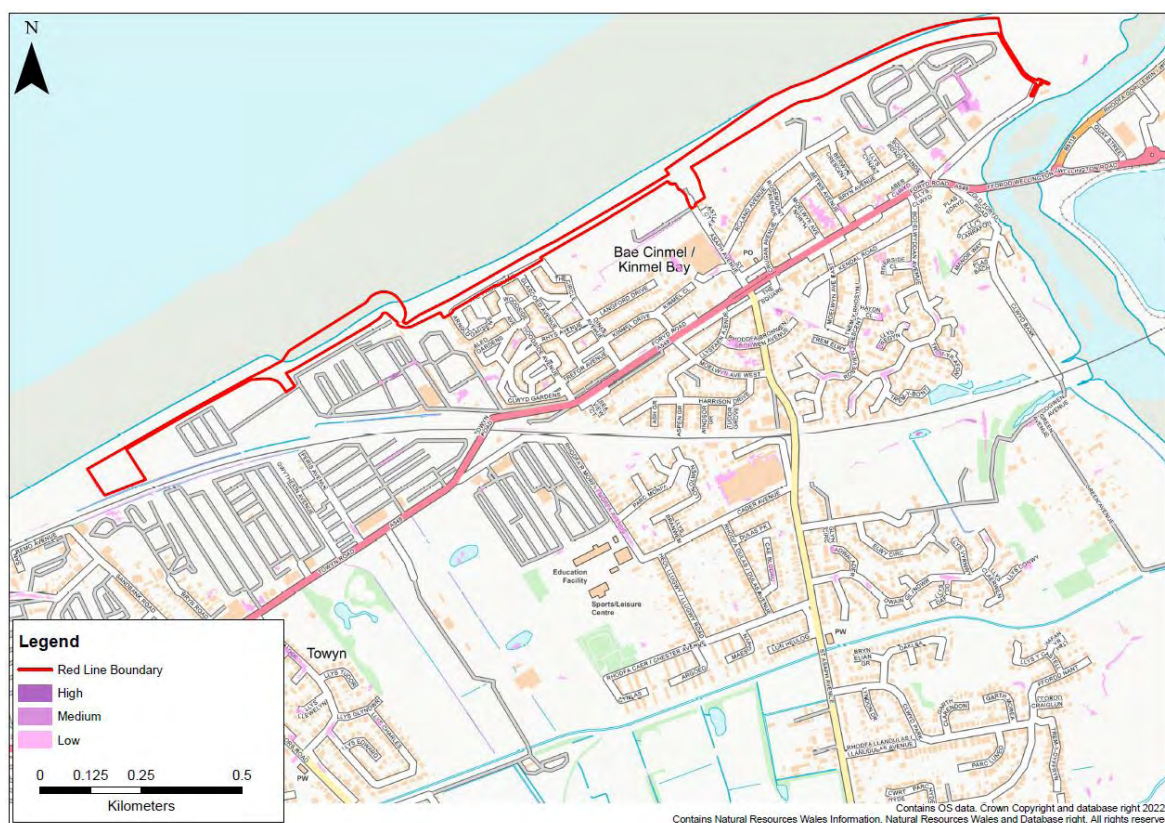


Figure 4-4 NRW FRAW – Risk of flooding from Surface Water and Small Watercourses

4.6 Groundwater flood risk

Groundwater flooding occurs when the level of groundwater increases and rises above the level of the ground causing flooding. It occurs as excess water, which occurs after heavy rainfall, emerges at the ground surface or within manmade structures such as basements, groundwater flooding tends to be more persistent than surface water flooding, in some cases lasting for weeks or months, and can result in damage to property. The risk of groundwater flooding depends on the nature of the geological strata underlying the site and the local topography.

The Conwy Council Flood Risk Management Plan states “flooding attributed directly to groundwater is extremely difficult to apportion as groundwater flooding usually occurs in combination with pluvial and fluvial flooding... As such historical records relating to groundwater flooding within Conwy Council are limited”.

Soils are likely to be comprised of sand and gravels. This combined with an underlying geology of sandstone and marine beach deposits allows for the movement of groundwater.

However, given the nature of the proposals, it is not envisaged that the proposed development would have a detrimental effect on groundwater levels in the area.

It can therefore be concluded that the risk of groundwater flooding at the site is low.

4.7 Reservoir flood risk

NRW flood maps indicate that a small area in the west of the proposed development site, proposed for public realm works of footpath widening, is at risk of flooding as a result of reservoir failure, as shown in Figure 4-5. The flood extent is derived from the potential failure of the Llyn Aled reservoir.

The heavily regulated nature of statutory reservoirs means that the probability of reservoir failure is extremely low. It is therefore reasonable to conclude that the risk of reservoir failure at the site is very low.



Figure 4-5 NRW FRAW – Flood risk from Reservoirs

4.8 Sewer flood risk

The Conwy Council Local Flood Risk Management Plan does not identify any significant incidents of flooding associated with nearby sewers to the site.

5 Detailed assessment of tidal flood risk

Unsurprisingly, tidal flood risk has been identified as the most significant source of flood risk to the site and surrounding communities. Consequently, a more detailed assessment of this flood risk source has been carried out and is reported in the following section.

5.1 Modelling undertaken

In order to assess the risk of coastal flooding to Kinmel Bay and to prepare designs for the scheme, JBA Consulting have undertaken detailed flood modelling of the area. The TUFLOW model used at the Outline Business Case (OBC) stage has provided the basis for the detailed design stage modelling.

The modelling accounts for flood inundation through wave overtopping and extreme sea levels. Due to the raised nature of the frontage the main driver for flood risk is through wave overtopping.

The OBC TUFLOW flood model used for this study was developed from that used by Wallingford HydroSolutions and HR Wallingford. The modelling study for the detailed design has utilised the existing model geometry and updated the boundary conditions where required.

Full technical details of flood modelling are contained within the associated model report, contained in Appendix A. A summary of the model updates is below:

- The model domain has been refined to contain only the Coastal Management Units (CMUs) identified at risk;
- Reduction of cell size to 4m to allow for more detail of flow paths to be identified;
- Modelling epochs of 2021, 2041 and 2121 have been used;
- Estimates of sea level rise with climate change have been applied in line with NRW's 2021 guidance², utilising the regional 70th percentile to inform design levels;
- The offshore boundary is forced by an extreme tidal (still water level) boundary. This follows the Environment Agency Coastal Flood Boundary (CFB) method and has been updated from the OBC model to use the latest datasets and guidance released;
- The model alters the offshore model domain, and that along the River Clwyd, to improve behaviour of the still water level boundary;
- Updated baseline overtopping rates to account for the altered distribution of overtopping inflow sections. Overall, these are reduced from the OBC stage and represent a defended scenario, meaning baseline flood risk is updated;
- Following on from the above, no failure of defences is represented; and
- The design stage represents the scheme using a combination of updated overtopping rates and model topography.

The results of this modelling have been used to assess the present and future flood risk to and from the development.

It should be noted that, in line with best practice, wave overtopping volumes are applied to the TUFLOW model behind the line of the existing flood defences. Consequently, the flood risk immediately in front of the defences can be under reported, as is the case for the much of the red line boundary. In other areas the red line boundary extends to cover areas of the foreshore, which will be inundated under normal tidal conditions.

² Climate change allowances and flood consequence assessments, September 2021: https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf
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5.2 Baseline flood risk

5.2.1 2021 Epoch (present day risk)

0.5 % AEP Event

Figure 5-1 shows that the red line boundary area is predicted to partially flood during the 2021 0.5% AEP event.

The red line boundary covers areas of the foreshore, along with the immediate vicinity of the existing and proposed defences. Areas along the foreshore, as expected, are inundated in this design event (and for all subsequent design events). Behind the line of the existing defence, predicted flood depths are shallow with depths of 0.2m to 0.5m predicted.

The settlement of Kinnel Bay is predicted to experience widespread flooding, predominantly to depths of between 0.2m and 1.0m during the 2021 0.5% AEP event, with some small, localised areas reaching depths greater than 1.5m. The approximate maximum depth behind the coastal defences is 1.52m within the existing caravan site accessed via Horton Nose Lane. The flood extent reaches the Ffynnon Y Ddod which is approximately 1.3Km to the south of the proposed scheme.

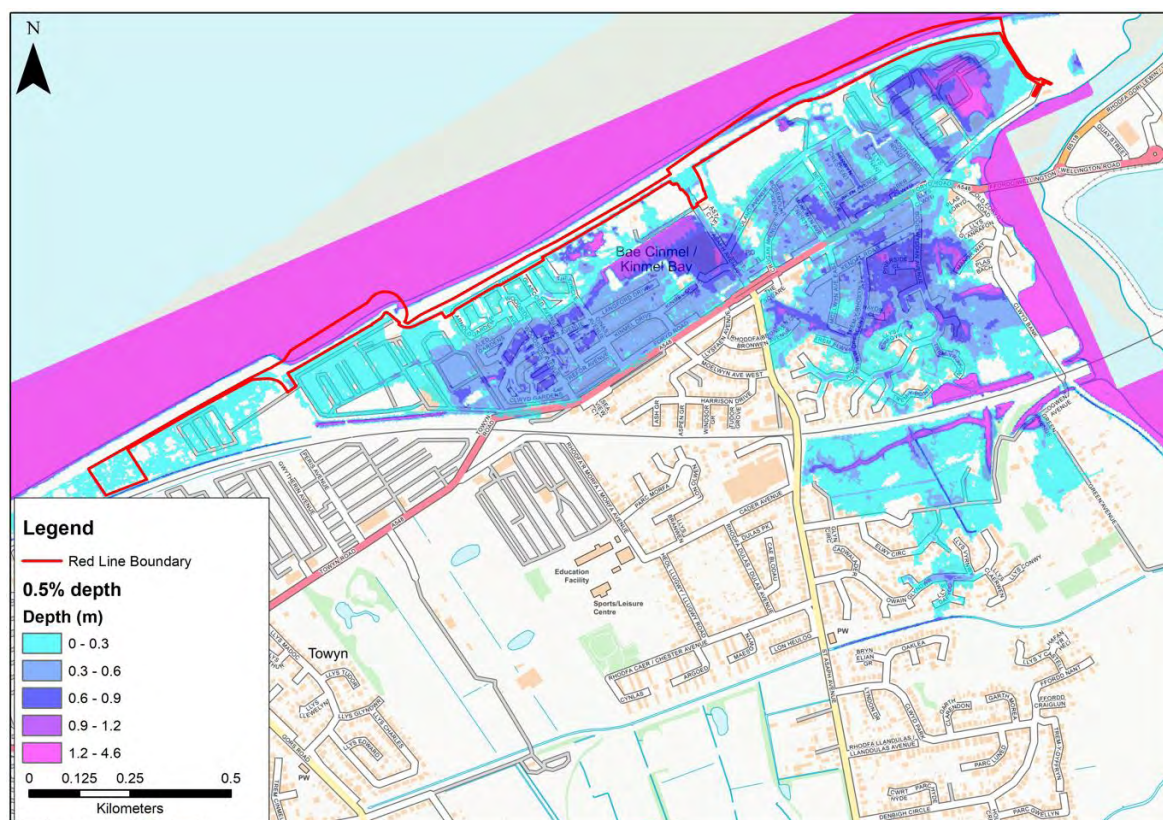


Figure 5-1 2021 0.5% AEP tidal flood event - depth

0.1 % AEP Event

Figure 5-2 shows the predicted flood depths for the 2021 0.1% AEP event.

Within the red line boundary, behind the line of defences flood depths are generally in the region of 0.3m, with maximum depths predicted to be approximately 0.4m.

During the 0.1% AEP event the extent of flooding to the settlement of Kinnel Bay is shown to be greater than the 0.5% AEP event, covering a widespread area as far as the River Gele which is approximately 2Km to the south of the site.

Flood depths to the caravan site accessed from Horton Nose Lane are predicted to be greater, with a large expanse of residential area forecast to flood up to 1.0m, along with commercial development to the north of Langford Drive, and the caravan site in the north east which are predicted to flood over 1.0m, with some localised areas reaching greater depths than 1.5m.

The residential area to the south of the A548 / west of St Asaph Avenue is predicted to flood to depths of between 0.2m-1.0m, with the greatest depths closest to St Asaphs Avenue.

To the west of St Asaph Avenue flood depths are predicted to flood predominantly between 0.5m and 1.0m.

The 0.1% AEP flooding extends south of the railway line to the River Gele, covering greenfield land and further residential development. Depths in this southern extent of the Kinnel Bay area are predicted to predominantly be between 0.2m-0.5m, with the greatest depths reaching over 1.5m where greenfield land is located.

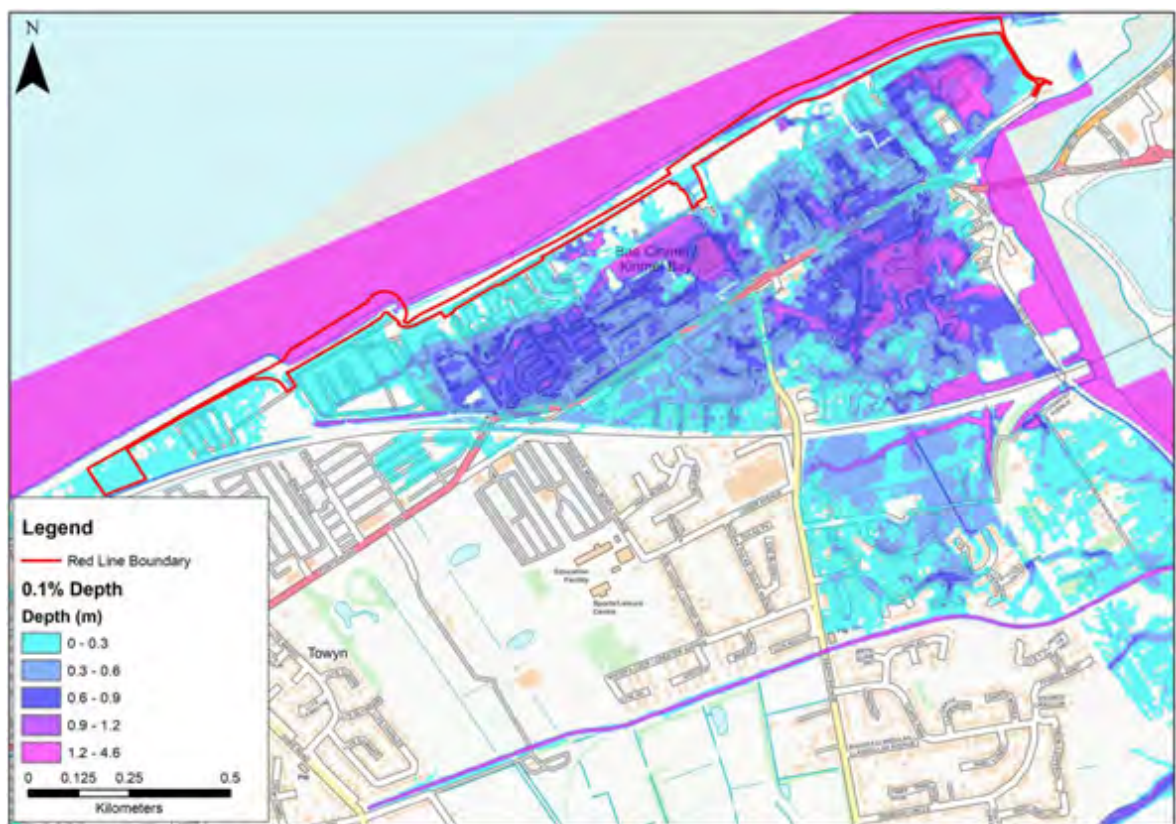


Figure 5-2 2021 0.1% AEP tidal flood event - depth

5.2.2 2121 Epoch (future risk)

0.5 % AEP Event

As per the 2021 design events, the foreshore is inundated with tidal waters during the 2121 0.5% AEP event, as shown in Figure 5-3. Behind the line of defence, flood depths are greater than in the 2021 event, with depths of up to 0.7m predicted.

Tidal flooding during this event is extensive across the settlement of Kinnel Bay with many residential and commercial areas north of the railway line predicted to flood to depths of greater than 1.5m. South of the railway line flood depths are predominantly between 0.5m-1.5m, with localised areas predicted to flood to greater depths than 1.5m.

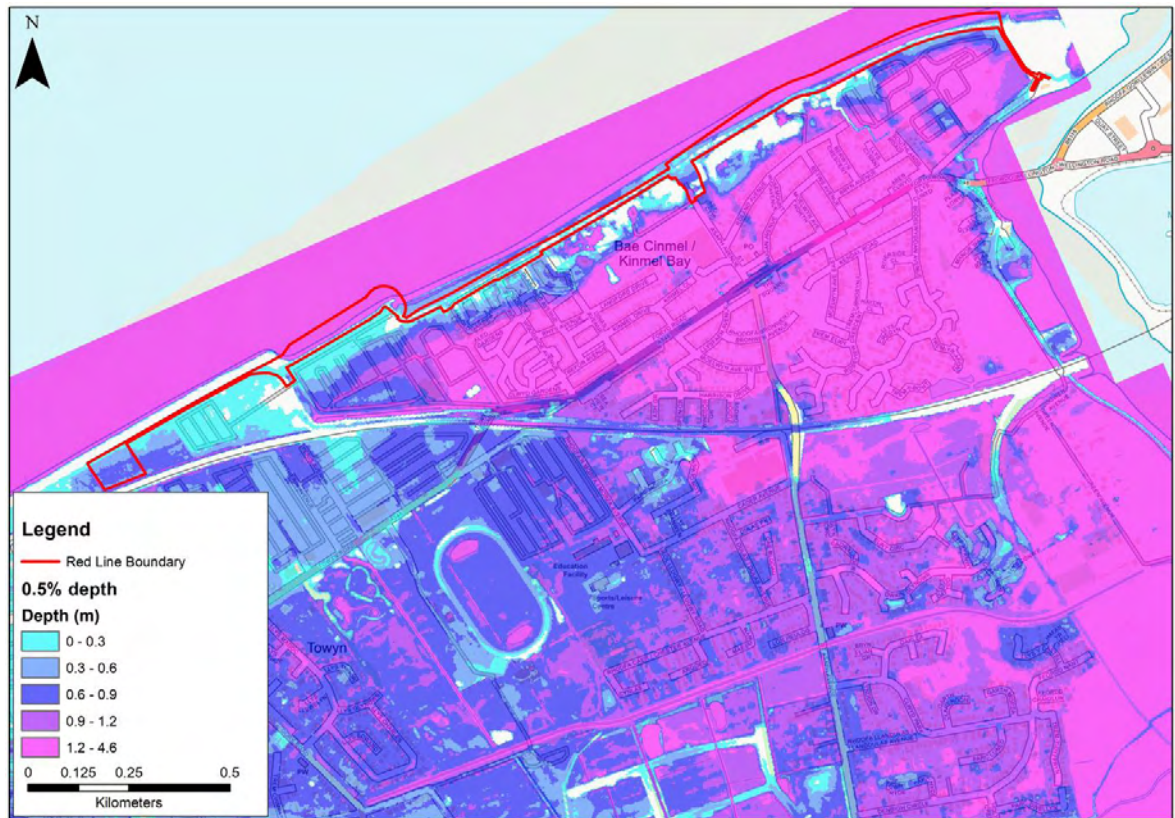


Figure 5-3 2121 0.5% AEP tidal flood event - depth

0.1 % AEP Event

In the 2121 0.1% AEP event, tidal flooding is predicted to impact a greater area behind the line of defence, as shown in Figure 5-4. Along the promenade, flood depths of up to 0.3m are predicted, whilst areas of car parking are predicted to flood to greater depths.

Flood depths across Kinnel Bay are extensive, with the majority of the settlement predicted to flood to depths greater than 1.5m.

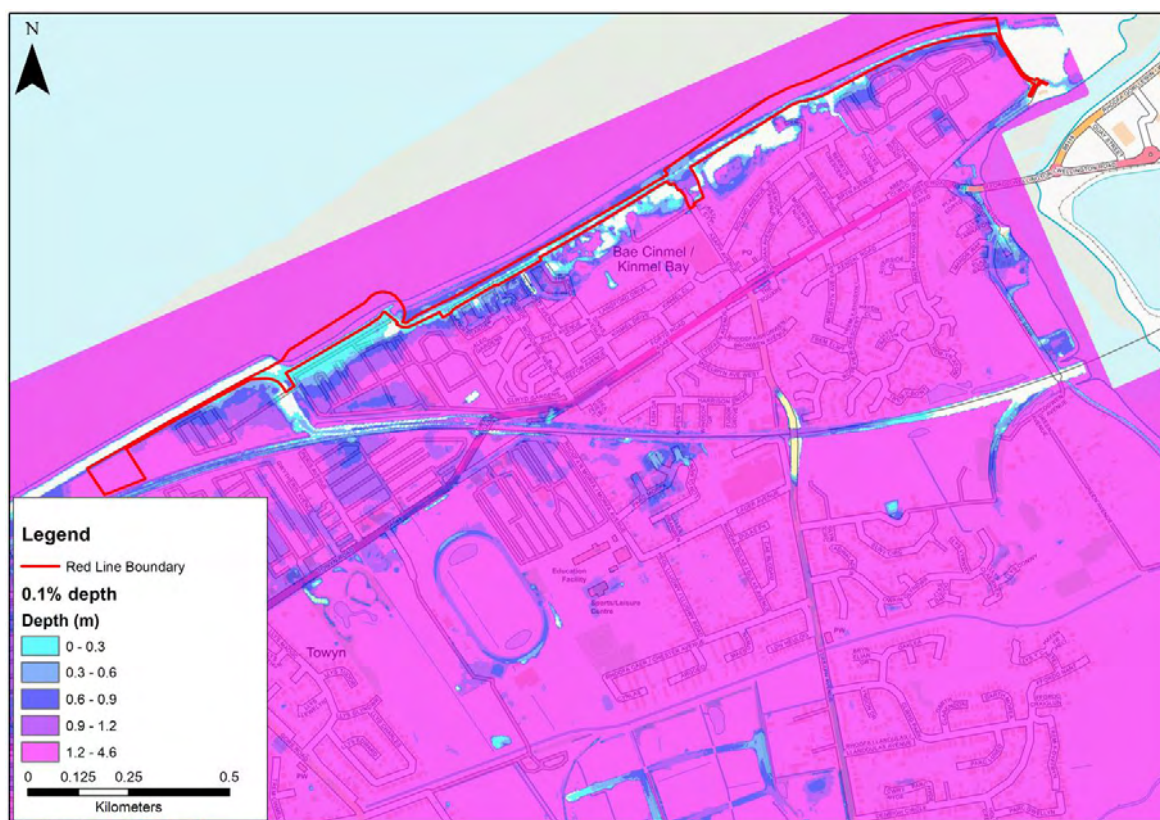


Figure 5-4 2121 0.1% AEP tidal flood event - depth

5.3 Post-development

5.3.1 2021 Epoch (present day risk)

0.5 % AEP Event

In the post-development scenario, the flood extent within the red line boundary area remains relatively unaltered. The foreshore remains inundated with tidal waters, and flood depths immediately south of the proposed defences reducing by up to 0.1m when compared to the baseline scenario.

Figure 5-5 shows that the proposed coastal defence scheme significantly reduces the risk of tidal flooding to the wider Kinmel Bay settlement in the 2021 0.5% AEP event. Flood water is present in residential and commercial development to the north of the A458 with flood depths predominantly predicted to be between 0.2m-0.5m. There are some small, localised areas in the commercial development and caravan park that are predicted to experience flood depths of up to 1.0m.

No flooding is predicted south of the A458.

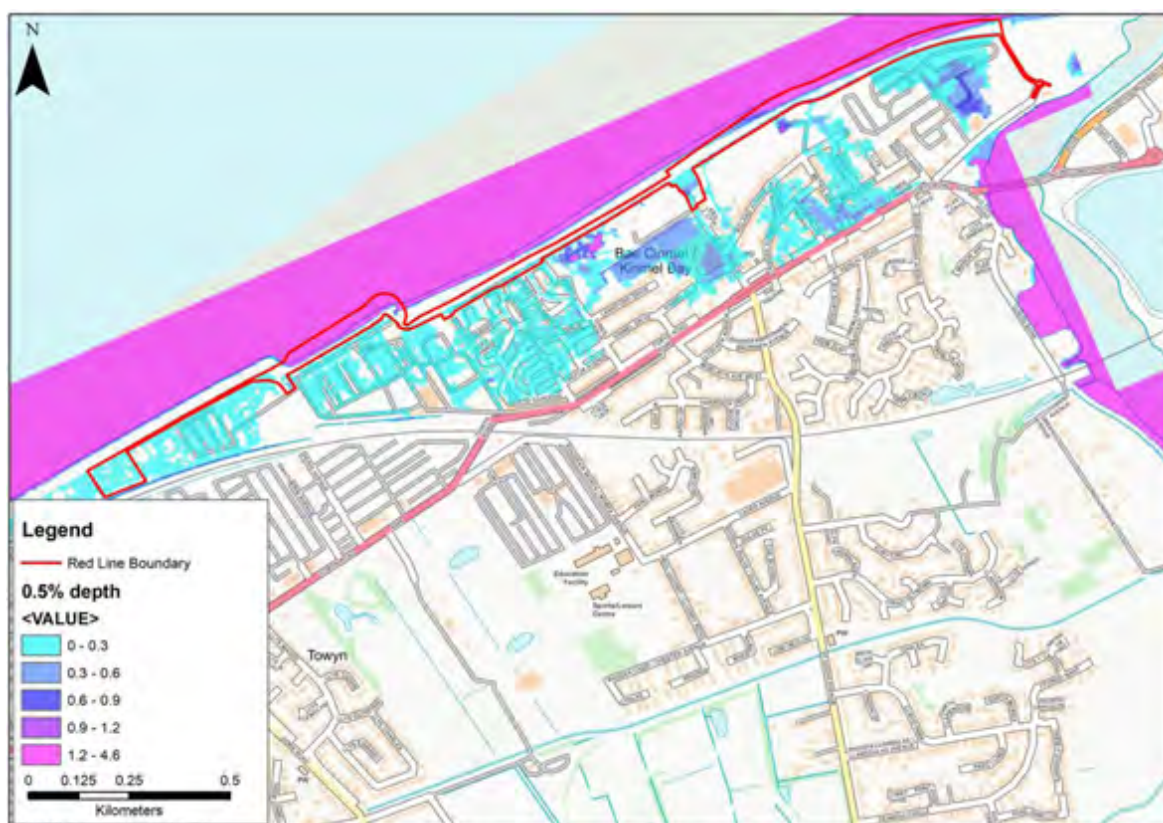


Figure 5-5 2021 0.5% AEP tidal flood event depth - post development

0.1 % AEP Event

In the post-development scenario, flood extents within the red line boundary area remain relatively unaltered when compared with the baseline scenario. A small reduction of flood depth of up to 0.1m is predicted to the immediate south of the line of defences.

Figure 5-6 shows that the proposed flood defence scheme significantly reduces flooding in residential areas to the south of the A548. Areas at risk of flooding within this area are located near to Clwyd Bank and are predicted to flood to depths of predominantly 0.2m-0.5m, with some localised areas projected to reach up to 1.0m.

The residential areas south of the A548 / west of St Asaph Avenue are predicted to be flood free during this scenario, along with areas south of the railway line.

Flood depths to the north of the A548 are reduced as a result of the proposed flood defence scheme and are projected to reach 0.2m-0.5m. Some small, localised areas are predicted to flood to depths of up to 1.0m in this area of Kinmel Bay.

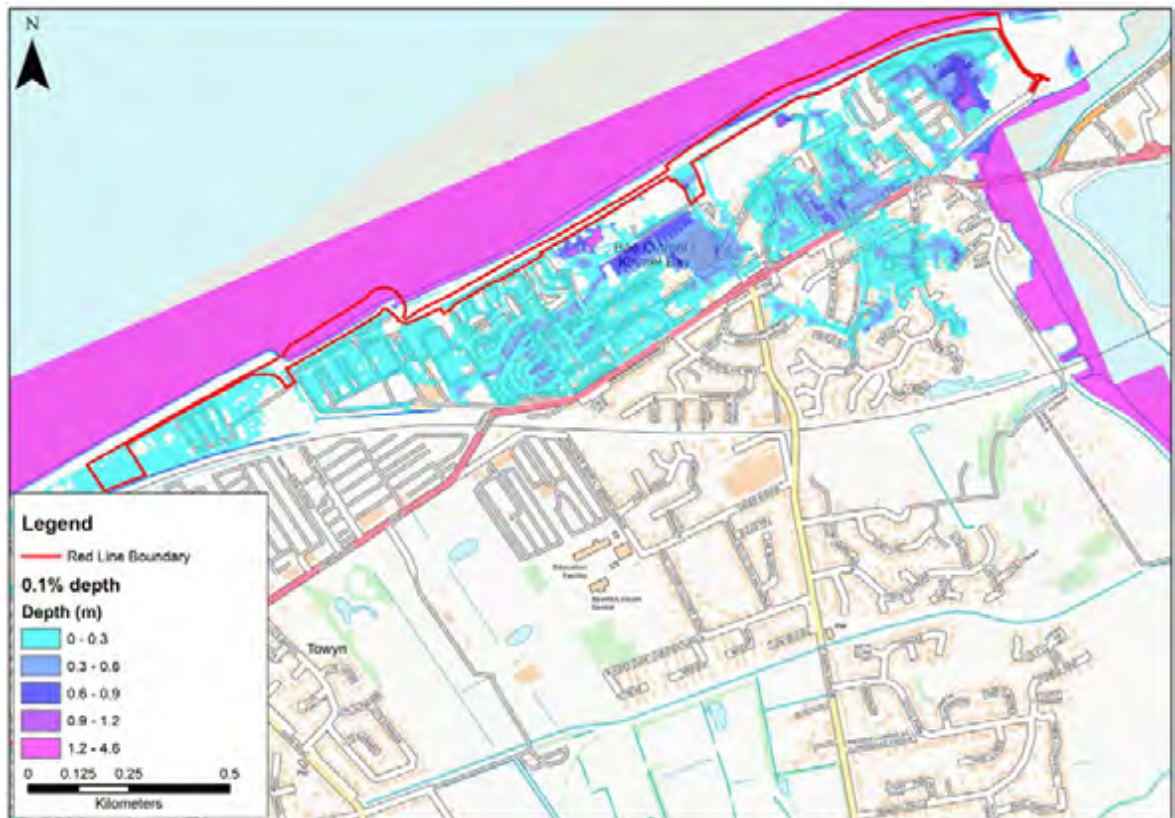


Figure 5-6 2021 0.1% AEP tidal flood event depth - post development

5.3.2 2121 Epoch (future risk)

0.5 % AEP Event

Within the red line boundary, the flood extent remains unchanged when compared to the baseline scenario.

Figure 5-7 shows that flood depths across the settlement of Kinmel Bay as a result of the flood defence scheme are reduced.

Flood depths north of the A548 are reduced significantly during the 0.5% AEP event. Residential development in this area is predominantly predicted to flood to depths of 1.0m-1.5m, where it was previously predicted to flood to depths greater than 1.5m in the baseline scenario. North of the railway line flood depths are predicted to be greater than 1.5m.

The flood extent south of the A548 is not predicted to change as a result of the proposal. However, flood depths are generally predicted to decrease by up to 300mm across the wider area.



Figure 5-7 2121 0.5% AEP tidal flood event depth - post development

0.1 % AEP Event

Within the red line boundary, the flood extent remains unchanged when compared to the baseline scenario.

There is a reduction in flood depths to the wider settlement of Kinnel Bay as a result of the proposed flood defence scheme during the 2121 0.1% AEP event, as shown in Figure 5-8. Although across the settlement flood depths remain greater than 1.5m in many areas, flood depths are generally predicted to be reduced by up to 300mm when compared to the baseline scenario.

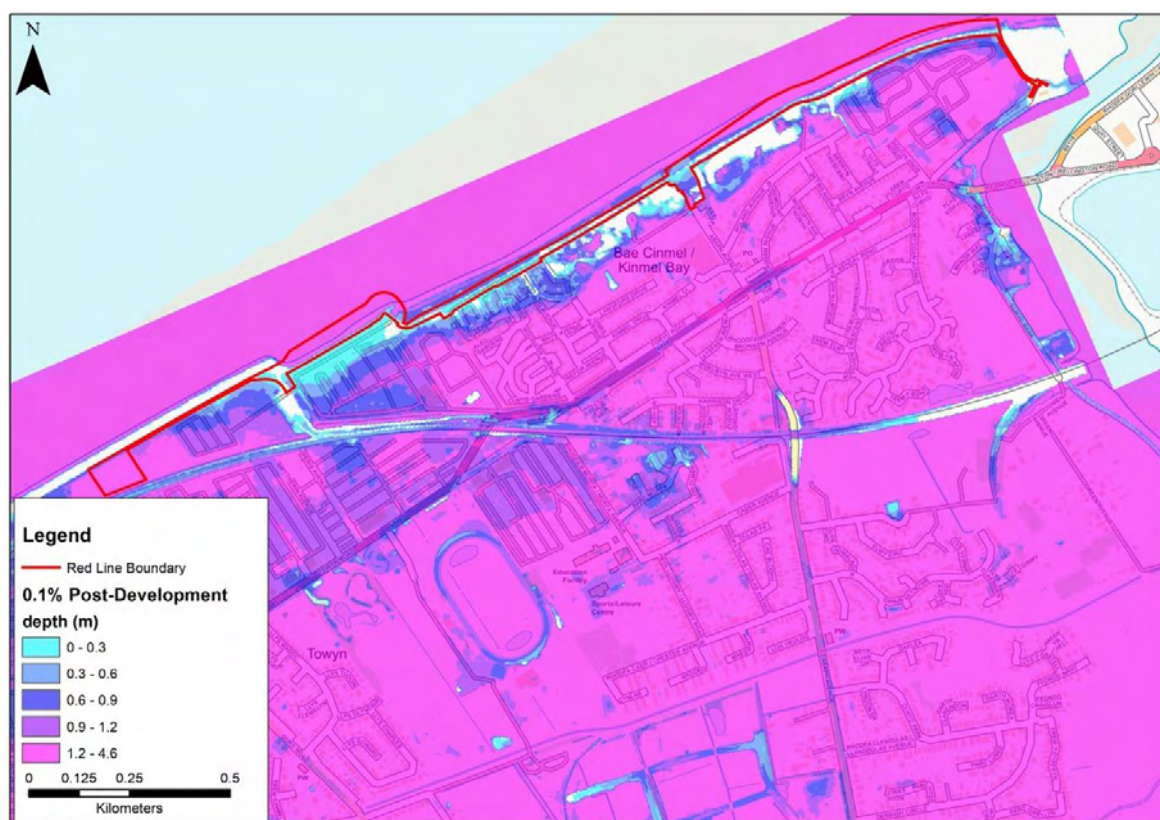


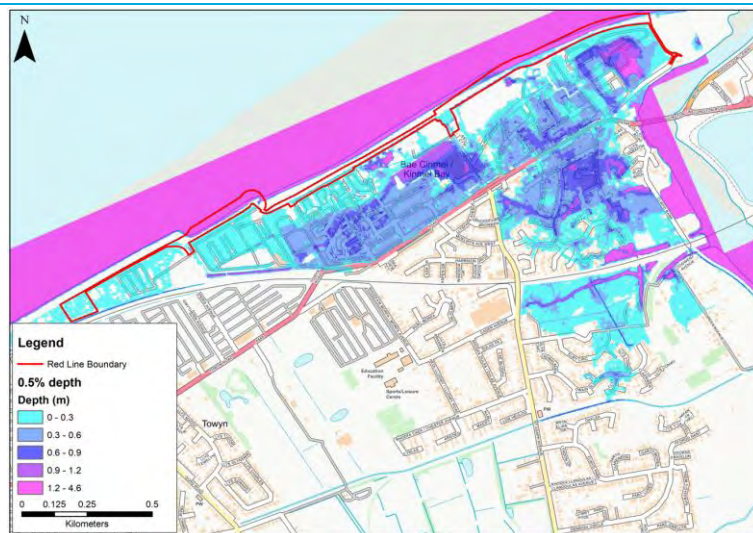
Figure 5-8 2121 0.1% AEP tidal flood event depth - post development

5.4 Scheme benefits

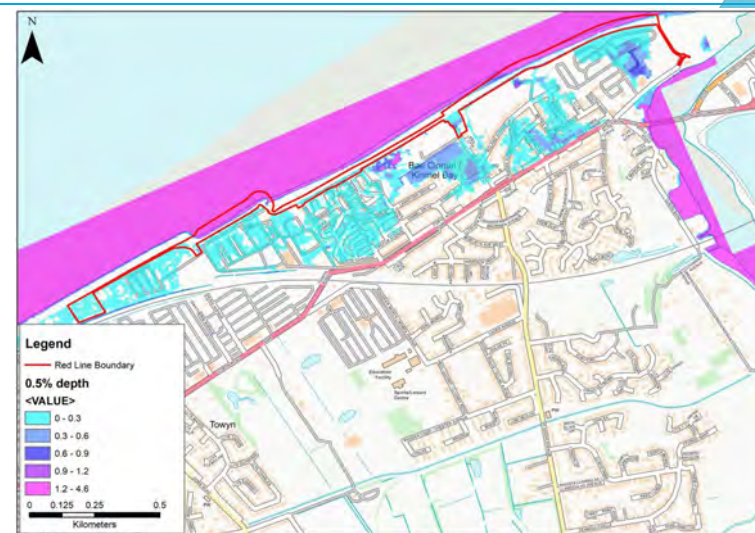
The above results clearly demonstrate the benefits of the proposed defence scheme for the wider Kinmel Bay area. This is evidenced from the greatly reduced predicted flood extents during the post-development 2021 design events. For clarity a comparison of these results is presented side-by-side in Figure 5-9.

Critically, the proposed coastal defences are designed to mitigate tidal flood risk to the Kinmel Bay area for the medium term, with a view to managing flood risk to 2041. It is recognised that further future works shall be required to address the increasing and long-term risks of tidal flood risk to the Kinmel Bay. For this, work is ongoing in the development of a long-term adaptive strategy for tidal flood risk management.

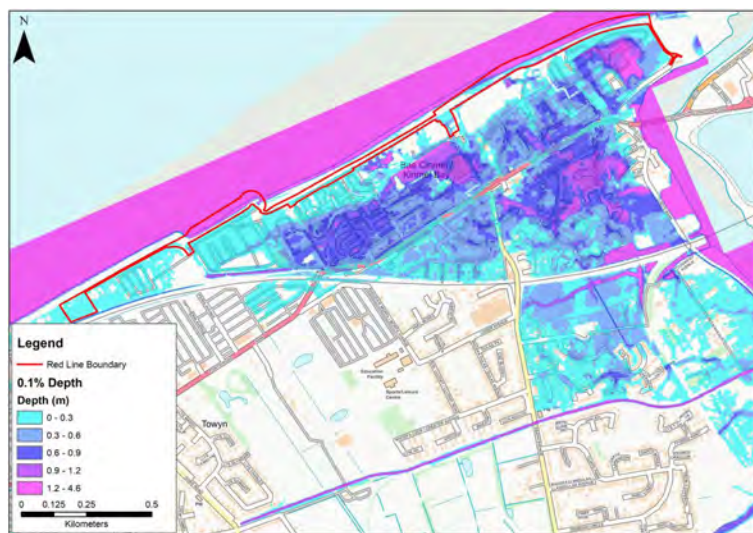
Figure 5-10 demonstrates the reduction in predicted flood extent across the Kinmel Bay area in the 2041 0.5% AEP event.



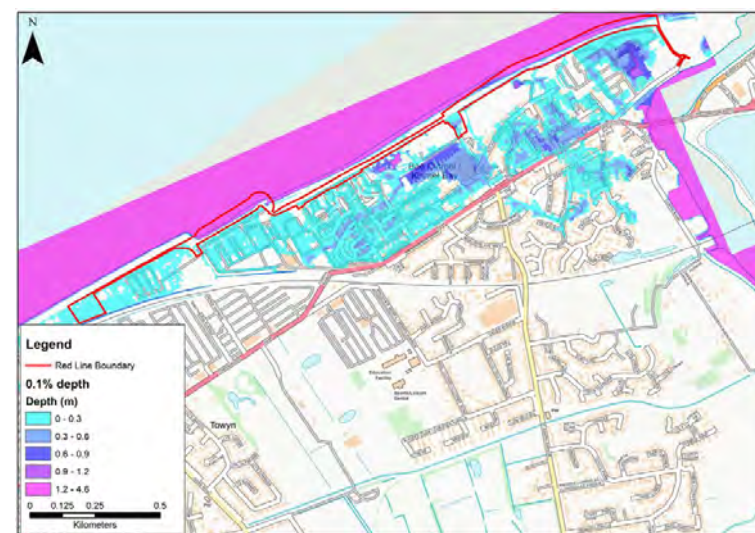
2021 0.5% AEP Baseline Flood Extent



2021 0.5% AEP Post-Development Flood Extent

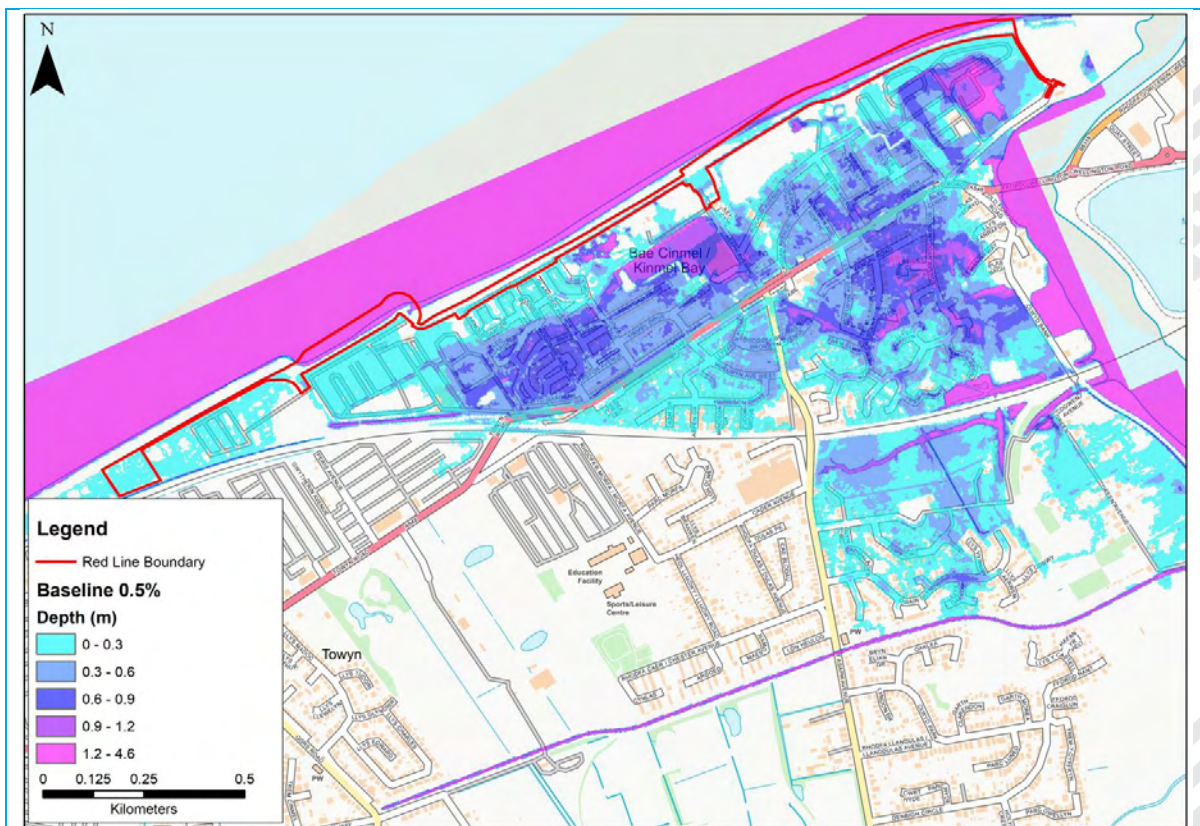


2021 0.1% AEP Baseline Flood Extent

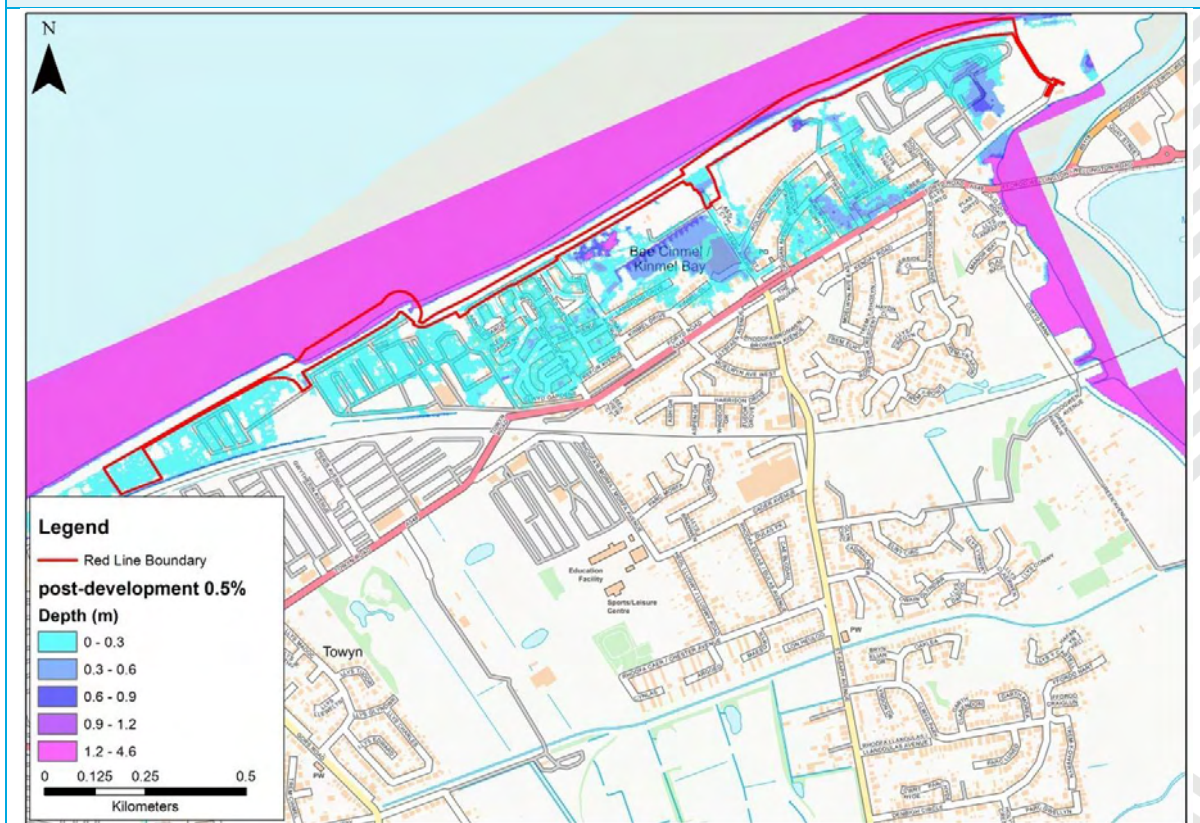


2021 0.1% AEP Post-Development Flood Extent

Figure 5-9 Comparison of Flood Extents for the 2021 Design Events



2021 0.5% AEP Baseline Flood Extent



2021 0.5% AEP Post-Development Flood Extent

Figure 5-10 2041 0.5% AEP Event Flood Extent Comparison

5.4.1 Third party impacts

Section 7.3 of TAN15 requires the demonstration that a proposed development will have minimal impact on flood risk generally (third parties). The construction of flood defences, whilst clearly for the benefit of the community, have the potential to disrupt flow paths, cause displacement of flood water, or a combination of both. Therefore, to assess this risk and determine the impact of predicted flood depths, comparisons of pre- and post-development flood water depths were undertaken in line with NRW guidance.

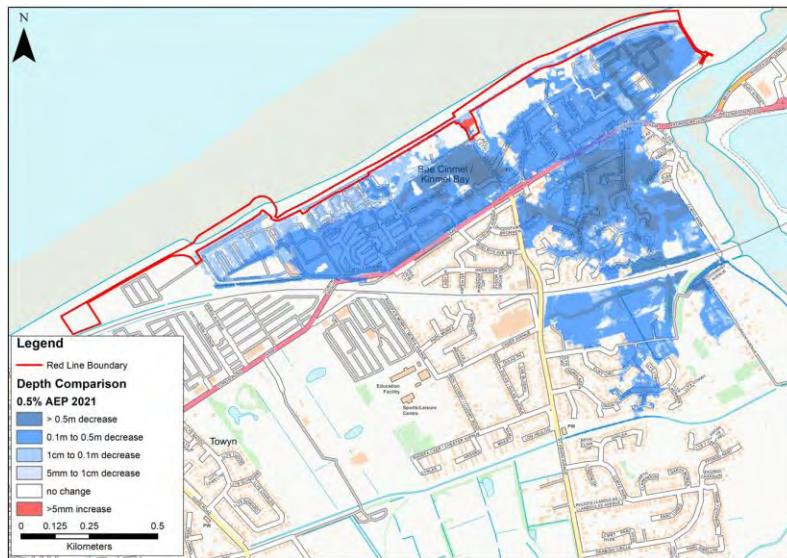
Figure 5-11 presents the depth comparison grids for the 2021 and 2121 0.5% and 0.1% AEP events. In all design events, it is demonstrated that there is a decrease in flood depths across the Kinmel Bay area as a result of the proposals, clearly demonstrating the benefits of the scheme on a flood risk basis.

During the 2021 0.5% AEP event, flood depths generally decrease by up to 0.5m. The Kendal Road area sees a decrease of approximately 650 - 800mm whilst flood depths to the caravan park accessed from Horton Nose Lane are predicted to decrease 650mm. An increase in flood depth is seen within the red line boundary within a car park accessed from St Asaph Avenue. At this location, flood depths are predicted to increase by 94mm for this design event. This area is owned by the Client and the increase in flood depth is fully accepted as a consequence of the proposals by the landowner.

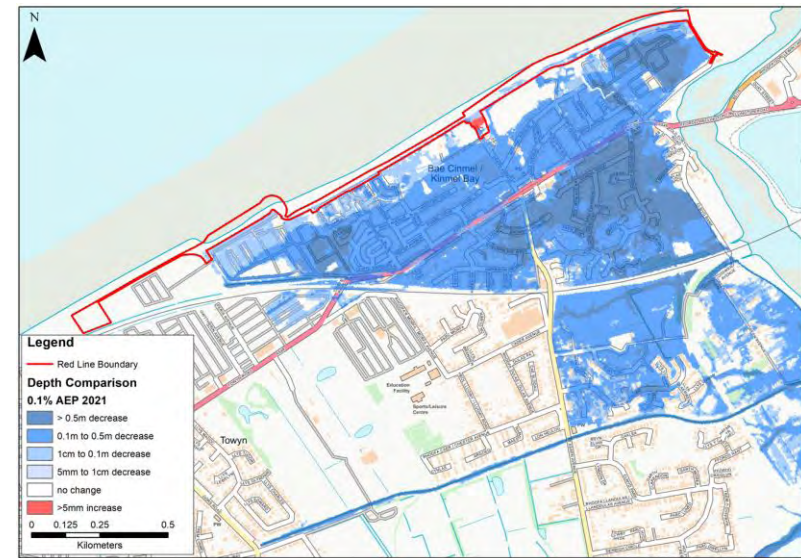
During the 2021 0.1% AEP event, flood depths generally decrease by up to 0.5m. The Kendal Road area sees a decrease of approximately 750mm whilst flood depths to the caravan park accessed from Horton Nose Lane are predicted to decrease by 530mm. Flood depths to properties west of St Asaph Avenue are predicted to decrease by 510mm as a result of the scheme. An increase in flood depth is seen within the red line boundary within a car park accessed from St Asaph Avenue. At this location, flood depths are predicted to increase by 60mm for this design event. This area is owned by the Client and the increase in flood depth is fully accepted as a consequence of the proposals by the landowner.

During the 2121 0.5% AEP event, flood depths to the north of the railway line are predicted to decrease by 400-500mm. Flood depths to the north of the railway line are generally predicted to decrease by approximately 200mm. Areas to the south-east of the flood extent are predicted to have decreased depths by 30-60mm. There is no increase in flood depth predicted across the flood extent for this design event.

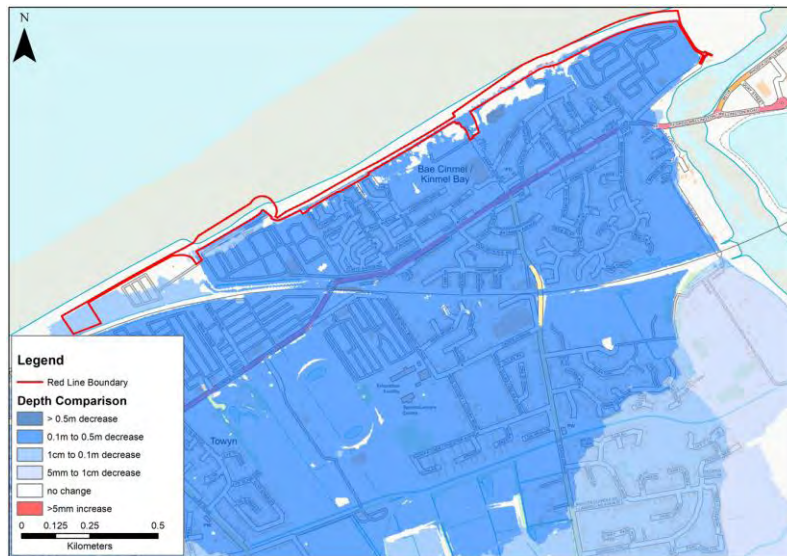
During the 2121 0.1% AEP event, flood depths north of the railway line generally decrease by 100-200mm. South of the railway line, flood depths are predicted to decrease by 75mm. In the Parc Morfa area, flood depths are predicted to decrease by approximately 100-200mm.



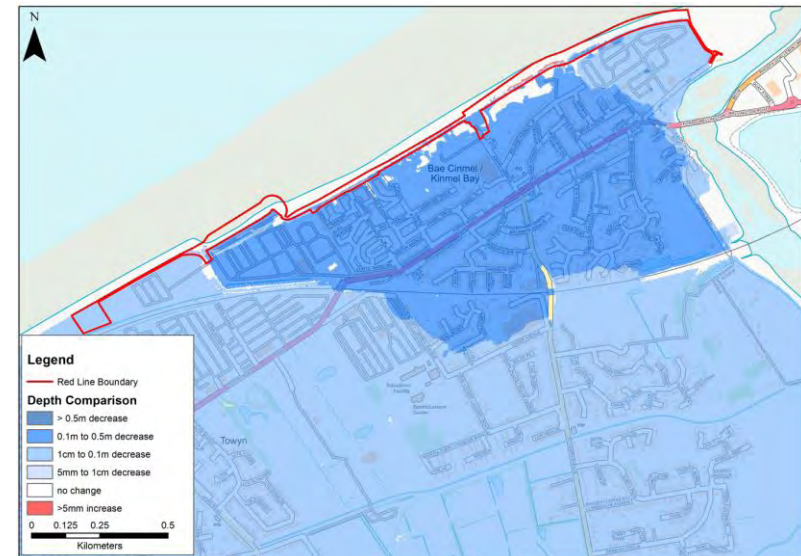
2021 0.5% AEP Event Depth Comparison



2021 0.1% AEP Event Depth Comparison



2121 0.5% AEP Event Depth Comparison



2121 0.1% AEP Event Depth Comparison

Figure 5-11 Depth Comparison Grids

6 Acceptability of consequences

As water compatible development, the development is not subject to the Justification Test. However, it is still subject to the acceptability of consequences. Therefore, an assessment against the acceptability criteria has been carried out for the site and is discussed below in Table 6-1.

Table 6-1 Acceptability Criteria for TAN15

TAN15 Acceptability Criteria	Comments	Satisfied?
Flood defences must be shown by the developer to be structurally adequate particularly under extreme overtopping conditions (i.e. that flood with a probability occurrence of 0.1%).	The proposed flood defences have been designed with a 100yr design life suitable to their exposed environment and allowing for climate change. The proposed flood defence will reduce flood risk to the residential and commercial developments within the Kinmel Bay settlement up to the 0.1% 2121 climate change scenario.	✓
The cost of future maintenance for all new/approved flood mitigation measures, including defences must be accepted by the developer and agreed with NRW.	The proposed flood defence will be maintained by Conwy Council as the Lead Local Flood Authority, in accordance with a Full Business Case.	✓
The developer must ensure that future occupants of development are aware of the flooding risks and consequences.	The nature of the proposed development as a coastal defence means that the red line boundary is required to be at risk of coastal flooding. Conwy Council, as owner of the asset are fully aware of the flood risks.	✓
Effective flood warnings are provided at the site.	The site is covered by the NRW Kinmel Bay flood warning area which covers the community of Kinmel Bay.	✓
Escape/evacuation routes are shown by the developer to be operational under all conditions.	Given the nature of the site, escape/evacuation routes are not required.	N/A
Flood emergency plans and procedures produced by the developer must be in place.	The frequency of flooding to the settlement of Kinmel Bay shall be reduced as a result of the proposals. Operational procedures for the asset will be put in place by Conwy Council as the Lead Local Flood Authority.	✓
The development is designed by the developer to allow the occupier the facility for rapid movement of goods/possessions	The rapid movement of goods and possessions will not be required given the nature of the development.	N/A

to areas away from the flood waters.		
Development is designed to minimise structural damage during a flooding event and is flood proofed to enable it to be returned to its prime use quickly in the aftermath of the flood.	The proposed flood defences have been designed with a 100yr design life suitable to their exposed environment and allowing for climate change.	✓
No flooding elsewhere.	The proposed coastal defence reduces the risk of flooding to the wider Kinmel Bay area.	✓
The development should be designed to be flood free during the 0.5% tidal flood.	The nature of the proposed development as a coastal defence means that the red line boundary is required to be at risk of coastal flooding. Flood risk to the wider Kinmel Bay area is greatly reduced in this design event.	N/A
The development should be designed so that in an extreme (1 in 1000 chance) event there would be less than 600mm of water on access roads and within the property.	The nature of the proposed development as a coastal defence means that the red line boundary is required to be at risk of coastal flooding. Flood risk to the wider Kinmel Bay area is greatly reduced in this design event.	N/A

7 Conclusions

- JBA Consulting were commissioned by Amey Consulting, to support the detailed design of sea defences along the North Wales coastline at Kinmel Bay. This FCA has been prepared in support of the planning application for the proposed coastal defence scheme.
- The site is located in Kinmel Bay, along the North Wales coastline. The site is owned by Conwy Council and is comprised of the existing coastal sea defences at Kinmel Bay.
- A new flood defence scheme consisting of rock armour instalment, embankment and seawall construction, coastal path refurbishment, improved beach access, upgraded car parks, and habitat enhancement, is proposed to be constructed within the proposed site boundary.
- The aim of the proposals is to manage tidal flood risk in the medium term (to 2041) to a 1 in 200 year standard of protection. The scheme will also support future works required to manage longer term tidal flood risk to the Kinmel Bay area. The design life of the structures constructed within these proposals is 100 years.
- The site falls largely within Zone C2 of NRW's Development Advice Maps. Zone C2 is described as "areas of the floodplain without significant flood defence infrastructure". Zone C1 is present in the southern vicinity of the site boundary which is defined as "areas of the floodplain which are developed and served by significant infrastructure, including flood defences". As the development is water compatible flood defence infrastructure, it is not subject to the justification test although it is still necessary to consider the acceptability criteria of TAN15.
- The site is not shown to be at risk of surface water and small watercourse flooding according to the NRW Flood Risk Assessment Wales. The vast majority of the site is not shown to be at fluvial risk of flooding. Flood risk from groundwater is considered to be low.
- A small area of the eastern site boundary is located in an area of high risk of fluvial flooding. Works in this area comprise widening of an existing footpath to improve the public realm. It is not envisaged that these works shall have an impact of fluvial flood risk and the works are water compatible by their nature.
- The site has a high risk of tidal flooding according to the NRW Flood Risk Assessment Wales.
- Detailed flood modelling has been undertaken for the area. The TUFLOW model used at the Outline Business Case (OBC) stage has provided the basis for the detailed design stage modelling. The modelling accounts for flood inundation through wave overtopping and extreme sea levels. Due to the raised nature of the frontage the main driver for flood risk is through wave overtopping.
- It should be noted that, in line with best practice, wave overtopping volumes are applied to the TUFLOW model behind the line of the existing flood defences. Consequently, the flood risk immediately in front of the defences can be under reported, as is the case for the much of the red line boundary. In other areas the red line boundary extends to cover areas of the foreshore, which will be inundated under normal tidal conditions.
- In the baseline scenario, areas within the settlement of Kinmel Bay are at risk during the 2021 0.5% AEP and 0.1% AEP scenarios. In the 2121 0.5% AEP and 0.1% AEP events, a significant area of residential and commercial development in Kinmel Bay are at risk of flooding, with predicted flood depths exceeding 1.5m.
- During the 2021 0.5% AEP and 0.1% AEP post development scenarios, flood extents are significantly reduced by the proposed scheme. During the 2121 design events, flood depths are generally predicted to decrease by up to 300mm.

- Critically, the proposed coastal defences are designed to mitigate tidal flood risk to the Kinmel Bay area for the medium term, with a view to managing flood risk to 2041. It is recognised that further future works shall be required to address the increasing and long-term risks of tidal flood risk to the Kinmel Bay
- There is no detriment to third parties as a result of the proposals.
- The FCA demonstrates that the proposed scheme fully satisfies the acceptability of the consequences criteria.
- As a result of the proposed Kinmel Bay coastal defence scheme, the risk of coastal flooding is reduced across the settlement. It is also hoped that the scheme will support an adaptive strategy of future flood defence improvements to keep pace with rising sea levels and the impacts of climate change.
- It is concluded that the proposed coastal defence scheme complies fully with the policy requirements of Planning Policy Wales and TAN-15.

Appendix A – Model User Report

Offices at

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Doncaster
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Edinburgh
Exeter
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Limerick
Newcastle upon Tyne
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Peterborough
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Tadcaster
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F Cultural Heritage

F.1 Heritage Desk Based Assessment

Llanddulas to Kinmel Bay Coastal Improvement Scheme – Historic Desk-based Assessment

October 2022

AVR-JBAU-00-00-RP-EN-0001-S0-P01_Llandulais_Kinmel

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Revision Ref/Date	Amendments	Issued to
P01.1	Edits to text	Internal
P01.2	Edits to text	Internal
P01.3	Edits to text	Internal
P01.4	Finalised document	Internal

Contract

This report describes work commissioned by Amey Consulting. Dr Dorothy Graves McEwan, Patrick Mayer and Kristian Evans of JBA Consulting carried out this work.

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Principal Archaeology and Heritage Consultant

Purpose

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1 Introduction

This Desk-Based Assessment (DBA) has been prepared by JBA Consulting on behalf Amey Consulting to support the application for the development of coastal improvements between the village of Llanddulas and the seaside resort of Kinmel Bay along the northwest coast of Wales. The application is submitted to Conwy County Borough Council (CCBC) as the determining Planning Authority.

This assessment has been prepared by Dorothy Graves McEwan with contributions by Emily Prtak, in line with the requirements in the Chartered Institute for Archaeologists (CIfA) Standard and Guidance for Historic Environment Desk-Based Assessments (CIfA 2020) and the Institute of Environmental Management and Assessment (IEMA)/CIfA/Institute of Historic Building Conservation (IHBC) Principles of Cultural Heritage Impact Assessment in the UK (IEMA/CIfA/IHBC 2021). The aim of this DBA is to determine (as far as is reasonably possible from existing records) the nature, extent and significance of the historic environment within the study area, to allow the impact of the proposed development on the significance of the historic environment to be identified (or to identify that further evaluation is required) and to allow reasoned proposals and decisions to be made whether to mitigate, offset or accept the impact without further intervention.

Specific objectives in relation to this project include:

- To identify whether there is potential for visible and sub-surface archaeological and built heritage assets to be present within the proposed development area and determine their significance and setting;
- To identify whether the proposed works will affect any buried archaeological remains based on their location and likely depth;
- To assess the potential effects on the setting of designated and non-designated heritage assets from the proposed development; and
- To identify any further design or mitigation measures that may be implemented as part of the proposals to mitigate effects or provide further enhancement opportunities.

1.1 Background and Scheme Objectives

JBA Consulting have been commissioned by Amey Consulting to deliver the Llanddulas to Kinmel Bay Coastal Improvement scheme. The existing coastal defences comprise a combination of timber groynes, rock revetment, cobbled beaches, sea walls and floodgates. This section of coastline is subject to frequent wave over-topping of the primary defences leading to flooding of nearby homes and local infrastructure. This risk is expected to increase as the effects of climate change (primarily increased mean sea levels of approximately 1m through to the year 2118) are realised. The objectives of the scheme are to:

- Reduce flood damages to residential and non-residential properties,
- Ensure community and stakeholder 'buy-in' for the Scheme,
- Develop a scheme that is deliverable within engineering time constraints,
- Develop a scheme that is adaptable to change; and
- Sustain and /or improve the tourist and amenity benefits through continued operation of the beach and the North Wales Coastal route.

The design life of the scheme is 100 years. Following an options appraisal analysis, the preferred option was identified as the Hard Engineering Option (Option 4), which comprises a mix of wall raising, new flood walls, rock revetment and beach recharge at eight specified locations throughout the 11km coastal frontage (JBA 2021). The option has been designed

to avoid significant impediment of views whilst achieving a significant reduction in the number of properties at risk of flooding.

1.2 Site Description

The Site comprises the 11km coastal frontage between the village of Llanddulas and the seaside resort of Kinmel Bay along the northern coast of Wales. The Site has been divided into five coastal management units (CMU), some of which have been further sub-divided, for a total of eight locations along the 11km coastal frontage. These are detailed in Table 1 as follows.

Table 1. CMU summary features

Unit	Name	Extant Characteristic Features
CMU 3-1	Quarry Jetty – Llanddulas Revetment	Jetty and large tetrapod revetment.
CMU 3-2A	Llanddulas – Revetment to Afon Dulas	Wooden shore parallel revetment fronted by rock armour with geotextile retainer and shingle fill leeward of the defence. Series of groynes west of Afon Dulas. Shingle beach and mud.
CMU 3-2B	Llanddulas Beach – Afon Dulas to Beach House	East of the Afon Dulas estuary. Large cobbles and shingle upper beach and sand low-tide platform. Low level rock revetment in front of the carpark.
CMU 3-3	Llanddulas Tip – Beach House to Han Wrych Farm	Recent rock revetment development in 2014 preventing further degradation of the coastal defence and erosion of the council refuse tip. Old timber groynes, shingle upper beach with sand low-tide platform.
CMU 3-4	Pensarn Beach – Han Wrych Farm to sewage Pumping Station (Welsh Water)	Sea wall, vegetated shingle and sand beach, shingle berm, sand low-tide platform.
CMU 3-5A	Belgrano Beach – Sewage Pumping Station (Welsh Water) to Golden Gate Holiday Centre	Concrete sea wall with recurve, small boulders in laid into concrete slope. Shingle berm at upper beach and sand low-tide platform.
CMU 3-5B	Towyn Revetment	Sea wall and large rock armour revetment. Shingle toe and sand low-tide platform
CMU 3-5C	Kinmel Bay Beach	Sea wall, large rock armour revetment, shingle, car park entrance, sand dunes.

The Site, including the CMUs, are shown in Figure 1, Appendix A. Selected photographs of the Site from the heritage assessment site visit are included in Appendix C.

The Site is bound in the west from Raynes Jetty to the north of Raynes Quarry, approximately 2km to the west of Llanddulas (SH 88703 78604). Heading east towards Llanddulas Beach, the Site then crosses a section of the River Dulas (at SH 90720 78629) as it empties into Liverpool Bay. Thereafter, the Site continues along Llanddulas Beach and passes the towns of Abergele with its satellite villages of Pensarn and Belgrano, where the Site becomes Pensarn Beach and Belgrano Beach, respectively. The Site passes the town of Towyn to arrive at Kinmel Bay, where the beach is also part of a Local Nature Reserve (LNR) of sand dunes known as the Kinmel Dunes. The Site is bound on its eastern end by a section of the River Clwyd as it empties into Liverpool Bay (up to SJ 03317 76180).

This Site is part of the northern coast of Wales and is predominantly recreational in character. The areas between the beach and the towns are primarily lined by holiday accommodation parks, holiday camps and leisure facilities. The Wales Coast Path, trails and a cycle path provide connections between the parks and the beaches, while the railway line and A55 dual carriageway are situated along the coastline to connect the neighbouring towns. Other sources of attraction to the area include a kitesurfing centre, the Y Morfa Leisure Centre, the Tir Prince Raceway, Knightley's Fun Park, the Pentre Mawr Park, the Abergele Golf Club, Gwrych Castle and its historic garden.

2 Proposed Development

The Proposed Development is described for each CMU separately. Where the CMU will feature areas of new or upgraded rock armour revetment, primary armourstone will be sourced from standard European Grading 3-6t and secondary armourstone (filter layer) will be sourced from the standard European Grading 0.3t-1t in accordance with BS EN 13393-1:2002. A geotextile layer (high performance square (HPS14) for coastal defence, or a similar approved membrane) will be placed beneath the filter layer to separate the beach level and the armourstones. The leading edge of the geotextile at the toe of rock revetments will be secured by wrapping around a single filter layer of rock. Where possible, existing rock armour will be re-used in the filter or lower primary armour layer providing it meets the dimensional requirements. The rock armour units will be formed such that each layer will be keyed onto one another with a minimum of five points of contact. Where possible, surplus beach arisings where available will be spread within the existing groyne bays of respective CMUs. Similarly, where possible, surplus rock armour from the existing defences where available will be re-used in the repair and re-instatement of the existing rock groynes of respective CMUs.

2.1.1 CMU 3-1: Quarry Jetty

This CMU comprises the area of beach between the Raynes Quarry Jetty (34205) to just east of where the Llysfaen Quarry Jetty (34206) once stood, at approximately SH 89771 78529 (see Figures 1-2 in Appendix A). Raynes Quarry Jetty is a working quarry that supplies aggregates from the Cemex Raynes Quarry in Conwy. Vehicular access to Raynes Quarry Jetty is by arrangement with Cemex off Abergale Road in Conwy.

The coastal edge when previously surveyed by CPAT (1997) was defined as formed by a dump of large boulders that was deposited during the construction of the A55 expressway, together with a foreshore comprised of pebble on the higher part of the beach and sand nearer the Low Water Mark (LWM) (CPAT 1997, 22). The OBC confirmed that in this CMU, the coastal defences contain the A55 defences built between 1980-1983 and a rock armour revetment constructed in the 1990s (CCBC 2021, 10).

This section of the Proposed Development is a private frontage and as such CCBC would not normally maintain it. Here the proposal is to maintain the existing defences to the current defence standard through regular monitoring and maintenance and to take appropriate action when issues become apparent (for example, in the event of breached defences). No further intervention is considered along this area.

2.1.2 CMU 3-2A: Llanddulas Revetment

Improvements to the public realm within this section of the project includes the following:

- Enhancement of the main car park at Llanddulas Beach, including the provision of electric car charging facilities and special car parking spaces for vehicles towing small boats/jet-skis;
- Widening of the main cycle path where the route is adjacent to the road to 3m;

- Development of a parklet within the secondary car park, which will include the following elements:
 - o A shelter where Oriel Mor, a project artist group that creates outdoor seaside art galleries, can place artwork;
 - o Oriel Mor signage;
 - o Lounge bench seating;
 - o Play climbing equipment;
 - o Cycle parking;
 - o Cycle maintenance station; and
 - o An electric cycle charging point
- Provision of several groups of benches and rest points along the cycle route between CMU 3-2A Llanddulas Revetment and CMU 3-2B Llanddulas Beach; and
- Provision of lighting between CMU 3-2A Llanddulas Revetment and CMU 3-2B Llanddulas Beach enhancing the safety of this route for pedestrians and cyclists.

2.1.3 CMU 3-2B: Llanddulas Beach

The proposed works in this CMU comprises an upgrade to the existing rock armour defence as well as an increase in the embankment elevation. The new defences are designed to offer a standard of protection (SoP) up to a 1 in 200-year coastal flooding event through to the year 2041. The upgrade to the rock armour defence will make every effort to reuse and repurpose existing rock material. The new defence will stretch roughly 350m from the eastern edge of the car park to the end of the caravan site on Beach House Road, along two existing bays bound by substantial rock groynes. The raised embankment will be tied into existing raised ground to prevent the new defence from being outflanked in coastal flood conditions. The level of the embankment crest will provide adequate protection considering the recommended allowances for sea level rise.

A review of the coastal defences at OBC reported it consisted of timber breastwork with rock revetment and timber groynes constructed between 1973-1976, plus a river training bank to the eastern side of the CMU constructed around 1973 (CCBC 2021, 10).

Improvements to the rock revetment were undertaken between 2013-2014. The OBC summarised the current coastal defences as a wooden shore parallel revetment fronted by rock armour with a geotextile retainer and shingle fill leeward of the defence, together with a series of groynes west of Afon Dulas. The beach is described characterised as shingle and mud.

There are varying combinations of width and heights across the Proposed Development in this CMU that will be used to create the new sea defence. The minimum and maximum widths of the rock armour will be 7.21m and 8.35m, respectively. The width of the rock armour crest will be 5m. The excavation toe depths will vary between 2.55m and 3m depending on the rock seabed level. The rock armour will have a 1-in-3 slope. The rock armour crest will be offset from the embankment on the seaward side with geotextile and reinforced with erosion matting. The embankment will be 1m higher than the crest and will be located over the existing cycleway and vegetated embankment at a height of 7.5m OD.

Within this CMU the proposals seek to provide fully accessible access to the beach, widen the cycle route where possible and to create formal access points where none exist at present. In addition to these public realm proposals, the scheme will also enhance the biodiversity of the area with proposals to seed the land-side of the sea defence embankment with coastal wildflowers.

2.1.4 CMU 3-3: Llanddulas Tip

The OBC confirmed that in this CMU, the coastal defences contain a flexible concrete matting revetment constructed in 1983, a rock armour revetment constructed in 1988-1990, a rock armour installed in 2014 to the upper embankment, and a Tyr crwn shingle nourishment employed from 2015 (CCBC 2021, 10-11). The CMU is characterised as a recent rock revetment development currently preventing further degradation of the coastal defence and erosion of the council refuse tip, with old timber groynes, a shingle upper beach and a sand low-tide platform.

The public realm proposals are to provide the following:

- Circa 3,000m² of environmentally beneficial shingle planting;
- A resting point complete with bench, litter bin and decorative paving; and
- A parklet that includes the following elements:
 - o Lounge seating;
 - o Picnic tables; and
 - o Cycle parking.

2.1.5 CMU 3-4: Pensarn Beach

Due to the presence of the Traeth Pensarn SSSI, this area is of great importance for this frontage. The stretch of frontage is suffering a long-term retreat with consequent realignment, caused by the very limited supply of shingle material travelling eastwards.

The proposed works will involve an initial capital beach nourishment, to achieve a minimum beach crest width to reduce overtopping to less than 10 l/s/m at this region in a 1 in 200-year coastal flood event while also providing erosion protection to the currently exposed sea wall.

A programme of maintenance including periodical beach recharge (estimated to be 3 to 5-yearly), which will then provide the needed supply of material to a starving beach, allowing the ridge to recover and vegetation to flourish. The nourishment will need regular maintenance to make sure that the area vegetated shingle does not narrow, below the minimum width required for the design overtopping rate, given that there is none or negligible feeding of shingle material from the west. It is, however, expected that storms will still potentially affect the ridge, though a larger beach will provide valuable dissipation area. Beach recharge at this location will benefit the adjacent Pensarn beach to the east.

There will also be an additional set-back wall further along the western end of the CMU approximately 1.8m tall on the landward-side of the existing road/cycleway. This will provide coastal flood protection to the A55 and northern Abergele.

This proposal seeks to add a parklet at the western end of Pensarn Promenade providing the following:

- Cycle parking;
- Cycle maintenance and charging facilities;
- A shelter where Oriel Mor can programme art installations;
- Oriel Mor signage;
- Picnic tables;
- Lounge seating; and
- Informal play equipment.

2.1.6 CMU 3-5A. Belgrano Beach

The coastal defence upgrade in this CMU has been divided into two schemes, one at the western end of Belgrano beach, where an existing sea wall currently offers limited coastal

flood protection and the other at the eastern end where there is a set-back sea wall from the beach. Dividing the CMU into two allows for appropriate design work to account for beach level variability along the foreshore. The design of both coastal defence upgrades along Belgrano Beach have been designed to provide adequate wave overtopping protection considering the recommended allowances for sea level rise.

The proposed designs for the coastal defence upgrade will be new rock armour defences in both sides (eastern and western) of the CMU. The rock armour is designed to offer wave overtopping protection of 1 l/s/m for a 1 in 200-year event in 2041.

On the western side of the CMU, the rock armour will be placed in front of the existing sea wall with a crest width of 6m and a slope angle of 1-in-4. The excavation toe depths will be up to a maximum of 3.5m depending on the rock seabed level. The total length of this rock armour installation will be 500m. The crest will be offset by 0.5m to avoid loading onto the sea wall and will be at the same height as the existing sea wall (8.25m OD).

The eastern side will involve new rock armour extending from the existing rock armour at Lyndale Holiday Park with a newly raised embankment behind. The total length of the eastern rock armour unit will be 300m with a crest width of 5m. The revetment will transition from a 1-in-3 slope to a 1-in-2 slope as the beach gets wider. The excavation toe depths will be up to a maximum of 3.5m depending on the rock seabed level. The crest will be offset by 0.5m to avoid loading onto the sea wall and will be 0.5m lower than the existing sea wall (8.5m OD). There will also be an additional 1.2m wave wall included along the frontage behind the rock armour.

The public realm enhancements in this CMU focus on the beach access points to improve existing level or footbridge crossings over the railway. The proposals are as follows:

- A stepped access will be provided opposite the Lyndale Caravan Park;
- A new fully accessible and Disability Discrimination Act (DDA) compliant access point will be provided near the Whitehouse Leisure Park level crossing; and
- In addition to the beach access, there are proposals to enhance the existing planting that sits alongside the cycle path.

2.1.7 CMU 3-5B. Towyn Revetment

The proposed upgrade in CMU3-5B will significantly increase the level of coastal flood protection offered by the current rock armour unit. The new design will keep the 1-in-4 slope angle of the current rock armour unit but increase the crest width and height so that a SoP of 1 l/s/m is achieved for a 1 in 200-year event up to the year 2041. The new design will make every effort to reuse and repurpose the current rock armour material by reprofiling the existing rock revetment to enable the placement of the new primary rock layer to the design level. Existing rock layers will be repurposed into filter layers provided the rock meets specification requirements.

The rock armour will be placed in front of the existing sea wall with a crest width of 6m with a slope angle of 1-in-4. The excavation toe depths will vary up to a maximum of 2.5m depending on the rock seabed level. The height of the existing sea wall will be raised by 0.75m and the crest will be offset by 0.5m to avoid loading onto the sea wall.

The public realm proposals are as follows:

- Enhancement of the areas of existing meadows;
- A proposed parklet at the eastern end that will comprise the following:
 - o Lounge seats;
 - o Picnic tables;
 - o A shelter for informal use; and

- o Decorative paving.
- Improvement will be made to the existing access points adjacent to the Golden Sands Caravan Park.

2.1.8 CMU 3-5C. Kinnel Bay Beach

The reduction of the overtopping within this CMU is characterised by the enhancement of the existing rock armour revetment at the eastern end. The coastal defence upgrade along this section requires several actions comprising an increase in the height of the sea wall create along the entire unit by 500mm and the upgrading/replacement of the flood gate at the carpark to be at the same level as the wall. The level of the sea wall crest will be increased to provide improved wave overtopping flood protection to Kinnel Bay, accounting for sea level rise up to 2041.

The proposed works also includes the re-profiling the level of the entrance to the car park located at the end of St Asaph Avenue. This localised change in elevation will provide flood protection landwards by preventing water entering the main town, with any flood water returned to the sea by flap gates.

The existing rock armour revetment in this CMU at the eastern end of Kinnel Bay Beach will be enhanced and upgraded. The existing sea wall behind the rock armour will be raised by 500mm and new rock armour will be installed in front.

The rock armour will have the same crest level as the sea wall (7.5m OD) with a crest width of 5.6m and 1-in-3 slope angle. The crest will be offset by 0.5m to avoid loading onto the sea wall. The length of the new rock armour unit will be approximately 420m. The excavation toe depths will vary up to a maximum of 2.5m depending on the rock seabed level.

In addition to the coastal flood protection offered by the rock armour design, there have also been considerations as to the environmental benefits. This will involve the creation of artificial rock pools to provide new habitats and texture to the surface of the rock armour to encourage colonisation of the material by marine invertebrates. The rock pools will be placed at different levels on the cross section of the rock armour to provide habitat opportunities within the different tide cycles.

Sand dunes will be reinstated where necessary along the stretch to the east of the car park at the end of St Asaph Avenue, where gaps exist along the landward side of the foot/cycle path.

Maintenance in terms of periodical recharge will be required at the western end downdrift the enhanced revetment at Towyn, where downdrift erosion may reach the sea wall.

Most of the public realm enhancements are proposed at Kinnel Bay with significant changes taking place on along this section of the project, as follows:

- A parklet at Sandy Cove, which will include the following:
 - o Cycle parking;
 - o Cycle maintenance and charging facilities;
 - o Lounge seating; and
 - o Informal play equipment.
- Widening the footpath to 4.5m between Sandy Cove and Baysville Grill;
- Enhancing the existing St Asaph Avenue car park to act as a beach-side hub for the community, which will now incorporate the following:
 - o Enhanced car park with rain gardens and electric car charging points;
 - o A new toilet facility building;

- o A shelter where Oriel Mor can programme art installations;
- o Cycle parking, maintenance and charging facilities;
- o Oriel Mor signage;
- o Picnic tables;
- o Play climbing equipment; and
- o Lawn planting with two proposed trees.
- Beach access improvements for Kinmel Bay Beach will include the following:
 - o Retention of three flood gate access points;
 - o Two enhanced access points to be fully accessible and DDA compliant; and
 - o Three enhanced access points with stepped access.

2.2 Construction Access

The main access route into North Wales is via the A55 (North Wales Expressway) dual carriageway. To get to Kinmel Bay from the A55 from the west, the main road would be the A548/Towyn Road heading east. National Rail services are available along the coastline between Colwyn Bay and Rhyl for the length in the study area. Compound locations have not been confirmed but will be agreed in consultation with the Local Planning Authority, community and business users in advance of the start of construction. The construction period is estimated to be 18 months.

3 Geology and Ground Condition

Geological data has been collected from the British Geological Survey (BGS) (BGS 2021) for each CMU as follows in Table 2.

Table 2. CMU Ground Conditions

Unit	Name	Geology (BGS 2021)
CMU 3-1	Quarry Jetty – Llanddulas Revetment	Clwyd limestone group sedimentary bedrock overlain by gravel storm beach deposits and marine sands.
CMU 3-2A	Llanddulas – Revetment to Afon Dulas	Clwyd limestone group sedimentary bedrock overlain by gravel storm beach deposits and marine sands. The east end where the River Dulas empties into the bay also contains tidal flat deposits of clay, silt and sand.
CMU 3-2B	Llanddulas Beach – Afon Dulas to Beach House	Clwyd limestone group sedimentary bedrock overlain by gravel storm beach deposits and marine sands.
CMU 3-3	Llanddulas Tip – Beach House to Han Wrych Farm	Clwyd limestone group sedimentary bedrock to approximately halfway along the CMU, which changes to Warwickshire group mudstone, siltstone and sandstone bedrock. Both types are overlain by gravel storm beach deposits and marine sands.
CMU 3-4	Pensarn Beach – Han Wrych Farm to sewage Pumping Station (Welsh Water)	Warwickshire group mudstone, siltstone and sandstone bedrock overlain by gravel storm beach deposits and marine sands.
CMU 3-5A	Belgrano Beach –	Warwickshire group mudstone, siltstone and

	Sewage Pumping Station (Welsh Water) to Golden Gate Holiday Centre	sandstone bedrock, which changes to Kinnerton sandstone formation bedrock approximately a quarter along the CMU. Both are overlain by gravel storm beach deposits and marine sands.
CMU 3-5B	Towyn Revetment	Kinnerton sandstone formation bedrock overlain by gravel storm beach deposits and marine sands.
CMU 3-5C	Kinmel Bay Beach	Kinnerton sandstone formation bedrock overlain by gravel storm beach deposits and marine sands.

4 Legislative & Planning Policy Context

The assessment aims to address the requirements of relevant legal frameworks and planning policy pertinent to the Proposed Development. The following are considered to be relevant to this assessment:

- Planning Policy Wales 2021;
- Technical Advice Note 24: The Historic Environment, 2017;
- The Well-being of Future Generations (Wales) Act 2015;
- The Historic Environment (Wales) Act 2016; and,
- CCBC Local Development Plan 2013.

4.1 Planning Policy Wales 2021

Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government, with Edition 11 published on 24th February 2021.

The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation.

Chapter 6.1 of PPW sets out the planning policy of the Welsh Government with regards to the historic environment. The national planning policy framework for the historic environment as set out in PPW is supplemented by Technical Advice Note 24: The Historic Environment and Cadw associated best practice guidance on the historic environment.

4.2 Technical Advice Note 24: The Historic Environment (2017)

The purpose of Technical Advice Note (TAN) 24 is to provide guidance on how the planning system considers the historic environment during development plan preparation. TAN 24 provides specific guidance on how the following aspects of the historic environment should be considered:

- World Heritage Sites,
- Scheduled Monuments,
- Archaeological remains,
- Listed Buildings,
- Conservation areas,
- Historic parks and gardens,
- Historic landscapes, and
- Historic assets of special local interest.

The historic environment is defined as follows:

"All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed."

A historic asset is defined as:

"An identifiable component of the historic environment. It may consist or be a combination of an archaeological site, a historic building or area, historic park and garden or a parcel of historic landscape. Nationally important historic assets will normally be designated."

4.3 The Well-being of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015 places duties on public bodies requiring them to act in accordance with the 'sustainable development principle'. The Act also establishes well-being goals which include achieving 'a Wales of vibrant culture and thriving Welsh language', described as 'a society that promotes and protects culture, heritage and the Welsh language. A properly protected, conserved and enhanced historic environment can improve the quality of life and well-being for everyone.

4.4 The Historic Environment (Wales) Act 2016

The legislative framework for the historic environment in Wales was revised by The Historic Environment (Wales) Act 2016. The 2016 Act amended the Ancient Monuments and Archaeological Areas Act 1979 and the Planning (Listed Buildings and Conservation Areas) Act 1990. It extended the definition of Scheduled Monuments and enhanced their protection, as well as making changes to the process of Scheduled Monument consent. Changes were also made to the protection of Listed Buildings. The 2016 Act also provided for a statutory register of historic landscapes, a statutory list of place names, and imposed a statutory duty on Welsh Ministers to compile and maintain HERs.

4.5 CCBC Local Development Plan 2013

CCBC adopted the current Local Development Plan in October 2013 and is currently carrying out a full review. The Plan covers the period 2007 to 2022. The following priority issue is relevant to this assessment:

- **Protecting Conway's Cultural Heritage**

There is a need for development to take into account the historic built environment, and ensure that design and build quality will help protect, maintain and, where appropriate, improve on this quality in Conwy.

The Plan also includes a number of Spatial Objectives, of which the following is relevant to this assessment:

- SO12 – Safeguard and enhance the character and appearance of the undeveloped coast and countryside, sites of landscape/conservation importance, features of archaeological, historic, or architectural interest and ensure the conservation of biodiversity and protected species.

The following spatial policies and supporting development management policies have been identified as relevant to this assessment:

- Strategic Policy CTH/1 – Cultural Heritage

The council is committed to protecting and, where appropriate, enhancing its cultural and heritage assets. This will be achieved by:

a) Ensuring that the location of new development on both allocated and windfall sites within the Plan Area will not have a significant adverse impact upon heritage assets in line with Policies CTH/2 – 'Development Affecting Heritage Assets', DP/3 – 'Promoting Design Quality and Reducing Crime' and DP/6 – 'National Planning Policy and Guidance';

- b) Recognising and respecting the value and character of heritage assets in the Plan Area and publishing Supplementary Planning Guidance to guide development proposals;
- c) Seeking to preserve and, where appropriate, enhance conservation areas, Conwy World Heritage Site, historic landscapes, Parks and Gardens, Listed Buildings, Scheduled Ancient Monuments and other areas of archaeological importance in line with Policy DP/6;
- d) Protecting buildings and structures of local importance in line with Policy CTH/3 – 'Buildings and Structures of Local Importance';
- e) Enhancing heritage assets through heritage and regeneration initiatives;
- f) Preserving and securing the future of heritage assets by only permitting appropriate enabling development in line with Policy CTH/4 – 'Enabling Development';
- g) Ensuring that development is compatible with the long-term viability of the Welsh Language in line with Policy CTH/5 – 'The Welsh Language'.

- Policy CTH/2 – Development Affecting Heritage Assets

Development proposals which affect a heritage asset listed below (a-f), and/or its setting, shall preserve or, where appropriate, enhance that asset. Development proposals will be considered in line with Policy DP/6, where applicable and Policy DP/3.

- a) Conservation Areas
- b) Conwy World Heritage Site
- c) Historic Landscapes, Parks and Gardens
- d) Listed Buildings
- e) Scheduled Ancient Monuments
- f) Sites of archaeological importance.

- Policy CTH/3 – Buildings and Structures of Local Importance

Development proposals affecting buildings or structures which make an important contribution to the character and interest of the local area will only be permitted where the building's distinctive appearance, architectural integrity and its setting would not be significantly adversely affected.

- Policy CTH/4 – Enabling Development

1. Enabling development which seeks to secure the preservation and/or appropriate alternative use of a Listed Building, or a building which makes a significant positive contribution to the character of a conservation area, historic landscape or parks and gardens of special historic interest will only be permitted where the following criteria are all met:

- a) It will not materially harm the heritage values of the historic asset or its setting and;
- b) It avoids detrimental fragmentation of management of the historic asset; and
- c) It will secure the long-term future of the historic asset and, where applicable, its continued use for a sympathetic purpose and;
- d) It is necessary to resolve problems arising from the circumstances of the present owner, or the purchase price paid and;
- e) Sufficient subsidy is not available from any other source and;
- f) It is demonstrated that the amount of enabling development is the minimum necessary to secure the future of the historic asset, and that its form minimizes harm to other public interests and;
- g) The public benefit of securing the future of the historic asset through such enabling development decisively outweighs the disbenefits of breaching other public policies.

2. If it is decided by the Council that a scheme of enabling development meets all the criteria set out above, planning permission should then only be granted if:
- a) The impact of the development is precisely defined at the outset, normally through the granting of full, rather than outline, planning permission;
 - b) The achievement of the heritage objective is securely and enforceably linked to the enabling development;
 - c) The place concerned is repaired to an agreed standard, or the funds to do so made available, as early as possible in the course of the enabling development, ideally at the outset and certainly before completion or occupation and;
 - d) The Council closely monitors implementation, if necessary acting promptly to ensure that obligations are fulfilled.
- Policy CTH/5 – The Welsh Language
2. The Council will encourage throughout the Plan Area both the provision of bilingual signs and the retention of traditional Welsh names for new developments and streets.

5 Sources Consulted

A study area of multiple buffers was created along the 11km coastal frontage between the village of Llanddulas and the seaside resort of Kinmel Bay in order to identify key heritage assets and establish the historic character of the area. The buffer is 300m inland and 500m to the sea (refer to Figure 1 in Appendix A). The following sources were consulted:

- Cadw for designated assets;
- CCBC Historic Environment Record (HER) as held by Clwyd-Powys Archaeological Trust (CPAT);
- cartographic sources; and
- documentary sources.

The baseline assessment and data collection were undertaken in 2021. At this time, it was due to the COVID-19 pandemic restrictions, it was not possible to conduct an archive visit as these were closed to the public.

A site visit was undertaken by Patrick Mayer over the 21-22nd February 2022 to assess the current site conditions, the effects on the setting of nearby designated and non-designated assets and the potential for future investigations.

The assessment considered both the direct effects of the proposal on cultural heritage assets within the Proposed Development of each CMU, and of indirect effects on assets located outside of the Proposed Development of each CMU. The baseline conditions were determined by means of desk-based studies and a site visit. The desk-based study collected information from the Regional HER, the National Monuments Record (NMR), and Scheduled Ancient Monument and Listed Building information. Aerial Photographs, Cartographic and documentary sources were also reviewed. A readjustment of the western part of the study area was also undertaken and additional data was gathered using online sources Archwilio and Cof Cymru.

6 Baseline Context

At the time of the data search there were 18 designated assets and 97 non-designated assets in the HER within the study area (see Tables B.1 and B.2 in Appendix B Gazetteer for full details). Figures 2-3f in Appendix A illustrate the locations of designated and non-designated assets. These are discussed within the context of the archaeological and historic baseline in the following sections. Bracketed numbers within the text refer to the record identification number.

Within the study area there are 18 designated assets that date to the post-medieval and modern period, including 16 Listed Buildings, one Conservation Area, and one Grade II* Registered Historic Park and Garden. There are also 90 non-designated assets and nine archaeological events (see Tables B.1, B.2 and B.3 in Appendix B Gazetteer for full details). These are discussed as per their CMU in the subsections 6.4 below.

A site visit was undertaken by Patrick Mayer over the 21-22nd February 2022 in order to assess the current site conditions, to identify heritage assets within the vicinity of the scheme and assess the effects on the setting of nearby and non-designated assets. There were intermittent rain showers and high winds that did not impact the assessment. The results of this visit are discussed as per their CMU in the subsections 6.4 below.

6.1 Prehistoric to early Medieval period (up to c 410 AD)

The primary evidence in Britain of the Palaeolithic period are stone tools that are usually found in one of two types of archaeological deposits: either as open-air 'lithic scatters' within extant or former river systems, or within locations that have preserved the artefacts and their associated sediment layers over time. The latter of these are typically caves; more rarely, they are gorges and fissures. Evidence from the Palaeolithic in Wales is rare and is material has primarily been recovered from caves (Walker et al 2003). Other discoveries have been made through the understanding of how sediments moved during the fluctuations of marine and riverine systems following the end of the last glaciation period.

The northern coast of Wales, especially the northeast between Rhyl and Prestatyn, is recognised as an area where the remains of Palaeolithic and early Mesolithic forests, now submerged, may be found preserved along the beaches (Clark 1938 and 1939; Manley 1988; Aldhouse-Green 2000; Bell 2007; David 2007). During the end of the last major glaciation, approximately 10,000 years ago until the beginning of the early Neolithic (approximately c.4000 BC), sea-levels rose rapidly as the ice melted, and there would have been local variations that sometimes overlapped with broader regional patterns (Tooley 1985a, 1985b and 1985c; Bibby 1940; Bell 2007, 266). When land surfaces were uncovered, they would become inundated again, mixing marine and estuary deposits and causing a series of marine transgressions and regressions that reflect a changing landscape and coastlines that can only be understood now through the interpretation of borehole data. The study area would likely have been subject to human occupation during the Mesolithic as the coastline varied in response to sea-level changes.

There are two assets potentially dating to the Mesolithic period within the study area. Submerged ancient forest, possibly pre-dating the Mesolithic period, is recorded in CMU 3-4 near Abergele (524722) and CMU 3-5C (524733) near Rhyl. An anvil stone (100485) was found at the former while the latter produced a mattock and other lithic tools beneath the peat. An axe was also found within the peat at a location recorded at Rhyl. There are no other recorded heritage assets or findspots dating to the Mesolithic period or earlier within the study area.

The earlier Neolithic is marked as the period when seasonal mobility was gradually overtaken by farming as the primary means for acquiring dietary subsistence, though it never ceased completely, as foraging and hunting continued to play an important role in the community's welfare, their identity, and their diets. Much of the evidence for Neolithic activity within the wider area of North Wales has primarily derived from the study of the distribution of late Neolithic passage graves, cairns and caves (Lynch 2000a).

Within the study area, the Neolithic is represented by an findspot in CMU 3-4, where a polished mid to late Neolithic stone axehead (651571) was found in 2013. There are no other recorded heritage assets or findspots dating to the Neolithic period within the study area.

The Bronze Age in Wales, like the rest of Britain, saw the rapid introduction of bronze and gold smithing technology and the production of everyday tools, weapons, and ritual items with these materials. Trade existed during this time for metal and other high-status materials such as gold, amber, beads and jet. Some of these have been recovered as unstratified single objects, while others were recovered in find spots that reflect the later Bronze age period phenomenon of hoarding. Unlike other parts of Britain, Wales did not adopt the practice of single inhumations quickly in this period; the preference throughout the middle to late Neolithic was for cemetery mounds, where no single person was singled out for priority, raising the suggestion that being a member of a particular family was more important than any individual person (Lynch 2000b, 122-137). There are no recorded locations, findspots, recorded heritage assets or events relating to the Bronze Age within the study area.

Into the Iron Age and early Romano-British period, the building of ceremonial barrows and stone circles ceased, while people turned to constructing enclosed settlements, particularly hillforts, which may indicate anxiety and a need to defend groups of settlements. Excavations have shown that palisades and ramparts were often allowed to decay and rot, therefore the development of defences in the late Bronze Age and into the Iron Age may reflect display and civil control as well as periods of prosperity and tranquillity in between times of unrest (Davies and Lynch 2000, 139). The period is also marked by the introduction of iron tools and weaponry. It is likely that continental politics influenced some of the settlement activity in the region during this time. This is reflected in the continuation of some of the social and trade networks that had developed in earlier periods, particularly the middle to late Bronze Age. Artefacts show the potential and appetite for long-distance trade in rare and exotic materials such as jet, amber and faience remained (Lynch 2000b). Other trade networks would have been locally based (Davies and Lynch 2000, 140). There are no recorded locations, findspots, recorded heritage assets or events relating to the Iron Age within the study area.

A primary source of written information for the Roman invasion of Wales is derived from the writings of Tacitus and Cassius Dio. The Roman incursions into north-west Wales are better understood with attacks on the island of Mona (Anglesey) by Gaius Suetonius Paulinus culminating around 60 AD, however evidence for the Roman invasion into northern Wales is comparatively limited. The study area falls within north and north-eastern Wales that is described by Tacitus as belonging to the Deceangli, a name which survives into the Middle Ages as Tegeingl, a cantred of the county (Rivet and Smith, 365). It is suggested that Flintshire belonged to this group and that their western boundary may have been close to the River Conway (Jarett and Mann 1968, 165-166). The Deceangli were attacked by Ostorius Scapula in 48 AD and they are believed to have been completely subdued by 58 or 59 AD (Jarett and Mann 1968, 163-166).

There are two insecure findspots of Roman coins recorded within the study area. The first coin (100479) was found in CMU 3-2B at Twn Yr Ogo, now the Oasis Club, sometime before 1858, and it is a denarius of Vespasian who ruled from 69–79 AD. The second was found in CMU 3-5C and recorded only as the Rhyl Roman coin (17613), with no further information. There are no other findspots, recorded heritage assets or events relating to the Romano-British period within the study area.

6.2 Early Medieval to Post-Medieval (410 – c.1540 AD)

The end of Roman control in Wales and the rise of the early Medieval period relies on understanding the Irish settlement to the west, the establishment of the early regional kingdoms, the rise of Christianity, the pressure from the Anglo-Saxon kingdoms and Viking incursions, and the Anglo-Norman and Welsh conflict (Edwards et al 2005, 33). Due to the limited records and historical information, the early medieval period of north Wales is one of the least understood in Britain, and archaeological deposits dated to this period are very rare in comparison to other parts of the country (Edwards, Lane and Redknap 2010; Bapty

2004; Edwards 2003). The transition from Roman control to the regional kingdoms took place well before the 7th century. By then, the two major early medieval monuments in the east and northeast respectively, and Wat's Dyke and Offa's Dyke had been established. Irish settlement is suggested in northwest Wales by the end of the Roman period, with the kingdom of Gwynedd founded by the early 6th century at the expense of the minor kingdoms of Rhos and Mierionydd (Edwards 2003). By the 9th century, Saxon aggression, Viking incursions and probable new medieval settlements were developing. Christianity was also on the rise and ecclesiastical records and locations began to appear on the landscape, providing documentary evidence to supplement archaeological research.

Within the study area, Llanddulas and Abergele show positive evidence of medieval origins (Silvester, Martin and Watson 2014; CPAT 2007a). The name of Foryd is likely a corruption of *môr* for sea and *rhyd* for ford, as the name of the Clwyd is traditionally crossed by a ford (CPAT 2007a, 15). However, Foryd grew into a settlement during the post-medieval period.

Llanddulas is translated as 'church on the River Dulas', and its ecclesiastical name may have been *Llangynbyrd*, while its original name may have been *Nant Dulas* or *Nandulas* (Silvester, Martin and Watson 2014, 19). It first appears in the 1254 Norwich Taxation document as *Llanndulas*, probably in relation to the medieval Church of St Crynbyrd, which was later demolished and rebuilt in the post-medieval period, but with the exception of other documentary references in the late 13th century, the history of the town is unknown until the 17th century (Silvester, Martin and Watson 2014, 19-20).

Abergele is translated as 'mouth of the Gele' and appears as *Opergelei* in the 9th century AD, *Abergel* in the 1254 Norwich Taxation document, and then as *Abergele* three years later (Silvester, Martin and Watson 2014, 7). In the 9th century it is associated with the archbishop Elfodd (who is more closely associated with the monastery at Holyhead on Anglesey). It is possible Abergele may have had two separate religious communities, or that the documentation refers to different stages of the same community that existed before the Norman Conquest (Silvester, Martin and Watson 2014, 7). By 1311, Abergele was part of the lordship of Denbigh and was recorded as having 24 burgesses, a market, a fair and a mill. The town was likely founded before Denbigh around 1250. Abergele does not contain any surviving buildings earlier than the 19th century, with the exception of the Grade II* Church of St Michael (237), which is approximately 1km to the south-east of the Proposed Development. The building occupies the location of a previous church that was erected in the 8th century on land granted by Maelgwyn Gwynedd to Elfodd, Bishop of Bangor. It dates to the late 12th to early 13th century and was modified or largely rebuilt around 1400, at which time the tower was probably built. The church was repaired in 1663 and restored in the mid-19th century. Its vestry contains rare surviving examples of medieval glass dating to the 1500s. A description from 1344 of the town includes a church (likely the aforementioned Church of St Michael), a marketplace, a prison, a bakery, stocks, a pigeon house, and the Pil (The Mount) (100487). It is currently unknown where the potential locations of any of these may have existed within Abergele, except for the church and potentially The Mount, though a 2008 geophysical survey of the latter's possible location did not suggest anything of note. It has been speculated that the medieval origins of the town may lie somewhere around the church, within the straightforward layout of Market Street leading to the Gele and potentially Water Street (Silvester, Martin and Watson 2014, 7-8). This area is approximately 1-1.2km to the south of the Proposed Development from CMU 3-4.

There is a single record of a medieval boundary stone within CMU 3-5C (101567) in the HER, however no further information is known. There are no other findspots, recorded heritage assets or events relating to the medieval period within the study area.

6.3 Post Medieval (1540 – 1750 AD) to Modern (1900 AD to present)

The post-medieval period encompasses the transition of the medieval world into the industrial and agricultural revolutions of the 18th and early 19th centuries.

At the end of the 17th century, Llanddulas is described by Edward Lhuyd's informant as having five or six cottages and by 1781, Thomas Pennant reported it was a small village with a church (Silvester, Martin and Watson 2014, 19). This was likely the Church of St Crynbyrd, a medieval church that was demolished and rebuilt in 1732. This church was then replaced in 1868-1869 by the present St Cynbyrd's Church, which is now a Grade II* Listed Building (19024) approximately 430m to the south of the Proposed Development at CMU 3-2A. The Tithe map of 1839 shows a village with the church and an attached vicarage, a mill, and houses, all on Mill Street. There are also agricultural fields to the northwest of the church in the location of the present-day Station Road and modern housing approximately 300m to the south of the Proposed Development at CMU 3-2A.

The town expanded greatly in the 19th and 20th centuries in response to the limestone quarries and later, the tourism industry. The Ordnance Survey (OS) first edition six-inch to one mile (1:10,560) of 1880 depicts new churches, schools, residences, mills, smithies, and limekilns to the west and south of the original town centre. The quarries to the west are served by a tramway attached to the combined London and North Western Railway (L&NWR) and Chester and Holyhead Railway, which also opened Llanddulas Station (87071) to the north of the village in 1889; the station was closed in 1952 (Catford 2008). Agricultural fields between the southern and western sides of Llanddulas are eventually taken over by housing and development, as shown by the OS six-inch maps of 1900, 1915, 1933, 1949 and 1953, while the coastline to the north of the village contains large caravan camps, as shown in the OS National Grid maps of 1964.

Abergele experienced growth during the late 17th century, likely also in response to the local limestone quarries, and around 1699 Edward Lhuyd's informant states that the village had grown to a town of around forty houses (Silvester, Martin and Watson 2014, 8). The Tithe map of 1839 shows the Grade II* Listed Church of St Michael (237) and many buildings along Market Street, Bridge Street, and Chapel Street. The line of Water Street/A548 leading to the village of Pensarn and the coast is clearly depicted. To the north of Abergele village centre, a row of housing is shown along what is now modern housing on Peel Street. The Chester and Holyhead Railway and the village of Pensarn is also depicted along the coast. However, the railway station is not depicted as it would open near Pensarn in 1848 (18703).

Like Llanddulas to the west, Abergele grew rapidly in the 19th and 20th centuries. The OS first edition six-inch map of 1880 depicts new churches to the north, east and south of the town centre, new residences to the south and north of the town centre, and a gas works and a police station to the south of the original town centre. Housing and developments continue to expand to the south, north, and eventually to the west of the centre of the town, overtaking areas of pasture and farm estates to the north join the northern section of Abergele with the southern side of Pensarn, as depicted in the OS six-inch maps of 1900, 1914, 1934, 1944 and 1953. The OS National Grid maps of 1964 show the Abergele & Pensarn Golf Course between coastal farms and the urbanised area linking Pensarn and Abergele, with caravan camps on the coast to the north and northeast of Pensarn.

6.4 Baseline by CMU

6.4.1 CMU 3-1: Quarry Jetty

The frontage of this CMU is entirely composed of a revetment constructed in the 1990s constructed of rock armour and tetrapods (CCBC 2021, 10). Directly to the south of this is the coastal cycle path that provides the main access to the CMU from the east and west (Plate 1). To the immediate south and southeast of this CMU were quarries that were greatly exploited in the 19th and early 20th centuries. The creation of the A55 Expressway

demolished most of the Penmaenrhos Quarry, which was immediately to the south of this CMU (Plate 2). Llysfaen Railway Station (87072) is located to the south of the A55 Expressway and the railway and in the southern part of this CMU. The station was opened as 'Llandulas' in 1862, renamed 'Llysfaen' in 1889 and closed in 1931 (Wright and Price 2008). The wider area around Llanddulas has been previously discussed in reference to historic mapping resources in section 6.3.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, Conservation Areas, Protected Wreck Sites or Registered Battlefields within the study area around this CMU.

Non-Designated Assets

There are five non-designated assets within the study area around CMU 3-1 (Quarry Jetty) and all are of post-medieval and modern date (see Figures 3–3a in Appendix A). The study area includes the following assets: the modern Raynes Quarry Jetty (34205); the record for the modern Llysfaen Quarry Jetty (34206), which was demolished in 2011; the potential location for the wreck of the Richard (240577), which was reported stranded near the quarry pier at Llandulas in December 1845; the 19th to early 20th century Llysfaen Railway Station (87072), which is to the south of the A55 Expressway and railway; and the location of the post-medieval turnpike road (140763), which runs along on what is now the A547/Abergele Road and is likely no longer extant as the construction of the modern road will have negatively impacted the earlier deposits.

The Raynes Quarry Jetty (34205) was observed near the current defences during the site visit (see section 6.4.1). A jetty has connected a quarry at Raynes since 1860 and this jetty was substantially rebuilt in 1983 (MAIB 2013, 20). The area of the Proposed Development makes a positive contribution to its setting as this part of the beach frontage has long served as the location of an industrial jetty that has loaded building material from a southern quarry onto a waiting vessel. The Llysfaen Railway Station is to the south of the A55 and railway and the Proposed Scheme makes no contribution to the setting of this asset. The recorded location of the potential remains of the wreck of the Richard was not observed during the site visit as the area was underwater.

Site visit

There were no new heritage assets identified within the bounds of CMU 3-1 during the site visit. Two non-designated heritage assets are recorded towards the east of the CMU and include the wreck of the Richard (240577) and where the Llysfaen Quarry Jetty was once in place (34206). After the coordinates of these assets were assessed, it was established that it would not be possible to visit them at the time of the visit due to the tides. Additionally, it was not possible to gain access to the location of the Llysfaen post-medieval Railway Station (87072), as the access was locked (Plate 3).

There are expansive views along the foreshore of CMU 3-1 both to the west towards Colwyn Bay, and up to the headland at Llanddulas beach where River Dulas empties into the Liverpool Bay (Plate 1). To the south of this the views are interrupted by the A55 Expressway and its rock revetment blocking the view of the adjacent hill side (Plate 4). The Raynes Quarry Jetty (34205) is not accessible to the public but could be easily observed from the cycle path stretching out from the edge of the A55 Expressway approximately 175m into the sea (Plate 5).

6.4.2 CMU 3-2A: Llanddulas Revetment

CMU 3-2A stretches along the western side of Llanddulas Beach from where the previous CMU ended at approximately SH 89771 78529 to where the River Dulas empties into Liverpool Bay (SH 91134 78714) (see Figures 1–2 in Appendix A). The Site in this CMU is approximately 280m in length and a maximum of 60m in width (Plate 6). It is located

alongside Wern Road on the eastern end of the CMU, adjacent to the Beach Caravan and Chalet Park. It is currently the location of two small car parks, where there are public toilets. The western car park is proposed as the location of a compound. There is a path leading from Wern Road to a slipway onto the shingle beach on the western side of the Site, just before the compound. There are two bench locations have been proposed approximately 40m and 190m along the cycle path to the east of the Site.

The coastal edge when previously surveyed by CPAT (1997) was defined as a boulder dump with boulder clay cliffs, together with a foreshore comprised of rock and pebble (shingle) beach near the high water mark (HWM), with sand lower down the beach CPAT (CPAT 1997, 23). There is a slipway to the north of the Craig Y Mor Holiday Park off Wern Road, which can be reached via the A547/Abergele Road, leading to the beach on the eastern side of this CMU. It cuts a path through the coastal slope and boulders. The wider area around Llanddulas has been discussed in reference to historic mapping resources in section 6.3.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, Conservation Areas, Protected Wreck Sites or Registered Battlefields within the study area around this CMU.

Non-Designated Assets

There are 15 non-designated assets within the study area of this CMU and all are of post-medieval and modern date (see Figures 3, 3a–3b in Appendix A).

Assets within close proximity of the Site include the former post-medieval Llanddulas Lifeboat House (34207) that has been converted into a modern residence, the 19th century Llanddulas Railway station (87071) and the post-medieval Dulas Railway Viaduct (87069). The original railway viaduct over the river Dulas was brought down by floods from 16-17 August 1879, an event that is locally remembered as the Lli Mawr (Abergele Town Council 1981, 29-35). The original viaduct was replaced by a temporary timber structure, which was then replaced by the current structure on 24 September 1879 by The Railway Company, who employed around 500 men and utilised electric light in one of its first uses for 24-hour construction work (Abergele Town Council 1981, 31). The viaduct was later upgraded as the present bridge deck dates to the latter half of the 20th century.

Four shipwrecks (519089; 271453; 271555; 271362) and the wreck of a Second World War Spitfire (130299) are recorded between the HWM and Low Water Mark of Ordinary Tides (LMWOT) between 100m-375m away from the Site. The remains of a modern timber jetty (34279) are approximately 300m to the northwest from the Site and are likely associated with the historic quarries to the south. The line of a former Llysfaen Quarry Tramway (34280) that once ran between the Llysfaen Quarry and its former jetty is approximately 400m to the southwest of the Site. The tram has been removed and its former line is now an inclined footpath that runs beneath the A55 and the railway.

The Llanddulas and Rhyd-y-Foel timber weir (214563) is considered to date to the late 20th century as it first appears in OS maps dated 1989 (AMBER Consortium 2020).

The record for the location of the post-medieval turnpike road (140763) has been discussed. The remaining assets (132615; 407132; 7676) are to the south of the A55 Expressway and the Site makes no contribution to the setting of these assets.

Archaeological Surveys and Events

A photographic survey (141870) was undertaken at Caersalem Chapel in 2010. No other events are recorded within this CMU.

Site visit

There were no new heritage assets identified within CMU 3-2A during the site visit.

Looking towards the west of CMU 3-2A there are expansive views towards Colwyn Bay, but the immediate views to the south-west across the foreshore are obscured by the rock revetment. Facing east the only views from the foreshore are of the sea owing to the small headland where the river Dulas crosses the beach (Plate 7). Looking south, the far east of the CMU the views are bounded by an area of scrub/large bushes, obscuring the views of the hillside to the south (Plate 8). The views south of the CMU on from the River Dulas are bounded by the Dulas Railway Viaduct (87069) and the modern Llanddulas Lifeboat House (34207) that obscure the views of the hillside above (Plate 9).

The Llanddulas Lifeboat House (34207) is situated approximately 70m from the sea front in the eastern half of the CMU. The Site is approximately 15m to the north of this asset and the shoreline makes a positive contribution to its setting, which includes extensive views across Llanddulas beach (Plate 10). It was not possible to visit the nearby Llanddulas Railway Station (87071), which is approximately 25m to the south of the Site, as the gate was locked. However, the Site does make a positive contribution to the setting of this asset, which includes extensive views across Llanddulas beach.

The coordinates of the four shipwrecks (519089; 27153; 271555; 271362), the wreck of a Second World War Spitfire (130299), and the remains of a modern timber jetty (34279) were checked but none could be physically verified due to health and safety reasons as these were underwater at the time of the site visit. However, the walkover included the area of the Site boundary and there was no evidence of shipwrecks or the wreck of the Spitfire within this area. In addition, the Llysfaen Quarry Tramway (34280) could not be visited as it was on private land. However, as it runs under the railway and A55 Expressway, it is not visible from the Site.

Directly to the southeast of the Llanddulas Lifeboat House lies the Dulas Railway Viaduct (87069), which is approximately 50m to the south of the Site. It was not possible to get onto the viaduct, but much like the Llanddulas Lifeboat House (34207), the viaduct commands wide views of Llanddulas beach (Plate 11), and therefore, the Site also makes a positive contribution to its setting.

6.4.3 CMU 3-2B: Llanddulas Beach

This CMU begins on its western end where the previous CMU ended, from where the River Dulas empties into Liverpool Bay (SH 91134 78714), and continues along Llanddulas Beach until it reaches just north of The Beach Caravan and Chalet Park (see Figures 1–2 in Appendix A). This caravan camp is located just off Beach House Road via the A547/Abergele Road. The CMU continues along Llanddulas Beach until it reaches its eastern end, which is roughly halfway between the fourth and fifth set of groynes along the Llanddulas Coastal Path, at approximately SH 91809 78332.

The Site in this CMU is approximately 480m in length and a maximum of 103m in width to stretch from approximately the first four groynes opposite The Beach Caravan and Chalet Park until just past the car park on Beach House Road, opposite the railway bridge (see Figures 2a–3b in Appendix A). A compound is proposed in the location of the car park. The Site is adjacent to Beach House Road and includes the Llanddulas Coastal Path, a small amenity grassed area running between the road and the coastal path, and the beach to approximately the MHW mark (Plate 12).

The OBC confirmed that in this CMU, the coastal defences contain timber groynes constructed between 1973-1974, timber groynes reinforced and extended with rock constructed in 1991, and a low level rock revetment that was constructed in 1998 (CCBC 2021, 10). The rock revetment post-dates the survey by CPAT, however the description of the foreshore, beach and caravan camp remains accurate.

Approximately 30m to the south of the A55 Expressway is the northern boundary of the Grade II* Registered Historic Park and Garden of Gwrych Castle (GD58), the ancestral home of the Lloyds of Plas yn Gwrych from at least the beginning of the 17th century

(National Library of Wales, 2022). The northern boundary of Gwrych Castle, a Grade II* Registered Historic Park and Garden (GD58), is approximately 250m to the south of the Site. The parkland is to the south of the railway and the A55 Expressway. The wider area and the historic mapping have been discussed in reference to historic mapping resources in section 6.3.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Conservation Areas, Protected Wreck Sites or Registered Battlefields within the study area around this CMU (see Figures 2–2a in Appendix A).

Gwrych Castle is a Grade II* Registered Historic Park and Garden (GD58) within the study area. The estate is bordered on its north side along the A547/Abergele Road by the Gwrych Estate Boundary Wall from Tan-yr-Ogof to Gwrych Lodge (19044). The estate features a park of authentic Gothic aesthetic design by Lloyd Hesketh Bamford-Hesketh, who became the High Sheriff of Denbighshire in 1828. The estate dates from 1819 to the 1830s with walling, lodges, and towers around the prominent landmark of the Grade I Listed Gwrych Castle (231), which is approximately 1.3km to the southeast of the Site and outside of the study area.

There is a grouping of two Grade II* and one Grade II Listed Buildings at Tan-yr-ogof Farm approximately 225m to the south of the Site that are historically relate to the Gwrych Castle historic park (GD58) These are located just to the north of the park's boundary. Plas Tan-yr-Ogof (19040) is a Grade II* Listed castellated lodge that was built around 1814 to serve as a farmhouse on the Gwrych Estate. It later became a night club and is now a residence. Tan-yr-Ogof Farmhouse (19041) is a Grade II* Listed castellated lodge built between 1820-1830 to serve as a farmhouse on the Gwrych Estate. Its Stable and Cart House Range (19042) is a Grade II Listed Building built around 1819 with later 19th and 20th century additions.

Non-Designated Assets

There are eight non-designated assets within the study area around this CMU and all are of post-medieval and modern date (see Figures 3 and 3b in Appendix A). There are records indicating that between the HWM and LMWOT there may be the remains of two shipwrecks (271454; 240576). However, these are located between 150m-225m from the Site. The record for the location of the post-medieval turnpike road (140763) has been discussed. The remaining non-designated assets (194994; 100479; 194995; 403535; 193779) are to the south of the railway and the A55 Expressway and the Site makes no contribution to the setting of these assets.

Site visit

No new heritage assets were identified within CMU 3-2B during the site visit. The coordinates of two shipwrecks between the HWM and LMWOT were checked (271454; 240576) but neither could be visited due to health and safety reasons as these were underwater at the time of the site visit (519089; 27153; 271555; 271362). The walkover included the Site boundary and there was no evidence of the shipwrecks observed within the area.

There is a clear vista to from the western side of CMU 3-2B looking out over towards Kinmel Bay, whereas to the west the view is limited by the headland at Llanddulas beach (Plate 15). Looking south there are very limited views from the frontage as the hillside is screened by trees along Beach House Road.

To the south of the A55 Expressway on the A547/Abergele Road, approximately 225m to the south of the Site are Grade II* Listed Tan-yr-Ogof Farmhouse (19041), Grade II Listed Plas Tan-yr-Ogof (19040) and Grade II Listed Tan-yr-Ogof Farm (19042). Although these buildings have wide views over the fields directly to the north (Plate 13), the view towards

the coastal frontage is screened by a section of trees along Beach House Road (Plate 14). Therefore the Site makes no contribution to the setting of these assets.

6.4.4 CMU 3-3: Llanddulas Tip

This CMU begins on its western end between the first set of groynes opposite the Llanddulas embankment near the eastern end of The Beach Caravan and Chalet Park off Beach House Road, which can be reached from the A547/Abergele Road (see Figures 1–2 in Appendix A). It continues on Llanddulas Beach until it reaches its eastern end, which is approximately opposite the western end of the Castle Cove Caravan Park, which can be reached from Sea Road or the A548/Dundonald Avenue via the A55 Expressway. There are clear unobstructed views across the CMU both to the east and the west, extending up out to the headland at headland at Llanddulas beach, and back over to Kinnel Bay to the east (Plate 15).

The Site continues from CMU 3-2 to the west as a narrow strip approximately 7m in width and 750m in length. At the east end of the CMU is a proposed 'lookout parklet' area measuring approximately 35m in length and 15.5m in width within an overall Site area of 90m in length. The 'lookout parklet' will consist of permanent picnic table sets, cycle stands, beach lounge sets and a litter bin.

The coastal edge when previously surveyed by CPAT (1997) was defined as a concrete block revetted bank with an additional boulder dump, together with a foreshore comprised mostly of sand with some shingle. There is a rough track along the landward side, behind which there is an embankment rising to the railway and A55 Expressway (CPAT 1997, 24). The OBC has updated the area as having had a recent rock revetment (CCBC 2021, 10-11).

The Site is to the north of the Grade II* Registered Historic Park and Garden of Gwrych Castle (GD58) as follows. The western and central part is approximately 8m in width and 800m in length and is located between 250m-125m to the north of the park. The eastern end is approximately 125m to the north of the park near Hen Wrych and is an irregularly shaped area of maximum 90m in length and 16m in width.

The wider area and the historic mapping have been discussed.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Conservation Areas, Protected Wreck Sites or Registered Battlefields within the study area around this CMU. The following designated assets are shown in Figures 2 and 2a in Appendix A.

Gwrych Castle is a Grade II* Registered Historic Park and Garden (GD58) to the south of this CMU and to the south of the A55 Expressway. It has been previously discussed.

There are four Listed Buildings approximately to the south of the coastal frontage of this CMU. All of these are to the south of the A55 Expressway. The first is the Grade II Listed Gwrych Estate Boundary Wall from Tan-yr-Ogof to Gwrych Lodge (19044). It runs alongside the A547 for approximately 1km and is approximately 125m to the south of the Site. The remaining Listed Buildings relate to the complex at Hen Wrych, which are between 125m to 225m to the south of the Site and within the designated boundary of the Gwrych Castle Registered Historic Park and Garden (GD58). These include the Grade II* Listed Hen Wrych Lodge (19039), the Grade II Listed Hen Wrych House (19038), and the Grade II Listed Hen Wrych Farm (275). This group listing reflects a multi-period complex constructed between the 16th-18th centuries to serve the Lloyd family prior to the construction of Gwrych Castle. The house was originally the junior house of the Morgans of Golden Grove before becoming the seat of the Lloyds of Gwrych. It was the childhood home of the poet Felicia Hemans from 1800-1809.

Non-Designated Assets

There are 10 non-designated assets within the study area around CMU 3-3 (Llanddulas Tip), and all are of post-medieval and modern date (see Figures 3 and 3b in Appendix A). This includes an additional non-designated asset, Ty Crwn (JBA-1), which was observed during the site visit.

Ty Crwn cottage (JBA-1) primarily dates to the 1830s and was once part of the Gwrych Estate and was used by the Lloyd family for sea bathing (Ridout 2019). Previously in poor condition, it has been renovated with modern extensions and is now a privately owned holiday rental. The beach and the sea form key views from the front of the cottage, which is approximately 75m to the southeast of the 'parklet' area of the Site. The Site boundary is adjacent to the fence approximately 20m to the front of the cottage. The Site makes a positive contribution to the setting of this asset.

There are records that there may be the remains of four shipwrecks between the HWM and LMWOT, approximately 200m-300m to the north of the Site (271450; 525143; 21590; 271731). The record for the location of the non-designated post-medieval turnpike road (140763) has been discussed. The remaining assets (27573; 96075; 301600; 27252) are to the south of the railway and the A55 Expressway and the Site makes no contribution to the setting of these assets.

Archaeological Surveys and Events

A photographic survey (95089) was carried out at Hen Wrych Farm Site 3 in 2005 and is the only event recorded within this CMU.

Site visit

There was one new heritage asset identified in CMU 3-3, a small cottage adjacent to the beach frontage called Ty Crwn (JBA-1), which is the historic bathing house of the Lloyds of Gwrych (Plates 16-17). This is a 19th century building and there is a modern extension to the rear. Although somewhat obscured by the current sea wall, vegetation and a low wall between the property and the sea wall, the front of Ty Crwn has expansive views across the whole beach frontage. The Site makes a positive contribution on the setting of this property.

There are four recorded shipwrecks between the HWM and LMWOT (271450; 525143; 21590; 271731). However, none could be visited due to health and safety reasons as they were underwater at the time of the site visit. The walkover included the Site boundary and there was no evidence of the shipwrecks observed within the area.

The group listing at Hen Wrych, which is within the boundary of the Grade II* Registered Historic Park and Garden of Grwrych Castle (GD58), was assessed from the A547/Abergele Road, which is bordered by the park's Grade II Listed Boundary Wall (19044). The Grade II* Listed Hen Wrych Lodge (19039) is set back from the A55 and the railway (Plate 18). The exterior of the lodge was observed adjacent the A547/Abergele Road, which is recorded as the location of the former post-medieval turnpike road (140763). The Grade II Listed Buildings associated with the lodge include Hen Wrych House (19038) and Hen Wrych Farm (275) and these were not visible from their locations within the park boundary. It was observed that the views towards the sea are limited along the park's Grade II Listed Boundary Wall (19044) and opposite the Hen Wrych complex. This is due to screening from hedges and trees that border the A55 Expressway and the way the land falls to the north beyond the A547, causing the A55, railway and beach to disappear from view (Plates 19-20). Therefore, the Site makes no contribution to the settings of the northern side of the Grade II* Registered Historic Park and Garden (GD58), including Hen Wrych Lodge (19039), Hen Wrych House (19038), Hen Wrych Farm (275), or the Gwrych Estate Boundary Wall from Tan-yr-Ogof to Gwrych Lodge (19044).

6.4.5 CMU 3-4: Pensarn Beach

This CMU begins on its eastern end on Llanddulas Beach opposite the western end of the Castle Cove Caravan Park, which can be reached from Sea Road or the A548/Dundonald Avenue via the A55 Expressway. It then continues along Pensarn Beach (Plate 21) until it reaches its eastern end opposite the sewage pumping station to the east of the Harts Caravan Park, which can be reached via the A548/Towyn Road off the A55 Expressway (see Figures 1–2 in Appendix A). From this CMU there are clear expansive vistas of the Site towards the east and west looking back towards Colwyn Bay and Kinmal Bay (Plate 22). To the south the immediate views are of the town of Abergele itself and the Castle Cove Caravan Cove, limited to the structures directly adjacent to the foreshore.

The Site in this CMU has two separate parts. Access to both Site areas will be made via the A55 Expressway and Sea Road. The first begins as an area of proposed beach recharge approximately 55m in width by 275m in length opposite the western end of Castle Cove Caravan Park. It continues as a temporary access to permanent works by narrowing to 10m in width by approximately 1.5km in length as it moves east along the beach, staying in front of the Pensarn Promenade until it wraps around its eastern end. It continues running parallel to the railway for approximately 600m in length by a maximum of 30m in width until it is opposite the sewage pumping station on Towyn Road, where the CMU ends. Along this side of the Site, there is a bench location proposed where the Llanddulas Coastal Path meets the railway bridge, which is part of a path that connects Hart's Caravan Park with the beach. The access point to the beach at Sea Road, close to the railway station, will also be upgraded.

The other part of the Site in this CMU is the proposed new secondary defense wall, which is located to the west of the Pensarn Promenade. The area is situated between the eastern end of Castle Cove Caravan Park and a car park to the west of The Beach Cafe, which currently encompasses a small area of beach between the Llanddulas Coastal Path and a private road that connects the car park with the caravan park. The area measures 380m in length by a maximum of 28m in width. The northeast side of the Site is adjacent to the western end of the promenade and features a proposed 'lookout parklet'. The 'lookout parklet' will consist of permanent picnic table sets, cycle stands, beach lounge sets and a litter bin.

The western coastal edge of this CMU when previously surveyed by CPAT (1997) was defined as a pebble and shingle bank with a sandy foreshore, together with a sea wall placed in front of the caravan camp that is to the north of and alongside the railway (CPAT 1997, 25). The eastern end features the Pensarn Promenade and the Abergele Railway station, the Station Business Park, and another caravan camp. The village of Pensarn is immediately to the south of the railway station. Further holiday parks and caravan camps are to the south of the railway line and towards the east. The Llanddulas Coastal Path cuts across the CMU.

The Pensarn Promenade consists of shelters, public toilets, three car parks, and a play area to the east. There are access points leading from the car parks onto the beach at the western, central and eastern end. Sea Road leads from Abergele to the promenade directly from the south; alternatively, the CMU is reached by the A55 Expressway and the roundabout to the southeast.

The OBC confirmed that the coastal defences in this CMU consist of a setback floodwall constructed after heavy floods in the 1990s and a section of old rock groynes of unknown date (CCBC 2021, 10). The wider area and the historic mapping have been discussed in section 6.3.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Conservation Areas, Protected Wreck Sites or Registered Battlefields within the study area around this CMU. The following designated assets are shown in Figures 2 and 2b in Appendix A.

To the south of the A55 Expressway is the Grade II* Registered Historic Park and Garden of Gwrych Castle (GD58), which has been discussed.

There are five Listed Buildings within the study area around this CMU. The closest are four Grade II Listed Buildings related to the 19th century Abergele and Pensarn Railway station and are clustered approximately 10m to the south of the Site. These include the Abergele and Pensarn Railway Station Booking Hall (18703), the 'Up' and 'Down' Platform Buildings (18704, 18705), and the LNW Type 4 Signal Box (18706). These four Listed Buildings comprise a rare grouping of surviving, mostly unaltered examples of late 19th century railway structures exhibiting terracotta detailing. The Abergele and Pensarn Railway Station Booking Hall (18703) was designed by the English railway architect Francis Thompson and constructed by Chester and Holyhead Railway. The present building and the 'Up' and 'Down' Platform Buildings (18704, 18705) date to the 1883 modifications made by L&NWR. The 'Up' Platform features a waiting room and cloakrooms, and the line at the rear, by the beach, was used for camping coaches. The LNW Type 4 Signal Box (18706) was built around 1897 and features a 60 lever frame, of Tumbler type, of which many are no longer in use.

The remaining asset is a Grade II Listed English Presbyterian Church (18696) that is approximately 175m to the south of the Site. It was built in 1877-1878 in an Early Gothic style by Richard Owens of Liverpool in order to serve the growing English-speaking community in Pensarn at the end of the 19th century.

Non-Designated Assets

There are twelve non-designated assets within the study area around CMU 3-4 (Pensarn Beach) (see Figures 3, 3c-3d in Appendix A).

This CMU produced the earliest artefacts found within the study area. A late Mesolithic Abergele anvil stone (100485) was found approximately 110m to the north of the Site, potentially on the remains of a Palaeolithic or late Mesolithic submerged forest (524722) approximately 50m to the north of the Site. A mid to late Neolithic polished stone axehead (651571) was also found approximately 75m to the north of the Site and reported to the Portable Antiquities Scheme (PAS) in 2013.

Approximately 200m to the north of the Site are the confirmed remains of a wooden shipwreck (164090). The lower elements of the stern, port and starboard futtocks and possible bowsprit were reported as visible in 2019. Subsequent survey by CPAT in 2019 has led to the tentative identification of the vessel as the Endeavour, a sloop lost in 1854 (271368). There are records that there may be the remains of three further shipwrecks (27151; 271455; 544282) approximately 50m-375m from the proposed works area.

An unusual gold *fede* or fidelity ring (961767) bearing the inscription 'After consent ever content' was found approximately 35m to the north of the Site and reported to the PAS. The form and shape of the ring and lettering style of the inscription date it to the 17th or 18th centuries. The ring is now at the National Museum Wales.

There are records of two non-designated assets to the south of the railway line within this CMU. The first is a record for the Pensarn Welsh Calvinistic Methodist Chapel (Ger-Y-Mor) (7434) that was built in 1858; the church has since been demolished and the location converted into residential accommodation. On South Parade, approximately 200m to the south of the Site, is the record of Canolfan Dewi Sant (129592), which was a tin church that was built in 1866 by David Evans. It was replaced with a new building in 2010. As these assets are no longer extant there will be no impact as a result of the Proposed Development.

The final asset is the Abergele milestone (165063), which is approximately 250m to the south of the Site. It is set within a stone wall within the Gwrych Castle Grade II* Registered Historic Park and Garden (GD58). Its setting is its stone wall and its immediate surroundings within the park and therefore the Site does not contribute to its setting.

Archaeological Surveys and Events

There are three events recorded in this CMU. A preliminary survey was undertaken in 2019 approximately 200m to the north of the Site by CPAT at low evening tide of a wrecked vessel at Pensarn Beach (164091). Initial observations suggested that the lower portions of wooden vessel were present. Remaining partially submerged, the lower elements of the stern, port and starboard side of the vessel were visible. The bow appeared to be lost or submerged, although elements of a possible bowsprit were visible. The vessel has been tentatively identified as the wooden sloop Endeavour, which was lost in 1854.

The remaining events are as follows. There was a photographic survey (132804) of the Grade II Listed English Presbyterian Church (18696) 175m to the south of the Site prior to its conversion. Nearby on South Parade, there was a photographic survey undertaken in 2010 ahead of the development at Canolfan Dewi Sant (129321), a multi-purpose community church and facility.

Site visit

There were no new heritage assets identified within CMU 3-4 during the site visit. Records show that within this CMU between the HWM and LWMOT there may be the remains of three shipwrecks (27151; 271455; 544282). However, none of these could be visited due to health and safety reasons as they were underwater at the time of the site visit. The walkover included the Site boundary and there was no evidence of the shipwrecks observed within the area. Further, there was no evidence observed of peat or ancient submerged forest remains (524722) observed on the shore, including within the Site boundary and as close to the location of the findspots of the Mesolithic and Neolithic artefacts (100485; 651571) as was possible to visit due to the tide.

The western end of the Site is closest to the northern boundary of the Grade II* Registered Historic Park and Garden of Grwrych Castle (GD58), at approximately 150m. Views to the Site were observed from the northern boundary of the park at A547/Abergele Road along the alignment of the former post-medieval turnpike road (140763), which continues in a south-easterly direction towards Abergele. Views from the A547/Abergele Road towards the Site between Hen Wrych Farm and the northwest end of Abergele were observed to be screened by vegetation and the intervening coast, which drops dramatically to the north. This causes the A55, railway and beach to drop from sight, while the sea remains present in long views. As the A547/Abergele Road heads southeast into Abergele, the view westwards towards the sea becomes obscured by intervening housing and development to the northwest of Abergele. The Site therefore does not contribute to the setting of the designated park.

There are five designated Grade II Listed assets within CMU 3-4, all of which were visited. Four of these are located around the Abergele and Pensarn train station, which includes the Abergele and Pensarn Railway Station Booking Hall (18703) (Plate 23), the "Up" and "Down" Platform buildings at Abergele and Pensarn Railway Station (18704; 18705) (Plates 24-25), and the Signal Box at Abergele and Pensarn Railway Station (18706) (Plate 26). It was observed that there is very good intervisibility between the designated assets. From the platforms there are limited views towards the southern edge of the Site, which is situated on elevated ground above the station. The current sea wall also blocks the view of the foreshore directly to the north from the platform levels (Plate 27). However, there are some limited views towards the Site from the ramp leading down from the Abergele and Pensarn Railway Station (18703). Directly to the west of all four assets there is a bridge at Sea Road crossing the railway line and from this vantage point it is observed that there is very good intervisibility between the foreshore and all four designated assets associated with the train station (Plate 28). From the edge of the sea wall looking back towards the south, there are clear views of the train station buildings (Plate 29). Overall, the Site makes a limited positive contribution to the settings of four designated assets at Abergele and Pensarn train station (18703-18706).

Set back away from the beach frontage on the corner of Berllan and Towyn Road is the Grade II Listed English Presbyterian Church (18696) (Plate 30). This has no visibility north towards the Site as the view is blocked by Kingsley Holiday Park and the residential housing on Towyn Road (Plate 31). The Site therefore does not contribute to the setting of the church.

6.4.6 CMU 3-5A: Belgrano Beach

This CMU begins on its western end opposite the sewage pumping station to the east of the Harts Caravan Park, which can be reached via the A548/Towyn Road off the A55 Expressway. It then continues east along Belgrano Beach until just before the railway level crossing to the northeast of the Millers Cottage Holiday Park caravan camp in Towyn, which is located off Gaingc Road, via the A548/Towyn Road and the A55 Expressway (see Figures 1–2 in Appendix A). The shorefront at the CMU consists of a sandy beach, with rock armour and the current sea wall which backs onto the public cycle path to the south, and the railway line to the south of that again (Plate 32). From the shorefront there are wide unobstructed views across Pensarn Beach and Kinmel Bay (Plate 32). The views to the south are dominated by a series of caravan Parks.

The Site continues from the previous CMU opposite the sewage pumping station on Towyn Road, adjacent Hart's Caravan Park, and widens into an area of proposed rock armour measuring approximately 50m in width at its maximum point and approximately 615m in length. This side of the Site encompasses the beach and the Llanddulas Coastal Path until it reaches rock revetment to the north of the railway, where it then narrows to approximately 6m in width to capture the coastal path. Here there is a break in the Site for the access point leading off the railway bridge opposite Ty Gwyn Caravan Park. At this location there is an area for a proposed new bench. The Site continues as a narrow strip of approximately 6m in width along Belgrano Beach along the Llanddulas Coastal Path, between the railway and the beach, until it reaches the next access point onto the beach, where it widens to 20m for approximately 70m, and then widens again to approximately 30m for 265m. It gains a maximum of 45m in width along 65m in length before reaching the end of the CMU at approximately SH 96592 79603, which is just to the west of the level crossing to the north of Miller's Cottage Holiday Camp off Gaingc Road. As the Site widens from the railway bridge, it takes in more of the beach frontage and grassy areas straddling the Llanddulas Coastal Path. Access to the Site and the nearest compound is to the east (CMU 3-5C Kinmel Bay Beach) from Towyn Road via Foryd Road.

The western coastal edge of this CMU when previously surveyed by CPAT (1997) was defined as a shingle bank with a sandy foreshore from the western side of the CMU, and towards the eastern side of the CMU, a new 'boulder dump' alongside the railway, with holiday parks along the land edge, together with a foreshore comprised mostly of sand with shingle along the HWM (CPAT 1997, 25). The OBC confirmed that the coastal defences in this CMU consisted of a rock revetment of unknown date (CCBC 2021, 10). The CPAT survey suggests the revetment may date to the late 1990s.

The urban area of Belgrano is to the east of Pensarn and to the west of Towyn at approximately SH 955789. The name 'Belgrano' does not appear on historic maps until the OS six inch to the mile (1:10,560) map revised in 1938 that was published ca 1944. Prior to this, the area between the villages of Pensarn and Towyn is shown as agricultural fields with farmsteads in the OS six-inch maps of 1880, 1900, 1914, and 1934. Shortly after the Second World War, the OS six-inch map of 1953 and OS National Grid (1:10,560) map of 1964 show rapid change in this area in this form of holiday camps and caravan camps. Groynes appear for the first time within the CMU just opposite the new holiday camps marked as 'Children's Summer Camp' and 'North Wales Holiday Camp' in the OS National Grid map of 1964. The wider area and the historic mapping have been discussed.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Protected Wreck Sites or Registered Battlefields within the study area around this CMU.

Non-Designated Assets

There are 10 non-designated assets within the study area around CMU 3-5A (Belgrano Beach) (see Figures 3 and 3d in Appendix A). All are of post-medieval and modern date and are recorded between 125-265m to the south of the Site. The North Wales Holiday Camp, otherwise known as Elwy Hall (412066), is no longer extant. Its former location is now the location of the Lyndale Holiday Park and modern housing near Pen-Y-Cae Road. There are nine assets that refer to traditional farmhouses and associated agricultural buildings that have been identified in 19th century OS historic maps (193731; 193732; 194833–194839). Of these, the seven assets at Ty-gwyn are still extant (193731, 194833–194838).

Site visit

There were no new heritage assets identified within the CMU during the site visit. The farm buildings at Ty-gwyn were visited (193731, 194833–194837) (Plate 33). The views seawards are now blocked by the surrounding caravan park with very limited visibility back towards it from the sea wall (Plate 34).

6.4.7 CMU 3-5B: Towyn Revetment

This CMU begins on its western on the beach frontage (Plate 35) just before the railway level crossing to the northeast of the Millers Cottage Holiday Park caravan camp in Towyn, which is located off Gaingc Road, via the A548/Towyn Road and the A55 Expressway (see Figures 1–2 in Appendix A). It continues east along Towyn Beach until it reaches its end opposite the eastern end of the Golden Sands Holiday Park. This holiday park is in Sandy Cove off the A548/Foryd Road in Kinmel Bay, which can be reached via St Asaph Avenue following the A547/Abergele Road from the A525 off the A55 Expressway. There are five access points along the defences across this CMU that are accessible via the Llanddulas Coastal Path that cuts across the CMU. The coastal path runs parallel to the railway, which borders the coastal frontage to the south of the CMU.

The Site in this CMU is comprised of three parts, the third of which continues into the next CMU. Access to the Site in this CMU will be from the east via St Asaph Avenue off Towyn Road following Foryd Road. The first part of the Site in this CMU continues from the previous CMU just to the west of the level crossing to the north of Miller's Cottage Holiday Camp. This location is proposed as a compound and measures approximately 90m in length by 50m in width. A second compound within this CMU is proposed opposite the Abbeyford Holiday Park, between Knightly's Fun Park and the next caravan park to the east. This second compound is approximately 115m in length by a maximum of 90m in width. The third part of the Site is on the eastern end of the CMU opposite the Golden Sands Holiday Park. It incorporates the western access point onto the beach and includes the area of rock revetment before it becomes Kinmel Beach. Rock armour is proposed here and the Site measures approximately 360m in length and a maximum of 100m in width.

The western coastal edge of the CMU when previously surveyed by CPAT (1997) was defined as comprising a new boulder dump, behind which there was a narrow grassy strip alongside the railway with holiday camps to the south, together with a beach comprised primarily of sand with some shingle at the HWM. At the eastern side of the CMU, there is also a concrete sea wall with more holiday camps to the south; the sandy beach continues with shingle present at the HWM (CPAT 1997, 26).

The OBC confirmed that the coastal defences in the western and central part of this CMU consists of defences for the railway that were constructed in the 1840s (CCBC 2021, 10). A sea wall was constructed in the 1960s, which was then followed in the 1990s by a rock revetment, which was extended at an unknown period along the eastern side of the CMU.

The town of Towyn at approximately SH 974794 is to the west of the small urbanised area of Belgrano and the town of Rhyl. The name appears as 'Tywyn' in the first edition six inch to the mile (1:10,560) map of 1878 as a small village with a Church, a Methodist Chapel, and six farmsteads to the south of the L&NWR (Chester and Holyhead Branch) Railway. The name changes to 'Towyn' in the OS Second edition six inch to the mile map of 1900. The area immediately south of the Proposed Development area along the beach front of the CMU is characterised as agricultural fields with farmsteads, as shown in the OS six-inch maps of 1878, 1900, 1914 and 1949. Breakwaters appear in Proposed Development area of the CMU on the revised six inch map of 1949 just to the opposite the northwest corner of the present-day Golden Sands Holiday Park, where there is currently rock revetment.

The OS six-inch map of 1953 shows 'Holiday Camps' appearing where the present-day Golden Sands Holiday Park is now located. Towyn shows modest growth in the first half of the 20th century with new housing and development slowly transforming the former agricultural landscape in the old village centre. Following the Second World War, the OS National Grid (1:10,560) map of 1964 shows rapid change. The village becomes bordered on its north side by holiday parks and caravan camps that line the coast, effectively connecting Towyn to Belgrano. The sea wall also appears at this time as the rest of Towyn continues to expand to the south and east.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Protected Wreck Sites or Registered Battlefields within the study area around this CMU.

Non-Designated Assets

There are eight non-designated assets within the study area around the CMU and all date to the post-medieval and modern period (see Figures 3 and 3e in Appendix A). There are records that the remains of two shipwrecks (240961; 271737) may be located close to the LWMOT. These are recorded approximately 200-275m from the Site. The location of the Winkups Holiday Camp (418593) is recorded approximately 325m to the south of the Site, however the triangular camp extends to the railway on its north side, to the A548/Towyn Road on its southern side, and to Peris Avenue on its western side. It was founded in 1925 and is one of ten modern holiday parks in north Wales owned by the leisure company Lyons. It has been extended and extensively modified throughout the 20th century.. Three assets at Gaingc-fawr located approximately 400m to the southeast of the Site (193733; 194840; 194841) refer to traditional farmhouses and associated agricultural buildings that have been identified in OS historic maps. These appear no longer extant as the area has been redeveloped into the Gaingc View Holiday Park. The record for the location of the early 20th century rifle range (300223) is approximately 160m to the south of the beach frontage. The range is no longer extant as the location has been redeveloped as part of the Golden Sands Holiday Park. Salem Chapel (97202) is recorded approximately 115m to the southeast of the Site. The chapel is no longer extant as its former location has been redeveloped within Miller's Cottage Holiday Camp.

Site visit

There were no new heritage assets identified within the CMU during the site visit. There are the remains of two shipwrecks recorded as being within the vicinity of the CMU (240961; 271737), approximately 200-275m from the Site; both are close to the LWMOT. Neither of these were visited as their coordinates were underwater at the time of visiting. The walkover included the two areas that make up the Site within the CMU and there was no evidence of the shipwrecks observed within these areas.

There are large expansive views across the frontage of CMU 3-5B looking out over the coast, both to the west (Plate 35) and to the east (Plate 36). There were no other heritage assets that remained extant to be visited within CMU 3-5B.

6.4.8 CMU 3-5C: Kinmel Bay Beach

This CMU begins on its western end opposite the eastern end of the Golden Sands Holiday Park in Sandy Cove off the A548/Foryd Road in Kinmel Bay, which can be reached via St Asaph Avenue following the A547/Abergele Road from the A525 off the A55 Expressway. The CMU then continues along Kinmel Bay Beach until the CMU reaches its eastern end adjacent to the car park at Rhyl Harbour (approximately SH 99583 80879). Rhyl Harbour is located where the River Clwyd empties into Liverpool Bay (approximately SH 99465 80754) (see Figures 1–2 in Appendix A).

The CMU is defined on its southern side by the Kinmel Bay Promenade, which is situated behind the sea wall (Plate 37). The areas immediately to south of the promenade, from west to east, are as follows: the Golden Sands Holiday Park; residential housing off Foryd Road in the northern part of the town of Kinmel Bay; the Sunnyvale Caravan Park; Rhyl Harbour; and the River Clwyd/Liverpool Bay. There are seven access points leading to the beach along the sea wall and two access points to the beach frontage at the eastern end of the CMU to the north of the Golden Sands Holiday Park.

The Site in this CMU is described in four parts. It begins on the western end of Kinmel Bay Beach along the sandy foreshore and measures approximately 1.1km in length by 31m in width. Second, there is a proposed compound just to the south of the Promenade Pay and Display Car Park, located off St Asaph Avenue. The compound measures approximately 40m in length by 30m in width. Third, as the main section widens as it continues along the beach just to the north of Roland Avenue and the promenade. This section measures approximately 530m in length and 40m in width, and the western side is proposed for widening of the promenade area, while the eastern side is proposed for rock armour. Finally, the eastern side of the Site comprises the access route from Rye Harbour via Horton Nose Lane off the A548/Foryd Road. It measures a total of approximately 245m in length and a maximum of 8m in width.

The western coastal edge of this CMU when previously surveyed by CPAT (1997) was defined by the sea wall to the south of the beach that featured shingle along the HWM together with a sandy foreshore. The survey noted that although some sand dunes survived along the land edge to the south the land was mostly occupied by holiday camps and caravan camps (CPAT 1997, 27).

The OBC confirmed that the coastal defences in this CMU consist of a sea wall and groyne system installed around 1967 on the eastern end of the CMU, renourishment to the shingle beach in 2013-2015, and the installation of a new flood gate in 2015 (CCBC 2021, 10).

An area labelled as 'Kinmel Beach' is shown in the OS 25-inch (1:2,500) map of 1872. The coastal edge is depicted with dunes and there are parcels of agricultural land immediately south of proposed works area. The coast and the agricultural land extends further than the present day indicating coastal erosion has affected the area. The map shows Foryd Lodge, Foryd House Vaults, a Landing Stage, Foryd-fawr, the Life Boat Station and a number of other buildings that are no longer extant in the eastern area of the CMU around Foryd. Rhyl Bridge is shown to the southeast but the map does not show detail of Rhyl.

The OS first edition six inch to the mile (1:10,560) map of 1878 is similar to the previous map but with more detail about the surrounding area. Rifle ranges are shown along the beach with 'Mantlet' (mantelet targets) indicating target ranges. To the east of the CMU around Foryd, the area indicates new industrial and commercial activities including the Foryd Saw Mills and the Shipbuilding Yard. Across Rhyl Bridge and to the north of what would later become Marine Lake, the map shows Foryd Hall, Packet Hotel, another Ship Building Yard, and agricultural fields between Foryd Hall and the main town centre of Rhyl. A railway runs around the south side of Foryd Lodge and Ferry House Vaults, and another railway line (the L&NWR) across the River Clywd to Rhyl Station.

As Foryd expanded in the 19th century, silting of the Foryd Harbour due to the River Clwyd was a constant issue. Though the mid-1800s saw many large timber vessels docking at the timber wharfs, by the 1960s, large vessels were unable to enter (CPAT 2007a, 15). The area shows little change on the OS six inch maps of 1900 and 1914 until 1948.

Immediately following the Second World War, a 'Holiday Camp' appears on the eastern side of the beach, while new residential development is shown immediately to the south of the beach and to the west of Foryd. The area to the north of the railway line, which were late 19th century agricultural fields that likely dated to previous periods, have become nearly completely developed as shown in the OS National Grid maps of 1963 and 1970. These maps show the new Kinmel Bay Promenade, new breakwaters along the shoreline, and new holiday camps along the western and eastern ends of the CMU.

Designated Assets

There are no World Heritage Sites, Scheduled Monuments, Protected Wreck Sites or Registered Battlefields within the study area of this CMU. The designated assets within the study area of this CMU are shown in Figures 2 and 2c in Appendix A.

The River Street Conservation Area (311) in Rhyl is approximately 725m to the east of the Site. This Conservation Area is within Denbighshire County Council (DCC) and is designated for being a good example of 19th century town planning characteristically based on a rectilinear grid (DCC 2013, 20). It is also for being representative of a seaside resort that developed over a relatively short space of time and is characterised as having a 'modest elegance' with buildings that display late Victorian, Arts and Crafts, Edwardian and Art Deco styles of architecture (DCC 2013, 20). It is further noted that the River Street conservation area, which features sea front views, is a key strength in attracting a wider range of residents to West Rhyl (DCC 2013, 22).

There are four Grade II Listed Buildings within the study area around this CMU: Nos 72, 73, 74 and 75 West Parade (14334–14337), which combine to create a terrace consisting of 5 double-fronted villas, 3 storeyed with basement and attics, and 3-storeyed wings to rear. (The fifth Listed Building in this terrace, No 71 (14333), is just outside of the study area.) The terrace faces towards the sea and is within the River Street Conservation Area (311). It is approximately 715m to the east of Site, between Butterson Road to its west and River Street to its east. The Listed Buildings in this terrace should be treated as a group. The terrace was built in stages and completed by 1889. The terrace retains almost all of its original details as late 19th century purpose-designed boarding houses that are the best example of their type in Rhyl. The terrace displays the characteristic multi-storeyed form with prominent bay windows that served as a model for the sea-side boarding house in the area in the later 19th century. Drawing rooms are located at the front of each house and on each floor to command a sea view.

Non-Designated Assets

There are 32 non-designated assets within the study area around this CMU (see Figures 3 and 3f in Appendix A). One asset dates to the Mesolithic (524773), one asset refers to a Roman coin (17613), and the remainder of the assets date to the post-medieval or modern period.

The closest assets to the coastal frontage of the Site are located within the Sunnyvale Caravan Park. Records indicate that most are no longer extant as the area was developed into holiday parks in the earlier 20th century. Two parts of the Liverpool and Holyhead Telegraph (300825; 300827) were built in 1828 and 1848, respectively, and there are no remains of either building at their respective locations. Three late 19th to early 20th century rifle ranges (141797; 141798; 141856) recorded approximately 100m-160m to the south of the Site within the Sunnyvale Caravan Park are also no longer extant. The location of the modern Foryd Bridge Holiday Camp (30022) is recorded within the Sunnyvale Caravan Park, approximately 80m to the south of the coastal frontage of the Site. The later caravan park may have incorporated some of the buildings from the earlier holiday camp

that began operation sometime in the 1930s or immediately after the end of the Second World War.

There are nine shipwrecks recorded within this CMU. Kinmel Bay Wreck 8243 (64185) is reported as measuring 17m in length and is approximately 350m to the north of the Site. Four further shipwrecks (271628; 271598; 524837; 524878) are recorded between 400m and 625m to the north and northeast of the Proposed Development. Three are recorded at Foryd Harbour (271360; 34276; 442), approximately 125m to the south of the eastern end of the Site. A potential fourth (506949) was recently visible in photographs of Foryd Harbour dating to July 1987, but its remains have not been further explored or identified. Its coordinates are also approximately 125m to the south of the eastern side of the Proposed Development.

There are a number of records within the CMU that refer to assets that are no longer extant as follows:

- The old Foryd breakwaters (83080) that correspond to the OS Second edition map of 1899 are recorded approximately 50m to the west of the eastern part of the Site. The area is now the Rhyl Harbour Car Park and Aqua Marine Solutions boat service company.
- The post-medieval Foryd railway (83559) is recorded approximately 180m to the west of the eastern end of the Site. This was a temporary structure located on the former Foryd beach on land owned by Hugh Robert Hughes of Kinmel Hall, a shareholder of the Vale of Clwyd Railway, who also constructed a terminal station at Foryd Pier (Wright 2017). This closed in 1959 and nothing remains of the former railway or the Foryd Pier Station at the former Foryd Pier, which has since been redeveloped.
- A landing stage (83523) is recorded across the river approximately 130m from the east side of the Site but is no longer extant as the shoreline has been redeveloped.
- Foryd Hall in Rhyl (35826) and the Bettws Private Hotel (422476) in Kinmel Bay have both been demolished.
- The former locations of a First World War army camp (132170) and the No 3 manoeuvring area of the camp (132184) are recorded at the northern side of the Winkups Holiday Camp, just to the south of the railway.

The remaining assets recorded within the study area around this CMU include the following:

- the potential Mesolithic or earlier remains of submerged forest at Rhyl that was exposed near the mouth of the River Clwyd (524773). This area is recorded approximately 400m to the northeast of the eastern end of the Site. It produced a mattock and other lithic tools below the peat, and an axe was also found within the peat;
- the Kinmel Bay Boundary Stone (101567) approximately 275m to the south of the Site, within the northern area of the Lyons Winkups Holiday Camp, just to the south of the railway line;
- The location of the Foryd former timber yard (83522) is approximately 50m to the west of the eastern part of the Site but very little remains, as the yard has been levelled. One building was retained for a re-development project (CPAT 2007a, 17);
- a post-medieval former industrial brick building at Foryd Harbour (128646) located approximately 80m to the west of the eastern end of the Site. It was once used to facilitate the narrow gauge railway nearby; and

- elements of the 19th century Foryd timber yard wharf (83555) and quay (83521), the latter in partly ruinous condition (CPAT 2007b), which are approximately 60m and 185m to the southwest of the eastern end of the Site, respectively.

Insecure findspots within the study area around this CMU include an incomplete finger ring of likely post-medieval date (122728), a copper alloy finger ring of uncertain date (122769), a post-medieval lead alloy musket ball (122767), and the aforementioned copper Roman coin (17613). The first three objects were recovered between 150m-315m to the north of the Site, while the coin, now lost, is reported to have been found somewhere in Rhyl, approximately 450m to the east of the eastern end of the Site (Davies 1983, 81). The Roman coin is described as a stamped Gaian ass, a copper coin potentially made on the Roman frontier in the manner of bronze issues struck in Rome during the time of Gaius, sometime between AD 41-69 (Davies 1983, 80-81; Kenyon 1992).

Archaeological Surveys and Events

There are four events recorded in this CMU, all of which were carried out in Foryd Harbour, near the eastern end of the Site. Headland Archaeology undertook a geophysical survey in 2010 (153016) and a fieldwalking survey in 2011(153015) for Foryd Harbour Transport Bridge, approximately 16m to the east of the eastern end of the Site. In 2007, CPAT carried out a watching brief and geotechnical investigations approximately 80m to the west of the eastern end of the Site for the Foryd Harbour Infrastructure Works (115408), which provided no indication of prehistoric deposits in this area, suggesting it lies on extensive deposits of sand, shingle and gravel associated with estuarine deposition and the formation of the spit at the mouth of the River Clwyd. CPAT also carried out a watching brief in 2012 approximately 10m to the west of the eastern end of the Site during groundworks associated with the regeneration scheme for the area of Foryd Harbour (152718). No archaeological features or significant artefacts were noted. The area was quarried for gravel until approximately 1960, then utilised as a rubbish dump until it silted up. Deposits in the area are described as natural gravels overlain by silts, sands and gravels deposited in the second half of the 20th century.

Site visit

There were two new heritage assets (JBA-2 and JBA-3) identified on the beach front near to the River Clwyd. They are approximately 100m to the northeast of the Proposed Development between the HWM and the LMWOT. Both have wide views all across Kinmel Bay (Plate 39) and appear to be the remains of a wooden groyne system, most likely the one installed in 1967 (CCBC 2021, 10). In Kinmel Bay there are records of one confirmed wreck (64185) and potentially four other shipwrecks (271628; 271598; 524837; 524878) between 350m to 625m to the north of the coastal frontage of the Site. At the time of visiting the coordinates for these wrecks were underwater and were therefore not visited. Another four shipwrecks are recorded in Foryd Harbour (271360; 34276; 442; 506949). However none were visible at the time of visiting. The walkover included the Site boundary and there was no evidence of shipwrecks observed within the area.

There are wide vistas from the frontage both back towards Rhyl (Plate 37), and also to the west looking across Kinmel Bay Beach (Plate 38). It was not possible to walk within the holiday camps however it was possible to observe that from the south, views are obscured looking inland by the sand dunes, caravans and residential properties that line the beach front.

It was not possible to visit the area reported as presenting peat or ancient forest remains (524773) as it was submerged at the time of the site visit. However, there was no evidence of peat or ancient submerged forest remains observed within the Site boundary or along the coastal frontage during the site visit.

The non-designated heritage assets in CMU 3-5C that were visited include a number of structures in Foryd Harbour as follows: a post-medieval brick building that provided access for one of the narrow gauge railway tracks nearby (128646); and elements of the 19th century Foryd timber yard wharf (83555) and quay (83521). It was observed that there is limited visibility from these assets to the eastern end of the Site, which is the closest part of the Site to these assets and functions as an access route to the coastal frontage at the northern part of the Site. The assets also have no direct line of sight to this northern part of the Site as the views are blocked by the meandering of the River Clwyd and the modern footbridge that crosses it (Plate 40).

The four Grade II Listed Buildings, Nos 72–75 West Parade (14334–14337), within the study area of the CMU were visited. These are situated within the River Street Conservation Area (311) (Plate 41). From the coastal defences in Rhyl there is good intervisibility between West Parade and CMU 3-5C, however from West Parade itself there are limited views as these are blocked by the current sea defences (Plate 42). Looking back up at West Parade from Kinmel Bay Beach there are clear views towards the Listed Buildings (Plate 43).

7 Assessment Methodology

The assessment methodology is based on the Principles for Cultural Heritage Impact Assessment (IEMA/CIfA/IHBC, 2021). The basis for assessing impacts on the historic environment is an understanding of the heritage assets that might be affected by a proposal. Planning policy and guidance emphasise the need to understand the cultural significance of heritage assets, including their setting, reflecting that the primary purpose is to preserve significance rather than no change. The process of gaining this understanding can be broken down into three distinct stages:

Description: Research leading to a preliminary factual statement that establishes the location, nature and setting of the asset.

Cultural significance: Analysis of what we value about the asset and the contribution made by its setting, leading to a statement of cultural significance. Cultural significance is not scaled but can be expressed in terms of four key 'heritage values' as outlined in Conservation Principles for the sustainable management of the historic environment in Wales (Conservation Principles) (Cadw 2011):

- **Evidential value:** every historic asset has a unique story to tell. The surviving historic fabric and detail — whether above or below ground — helps us to understand when and how each historic asset was made, how it was used and how it has changed over time. Pictorial and documentary sources may also increase our understanding.
- **Historical value:** historic assets may illuminate particular aspects of the past. They can help us to understand how people lived and worked, and the beliefs and values they cherished. They may be associated with notable people or events. Through evocation and association, historic assets can connect past people, aspects of life and events with the present.
- **Aesthetic value:** we may value historic assets for their visual qualities, whether they result from conscious design and craftsmanship, or from the fortuitous effect of change over time. Tastes alter and so do historic assets: earlier records and careful analysis of what survives may help in appreciating aesthetic value.
- **Communal value:** historic assets may be cherished by the people and communities who relate to them, and they may play an important part in collective experience or memory. Historic assets can have economic as well as

social value with the capacity to provide a valuable source of income or employment.

Importance: A conclusion regarding the level of protection or consideration that the asset merits in planning policy and cultural heritage legislation. A judgement on importance is scaled and can therefore be expressed in terms of the following criteria:

Importance	Examples
High	Scheduled Monuments Listed Buildings Conservation Areas Registered Historic Parks and Gardens Registered Historic landscapes Places or structures of international importance due to their 'outstanding universal value' Non-designated heritage assets of equivalent national importance or potential to contribute significantly to national research objectives
Medium	Non-designated assets of regional or high local importance with potential to contribute significantly to regional and local research objectives. This includes assets which have particular regional associations or may have important associations in a local context (e.g. they have significance to local population or embody something of the special identity of a locality).
Low	Non-designated assets which are relatively poorly preserved or have limited importance in a local context and low potential to add to local and regional research objectives.
Negligible	Assets that have very limited or no archaeological, historical or cultural importance.
Uncertain	Sites where there is evidence that a heritage asset may exist, but where there is insufficient information to determine its nature, extent and degree of survival given current knowledge.

Having understood cultural significance, the next step is to understand the proposed change(s) and the impact they would have on cultural significance. The process of evaluating the consequences of change can be usefully broken down into three distinct analytical stages:

Change: A factual statement of how a proposal would change an asset or its setting including physical, visual appearance, scale, nature and duration.

Impact: An assessment of the degree to which any changes would increase or decrease the cultural significance of an asset. Impact is scaled and the magnitude of impact is a reflection of the extent to which the cultural significance of an asset is changed by a proposal. A judgement of magnitude of impact can be made based on the following criteria:

Magnitude of Impact	Criteria
Major Negative	Causes total destruction, or change to, most key elements of the asset that results in substantial loss of integrity and cultural significance. Comprehensive change to the setting of the asset, which is a critical aspect of the cultural significance of the asset. Any such change would not normally be reversible.

Moderate Negative	Causes change to, or loss of, many key elements which result in a moderate loss of integrity and cultural significance of the asset. Moderate changes to the setting of the asset where this makes an important contribution to the cultural significance of the asset.
Minor Negative	Change to some elements which lead to a limited loss of integrity and cultural significance of the asset. Change to the setting of the asset where this makes a limited contribution to the cultural significance of the asset.
Negligible / No change	No appreciable change to the cultural significance of the asset or its setting.
Minor Positive	Change to some elements which leads to limited improvement in integrity and cultural significance of the asset, or arrests decline. Change to the setting of the asset where this makes a limited contribution to the cultural significance of the asset.
Moderate Positive	Causes change to many key elements which result in a moderate enhancement to integrity and cultural significance of the asset or reverses decline. Moderate changes to the setting of the asset where this makes an important contribution to the cultural significance of the asset.
Major Positive	Causes significant change to most key elements of the asset that results in substantial enhancement of cultural significance. Comprehensive change to the setting of the asset which this is a critical aspect of the asset's cultural significance.

Effect: A conclusion regarding whether an impact matters or not, reflecting the importance of the affected heritage asset. The effect is the measure that brings together the magnitude of the impact and the heritage asset's importance. This a critical stage of the assessment process as this determines the weight that should be given to the matter in either influencing the design of the proposal or ultimately in the test as to whether the proposal will be acceptable and permitted. The effect can be articulated through the use of a matrix which brings together the importance of an asset and the magnitude of impact on the assets significance. Where there are two options for a level of effect it is a matter of professional judgement which should be articulated in the text description as to the level of effect appropriate:

Importance of Asset	Magnitude of Impact			
	No Change	Minor	Moderate	Major
Negligible	Not Significant or Neutral	Slight/ Neutral	Slight/ Neutral	Slight/ Neutral
Low		Slight/ Neutral	Slight	Moderate/ Slight
Medium		Slight	Moderate	Moderate/ Large
High		Moderate/ Slight	Large/ Moderate	Large

8 Assessment of Significance and Assessment of Archaeological Potential

The baseline study identified no heritage assets considered likely to be directly physically impacted by the Proposed Development and 14 heritage assets considered likely to be indirectly impacted by the Proposed Development. This includes one additional heritage asset close to the Proposed Development boundary identified during the walkover site visit undertaken on 21-22nd February 2022. As these are the only heritage assets considered likely to be impacted by the scheme, they are the only heritage assets considered below in the significance and impact assessment. The remaining heritage assets are all sufficiently distant from the CMUs and Proposed Development areas that they will not be physically impacted. The CMUs make no contribution to the settings or significance of these assets and therefore the Proposed Development will not have an impact upon them.

8.1 CMU 3-2A: Llanddulas Revetment

The Llanddulas Lifeboat House (34207) is non-designated and holds aesthetic value by retaining its post-medieval appearance and contributes evidential value of a common activity that took place along the coast throughout the post-medieval period. The views of the sea from the building contribute to the aesthetic value and are characteristic of its coastal location. It has communal value to the people who live in building today, who are able to take in the seafront views, and to the wider area, for which the lifeboat house is a reminder of the history of marine and coastal life in north Wales. Its historical value is somewhat reduced because it is no longer an operating lifeboat house and evidence of how the lifeboat house operated (eg its equipment and layout) has been removed or altered as it has been redeveloped for housing. The Llanddulas Lifeboat House (34207) has low importance.

8.2 CMU 3-3: Llanddulas Tip

Ty Crwn (JBA-1) is non-designated and holds evidential value due to the retention and restoration of the 19th century architectural styles, material forms and construction techniques. The cottage holds historical value to the area as evidenced from being the former bath house to the Gwrych Estate. The views of the seafront from the cottage have aesthetic value and are characteristic of its coastal location. It has communal value as an authentic historic holiday accommodation. The historical value of the cottage is reduced by the modern additions to the interior and exterior. Ty Crwn (JBA-1) has low importance.

8.3 CMU 3-4: Pensarn Beach

The Grade II Listed Abergele and Pensarn Railway Station Booking Hall (18703) holds historical and evidential value due to its links to the English railway architect Francis Thompson, the early Chester and Holyhead Railway, and the early L&NWR. The Grade II Listed Abergele and Pensarn Railway Station "Up" and "Down" Platforms (18704; 18705) and the Grade II Listed Signal Box at Abergele and Pensarn Railway Station (18706) each also contribute historical and evidential value to the area by being relatively unaltered examples of historic railway buildings characteristic of the late 19th century. The limited views towards the sea at the Station Booking Hall (18703) has some aesthetic value and is characteristic of the coastal location, which reflects the history of all four assets as part of the development of the early rail and coastal tourism in north Wales during the late 19th and earlier 20th centuries. Each has communal value to the people who research the history of the industrial period, coastal tourism, and the development and impact of the early railway in north Wales. These assets were built around the same time to function together, thereby constituting a rare historical group survival. As such, they should therefore be treated as a group. The four Grade II buildings at Abergele and Pensarn Railway Station (18703–18706) as a group has high importance.

8.4 CMU 3-5C: Kinmel Bay Beach

The River Street Conservation Area (311) in Rhyl holds historical and evidential value for being a good example of 19th century town planning. It exhibits aesthetic value through its characteristic rectilinear gridded streets, which also reflects its history as a seaside resort. This is further evidenced within the Conservation Area through its key buildings that retain later Victorian, Arts and Crafts, Edwardian and Art Deco styles, material forms, and construction techniques. The Conservation Area has communal value as it has been identified as a key strength for attracting a wider range of residents into West Rhyl. The River Street Conservation Area has high importance.

The Grade II Listed Nos 72–75 West Parade (14334–14337) in Rhyl each retain historical and evidential value by exhibiting architectural styles, material forms and construction techniques that served as a model for the sea-side boarding house in the area in the later 19th century. The views of the sea afforded from the front drawing rooms of each floor of each building have aesthetic value and are characteristic of the coastal location. Each building has communal value to the people who utilise them today as residential housing. Together they constitute a rare historical group survival that retain almost all of their original details. The assets were built in stages with the goal of functioning as a single terrace (along with No 71, which is outside of the study area) and should therefore be treated as a group. Nos 72–75 West Parade (14334–14337) as a group has high importance.

The post-medieval brick building at Foryd Harbour (128646) and the Foryd timber yard wharf and quay (83555; 83521) are non-designated assets and each hold historical and evidential value by evidencing common industrial activities that took place around the Foryd coast and Foryd Harbour in the 19th and 20th centuries. The views towards the River Clwyd and the harbour at each asset have aesthetic value and are characteristic of their locations, which reflect their history as part of industrial development around Foryd and its relationship to the wider area of Rhyl and north Wales during the late 19th and earlier 20th centuries. The historical value of the brick building is reduced due to its condition and because limited evidence remains of its purpose. The historic value of the wharf and quay are reduced as few elements of the wharf remain in situ and much of the quay is in poor condition. The post-medieval brick building at Foryd Harbour (128646), timber yard wharf and quay (83555; 83521) each have low importance.

8.5 Archaeological Potential

The Mesolithic anvil stone from Abergele (100485), the Neolithic polished stone axehead from Pensarn Beach (651571), and the potential for a Palaeolithic submerged forest at Pensarn Beach (524722) and Kinmel Bay Beach (524773), the latter of which also produced a mattock, an axe, and other lithic tools, altogether contribute rare early archaeological evidence within the study area. However, the findspots, as individual assets, have negligible heritage importance as the removal of the artefacts from their context has reduced the heritage significance of each. There is a possibility that finds relating to the Mesolithic or Neolithic period may be present on the foreshore at Pensarn Beach or Kinmel Bay Beach. However, the coastline has been subject to change since this period and it is likely that coastal erosion will have removed earlier deposits, making it unlikely that a full stratigraphic sequence would be obtained. Any finds are therefore likely to be unstratified and redeposited. Overall, it is considered to be a low potential to encounter artefacts of Palaeolithic to Neolithic date within the Site.

The HER indicates that there is a potential for geoarchaeological and palaeoenvironmental evidence for the Palaeolithic or Mesolithic period associated with an ancient submerged forest present at the foreshore at Pensarn Beach (524722) and Kinmel Bay Beach (524773). However no evidence for either was observed during the walkover survey, including within the Site boundary. Tidal deposits are likely to have been redistributed due to periods of increased storminess and erosion and therefore it is likely to be very difficult to obtain clear stratigraphic sequences along the coastal frontages. Overall, it is considered

to be a low potential to identify archaeological deposits or encounter artefacts of Palaeolithic, Mesolithic or Neolithic date within the Site.

There are a number of shipwrecks recorded within the study area. Shipwrecks hold evidential and historical value of the post-medieval maritime period through the study of their remains to enhance our understanding of historic maritime life, transport and trade. There is aesthetic and communal value in the study of shipwrecks particularly for those who associate with maritime life, the coastal community and the families of individuals who lost their lives when the ships were lost. There are two confirmed wrecks within the study area (164090; 64185). However no evidence of shipwrecks was observed during the walkover survey, including within the Site boundary. Overall, it is considered to be a low potential to encounter shipwrecks within the Site.

There are a number of insecure findspots within the HER. Along the coastal frontage this includes a post-medieval gold *fede* or fidelity ring (961767) at Pensarn Beach and three artefacts from Kinmel Bay Beach, including an incomplete finger ring of likely post-medieval date (122728), a post-medieval lead alloy musket ball (122767) and copper alloy finger ring of uncertain date (122769). As the Roman coin (17613) can only be said to have been found in Rhyl the historic value of its findspot is negligible. Likewise, the locations of the findspots of the other artefacts have negligible historic value as the removal of the artefact has removed its heritage significance, therefore there is expected to be no impact to those locations as a result of the Proposed Development. Overall, it is considered to be a low potential to encounter artefacts of Roman to post-medieval date within the Site.

9 Impact Assessment

When assessing the impacts on heritage assets for the Proposed Development, there are three aspects to consider as follows: assets that may be directly impacted by construction of the works through the installation of rock armour and excavation for the new defences; assets that are located outside the permanent construction footprint but are within the construction corridor and may be impacted by construction activities; and impacts on the setting of heritage assets.

9.1 Construction related impacts

There are no direct, physical impacts on any World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, Conservation Areas, Protected Wreck Sites, Registered Battlefields, non-designated heritage assets, or archaeological environment deposits expected as a result of the Proposed Development.

Construction activities, such as plant movement and material storage for the proposed new defences have the potential to impact assets negatively on some heritage assets when located within or close to the Site boundary on the foreshore. The following identifies heritage assets that may be impacted and can be utilised to feed into the Construction Environment Management Plan for construction activities.

9.1.1 CMU 3-2A: Llanddulas Revetment

The Llanddulas Lifeboat House (34207) is close to the beach and the construction footprint. There will be a temporary, minor adverse impact on the setting of the house arising from increased vehicle movement and noise associated with the construction phase of the scheme. Views from the house overlooking the Site will be temporarily not in keeping with the aesthetic nature of the house, which is currently a quiet beachside property with minimal traffic related to the carparks nearby. A minor adverse impact on an asset of low importance will result in a slight adverse significance of effect during the construction phase. The impact is temporary and will cease once construction phase is completed. The overall residual impact on the setting of the non-designated Llanddulas Lifeboat House from construction activities is neutral.

9.1.2 CMU 3-3: Llanddulas Tip

Ty Crwn (JBA-1) is non-designated and close to the beach and the construction footprint. There will be temporary, minor adverse impact on the setting of the cottage arising from increased vehicle movement and noise associated with the construction phase of the scheme. Construction activities within the views from the cottage overlooking the Site will temporarily alter the aesthetic setting of the cottage, which is a quiet beachside property. A minor adverse impact on assets of low importance will result in a slight adverse significance of effect during the construction phase. The impact will cease once construction is completed. The overall residual impact on the setting of the non-designated Ty Crwn from construction activities is neutral.

9.1.3 CMU 3-4: Pensarn Beach

The four Grade II buildings at Abergele and Pensarn Railway Station (18703–18706) are near the coastal foreshore and close to the construction footprint. There will be temporary minor adverse impacts on the settings of each asset arising from increased vehicle movement and noise associated with the construction phase of the scheme. Construction activities within the views from each asset overlooking the Site will temporarily alter the aesthetic setting of each asset, which features a quiet coastal frontage. A minor adverse impact on assets of high importance will result in a slight adverse significance of effect during the construction phase. The impact will cease once construction is completed. The overall residual impact on the setting of the four Grade II buildings at Abergele and Pensarn Railway Station from construction activities is neutral.

9.1.4 CMU 3-5C: Kinmel Bay Beach

The River Street Conservation Area (311) and the Grade II Listed Nos 72-75 West Parade (14334–14337), also within the River Street Conservation Area, are outside of the construction footprint. During the construction stage, long views to the Site from the Conservation Area, including 72-75 West Parade, will be temporarily altered due to the addition of a construction area within this view as the project proceeds. This will not be in keeping with the natural seafront aesthetic from views that take in the Site. However, the change to the setting will be limited and the overall appreciation of the wider coastal location and context will remain legible. Therefore, the effect is considered to be a minor adverse impact. On assets of high importance this will result in a temporary slight adverse significance of effect during the construction phase that will cease once construction is completed. The overall residual impact on the setting of the River Street Conservation Area and the Grade II Listed Nos 72-75 West Parade from construction activities is neutral.

The post-medieval brick building at Foryd Harbour (128646) and the Foryd timber yard wharf and quay (83555; 83521) are both non-designated and outside of the construction footprint. This area of the Site is to be utilised as an access route for vehicles to reach the northern side of the Site along the coastal frontage. Therefore, there will be temporary minor adverse impacts on the settings of each asset arising from increased vehicle movement and noise associated with the construction phase of the scheme. On an asset of low importance, the minor adverse impact will result in a slight adverse significance of effect during the construction phase. The impact will cease once construction is completed. The overall residual impact on the settings of the non-designated post-medieval brick building at Foryd Harbour and the non-designated Foryd timber yard wharf and quay from construction activities is neutral.

9.1.5 Site compounds

The locations of works compounds have yet to be confirmed. However, the locations for compounds have been proposed utilising existing hardstanding and access from the construction compounds to the foreshore and are expected to utilise slipways. As a result, no impact on any buried archaeological remains is anticipated. One potential exception is a

compound location in CMU 3-5B, opposite the Abbeyford Holiday Park between Knightly's Fun Park and the next caravan park to its east. This compound location is on grass and may therefore result in impacts on previously unrecorded archaeological remains.

9.2 Operational Impacts

9.2.1 CMU 3-2A: Llanddulas Revetment

The foreshore and the sea beyond comprise the key view for the non-designated Llanddulas Lifeboat House (34207). The existing rock revetment will be used as part of the new structure and the existing rock groyne will remain to tie in with the new rock revetment. The addition of the new rock armour revetment will result in a very limited change to the revetment already in the view, even though the revetment will be an engineered rock design rather than a natural shelf. The new embankment, behind which the armour revetment will sit, will be higher than the existing vegetated embankment by approximately 1.5m. The scheme will also offer changes to the public realm that will have an impact. The development of an active parklet within the secondary park, enhancements to the main car park at Llanddulas Beach, and the widening of the reinstated cycle path, which will feature new lighting, benches, and rest points, constitutes a minor positive impact towards the community and aesthetic values of the assets. Overall, the new rock armour revetment, embankment, and reinstatement of the cycle path is expected to introduce a limited change to the views from the assets and the significance of their settings. A minor adverse permanent impact to a setting of an asset of low importance will result in a neutral significance of effect on the non-designated Llanddulas Lifeboat House.

9.2.2 CMU 3-3: Llanddulas Tip

The foreshore and the sea beyond comprise the key view for Ty Crwn (JBA-1). The view of new shingle on the beach to the east of the asset as a result of shingle planting will constitute a visual change to the view afforded at the cottage. However, as shingle is a natural part of this beach, the impact will be negligible. The scheme also offers changes to the public realm that will have an impact to this asset. The development of a parklet and a rest point constitutes a minor positive change towards the community and aesthetic values of the cottage. A minor positive permanent impact in an asset of low importance will result in a slight positive residual effect on the non-designated Ty Crwn.

9.2.3 CMU 3-4: Pensarn Beach

While the foreshore and the sea beyond is not a key view for all four Grade II buildings at Abergele and Pensarn Railway Station (18703–18706), the limited views towards the sea from the Station Booking Hall (18703) and views towards the Station Booking Hall from the Site are important to this group of Listed Buildings. The Proposed Development will provide a beach access upgrade that may be glimpsed from the Station Booking Hall. The effects of periodical beach recharge from the capital beach nourishment programme may also be slightly visible on the eastern side of Pensarn Beach over time, however, as this impact will be slow and gradual, the impact on the limited views from the Station Booking Hall will be negligible. It is considered that there will be no visibility from the four Listed Buildings to the new set-back wall or parklet on the western end of the CMU due to the intervening bridge over the railway and other buildings to the west of the railway. A proposed bench located near the Tennis Court Road railway crossing approximately 300m to the east of the assets is not likely to be visible from the assets due to its placement on the seaward side. The effect of the proposed works on the settings of all four Grade II buildings at Abergele and Pensarn Railway Station is assessed as neutral.

9.2.4 CMU 3-5C: Kinmel Bay Beach

The River Street Conservation Area (311) and the Grade II Listed Nos 72-75 West Parade (14334–14337), also within the River Street Conservation Area, are outside of the construction footprint. The construction will result in little change to the views which contribute to the settings of the Conservation Area and Nos 72-75 West Parade during the operation period of the Site. The effect of the proposed works on the River Street Conservation Area and the Grade II Listed Nos 72-75 West Parade is assessed as neutral.

All impacts to the non-designated post-medieval brick building at Foryd Harbour (128646) and the non-designated Foryd timber yard wharf and quay (83555; 83521) are limited to the construction period as there are no views to permanent effects to the coastal frontage from these locations. The effect of the proposed works on these assets is therefore assessed as neutral.

9.2.5 Scheme-wise operational impacts

One goal of the Proposed Development is to help preserve the built heritage assets along the northwest coast of Wales.

The four Grade II buildings at Abergele and Pensarn Railway Station (18703–18706) are in close proximity to the Proposed Development but are in front of the sea wall and below the beach, therefore are unlikely to see any alteration to their current baselines. The Llanddulas Lifeboat House (34207) and Ty Crwn (JBA-1), both of which are non-designated assets, are also in close proximity to the Proposed Development. As the proposed changes are in keeping with their beach settings, it is unlikely that either will experience any alteration to their current baselines.

The Proposed Development will act to increase the protection from flooding of the heritage assets within the study area. This would include the four Grade II buildings at Abergele and Pensarn Railway Station (18703–18706), the Llanddulas Lifeboat House (34207) and Ty Crwn (JBA-1), all of which are good examples of coastal heritage in north Wales for present and future generations. The overall residual impact on the heritage environment by increasing the protection against flooding is slight positive. The impacts of the proposed works should be weighed against the benefits provided from flood protection not just to heritage assets but to the study area as a whole.

10 Proposed Mitigation

There is a low potential that buried archaeological deposits or artefacts may be discovered during works on the foreshore within the Site boundary. A tool box talk (TBT) should be given as part of the works induction process and form part of the Construction Management Plan to help familiarise the project team with the cultural heritage of the area. The TBT should have an associated protocol for archaeological recording and reporting to the relevant authorities in the event of an unexpected discovery of archaeological deposits or artifacts.

No mitigation in relation to temporary effects on the setting of heritage assets is recommended.

The potential for introducing unanticipated impacts on the settings of heritage assets may be avoided through careful consideration of materials and finishes to be used. For example, it is recommended that the rock armour be of a type that fits in with the geology of the locality.

11 Conclusions

This Desk-Based Assessment has considered the impacts of the proposed development on the historic environment. It has identified that the Proposed Development will have the following impacts to heritage assets within the study area as follows.

Heritage Asset	Importance of Asset	Construction		Operation	
		Magnitude of impact	Significance	Magnitude of impact	Significance
Llanddulas Lifeboat House (34207)	Low	Minor Adverse	Slight Adverse	Minor Adverse	Neutral
Ty Crwn (JBA-1)	Low	Minor Adverse	Slight Adverse	Minor Positive	Slight Positive
Abergele and Pensarn Railway Station buildings (18703–18706)	High	Minor Adverse	Slight Adverse	No Impact	Neutral
River Street Conservation Area (311)	High	Minor Adverse	Slight Adverse	No Impact	Neutral
Nos 72-75 West Parade (14334–14337)	High	Minor Adverse	Slight Adverse	No Impact	Neutral
Post-medieval brick building at Foryd Harbour (128646)	Low	Minor Adverse	Slight Adverse	No Impact	Neutral
Foryd timber yard wharf and quay (83555; 83521)	Low	Minor Adverse	Slight Adverse	No Impact	Neutral

The assessment has also identified a low possibility of discovering buried archaeological remains on the foreshore within the Site boundary. This potential can be managed through a toolbox talk, the legal reporting of all archaeological discoveries (however found) and, if warranted, further licensed archaeological investigations.

The proposed development will provide benefits to heritage assets located behind the sea wall through increased flood protection, including the four Grade II buildings at Abergele and Pensarn Railway Station (18703–18706), the Llanddulas Lifeboat House and Ty Crwn, all of which are good examples of coastal heritage in north Wales for present and future generations. The overall assessment of the magnitude of impact on the heritage environment is minor positive and the significance of effect is minor positive.

Consultations should be undertaken with the appropriate advisory bodies including CCBC and CPAT prior to construction to confirm the details of the proposed mitigation, detailed design, finishes and construction methodology.

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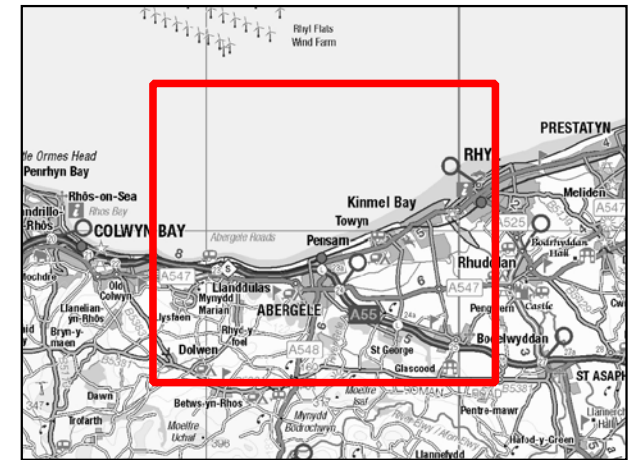


Appendices
A Figures



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Llanddulas Kinmel Heritage Statement

 Study Area (300m inland and 500m seaward)

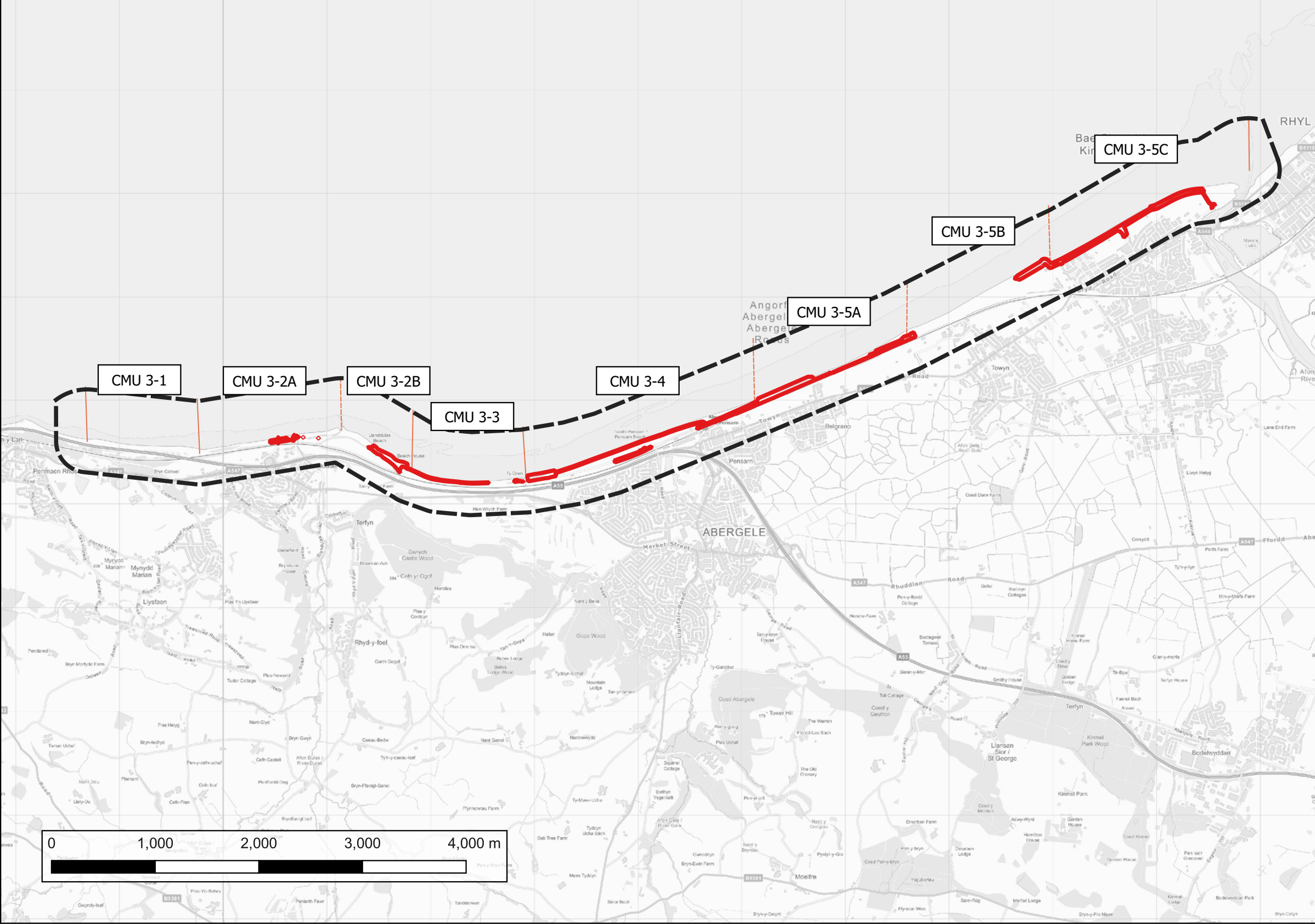
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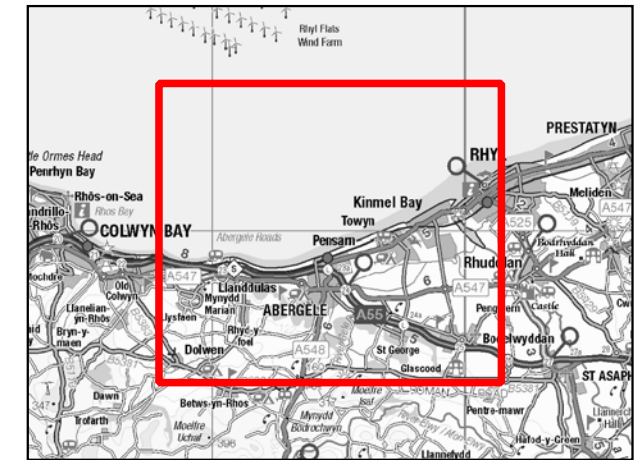
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Approved By:	KH	Date:	24/08/2022		Original at A3

Figure Title: Figure 1: Site Location

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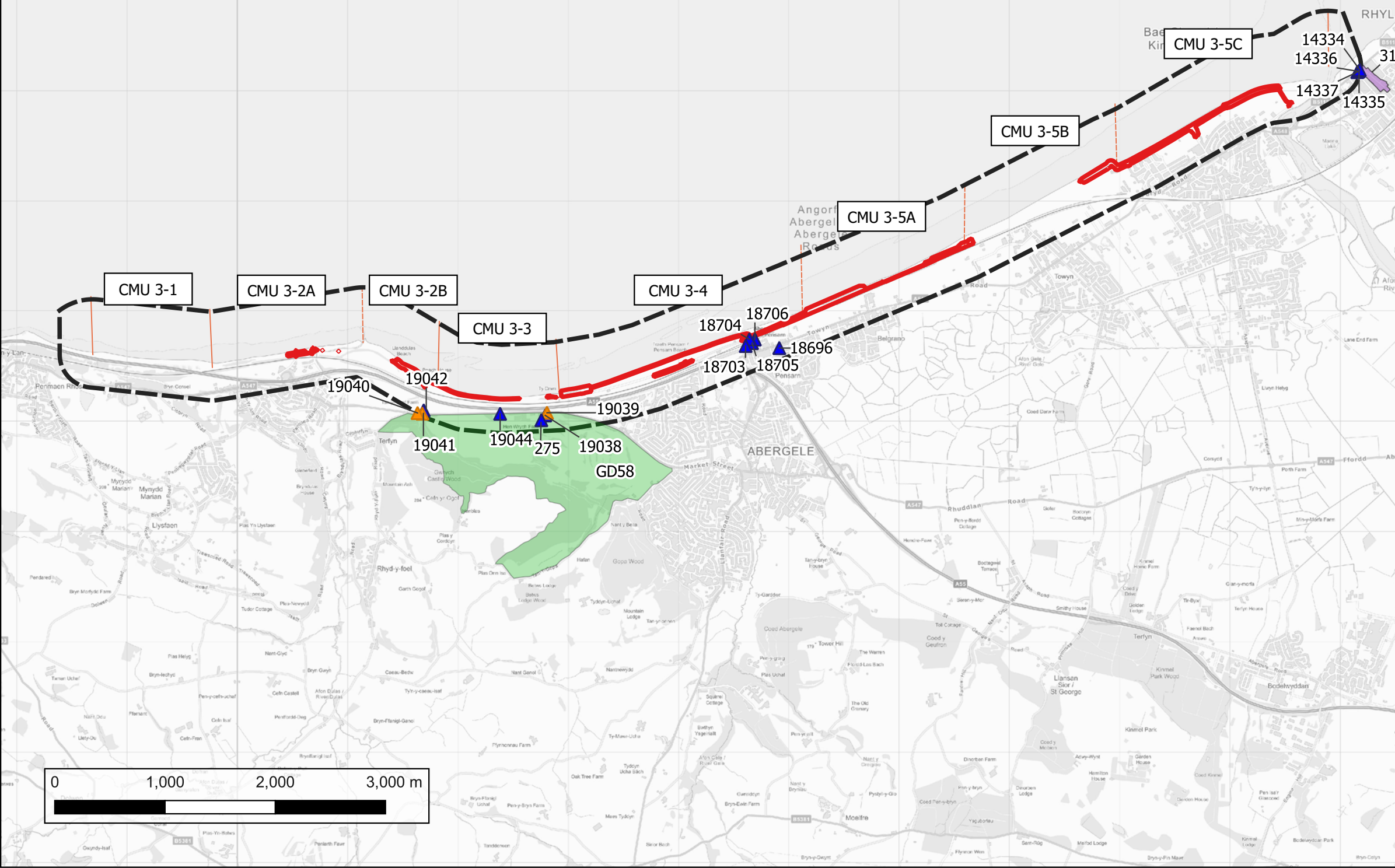


Llanddulas Kinmel Heritage Statement

- Site Boundary
- Study Area (300m inland and 500m seaward)

Listed Buildings:

- ▲ Grade II
- ▲ Grade II*
- Registered Historic Parks and Gardens
- Conservation Area



Drawn By: KE Date: 25/08/2022 Scale: 1:40,000
Checked By: DGM Date: 25/08/2022 Original at A3
Approved By: KH Date: 25/08/2022

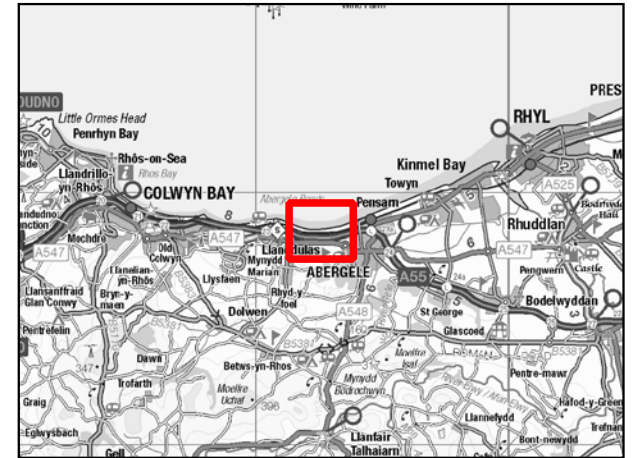
Figure Title: Figure 2: Designated Assets Overview

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Llanddulas Kinmel Heritage Statement

-  Site Boundary
-  Study Area (300m inland and 500m seaward)
- Listed Buildings:
 -  Grade II*
 -  Grade II
-  Registered Historic Parks and Gardens
-  Conservation Area

Drawn By:	EP	Date:	25/08/2022	Scale:	
Checked By:	DGM	Date:	25/08/2022		1:7,500
Approved By:	KH	Date:	25/08/2022		Original at A3

Figure Title: Figure 2a: Designated Assets

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CMU 3-2B

CMU 3-3

Llanddulas Beach

Beach House

Ty Crwn

A55

19042

19040

19041

19044

GD58

Hen Wrych Farm

275

19039

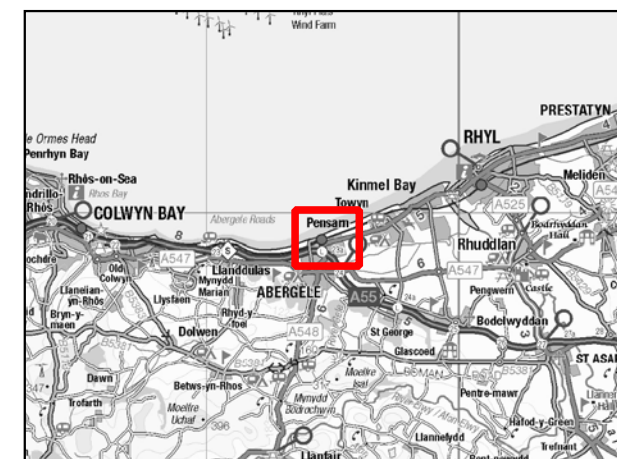
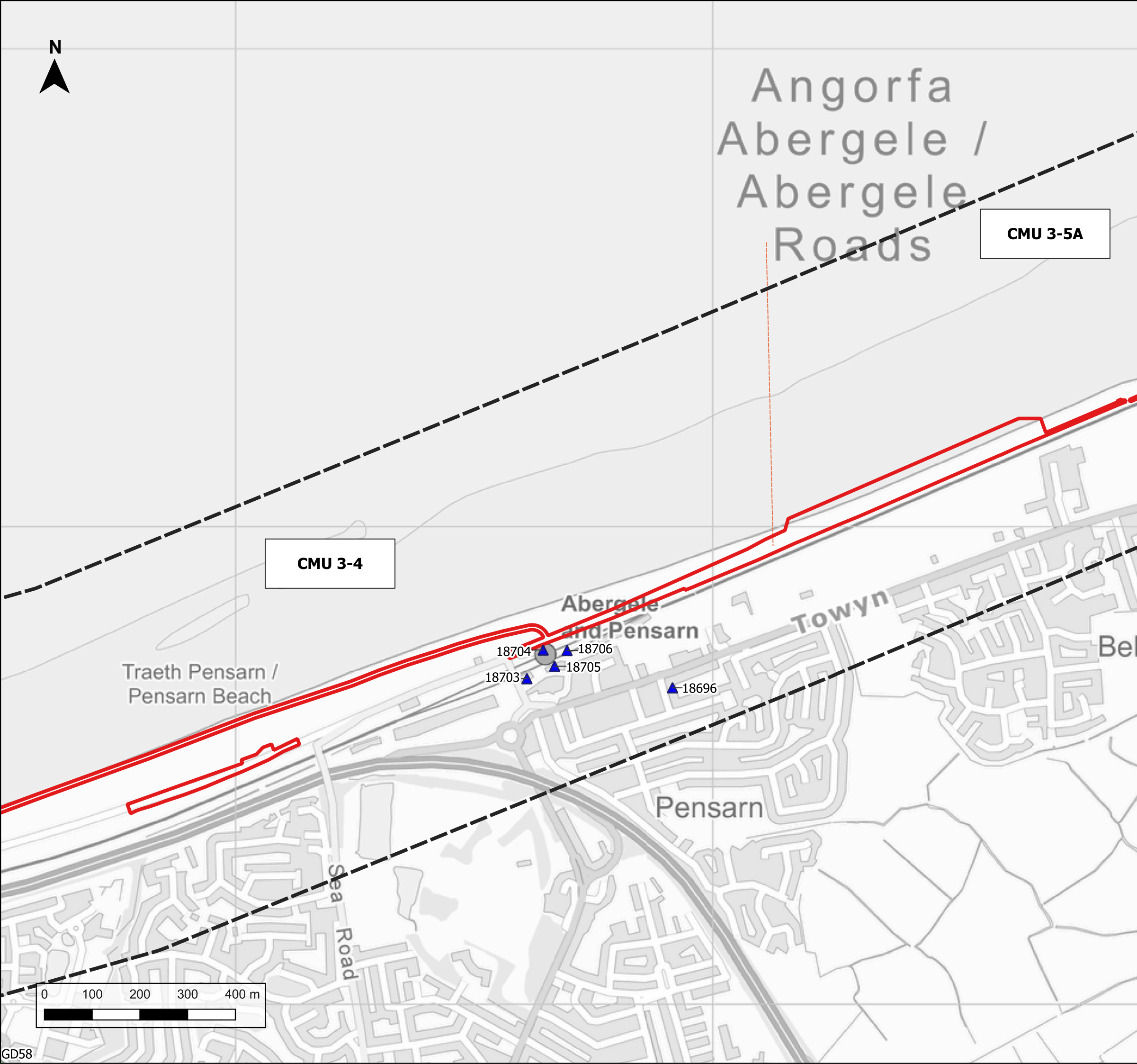
19038

Terfyn

Gwrych
Castle Wood

Mountain Ash

0 100 200 300 400 m



Llanddulas Kinmel Heritage Statement

- Site Boundary
- Study Area (300m inland and 500m seaward)
- Listed Buildings:
 - ▲ Grade II*
 - ▲ Grade II
- Registered Historic Parks and Gardens
- Conservation Area

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Figure Title: Figure 2b: Designated Assets

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Bae Cinmel / Kinmel Bay

CMU 3-5C

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14335
14336
14337

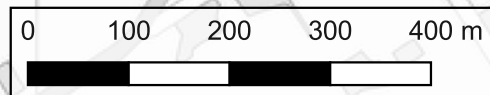
Llanddulas Kinmel Heritage Statement

- Site Boundary
- Study Area (300m inland and 500m seaward)
- Listed Buildings:
 - ▲ Grade II*
 - ▲ Grade II
- Registered Historic Parks and Gardens
- Conservation Area

Drawn By: EP Date: 25/08/2022 Scale: 1:7,500
Checked By: DGM Date: 25/08/2022 Original at A3
Approved By: KH Date: 25/08/2022

Figure Title: Figure 2c: Designated Assets

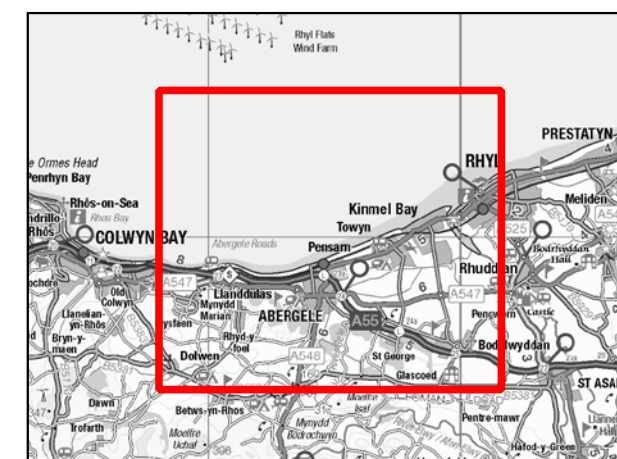
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Llanddulas Kinmel Heritage Statement

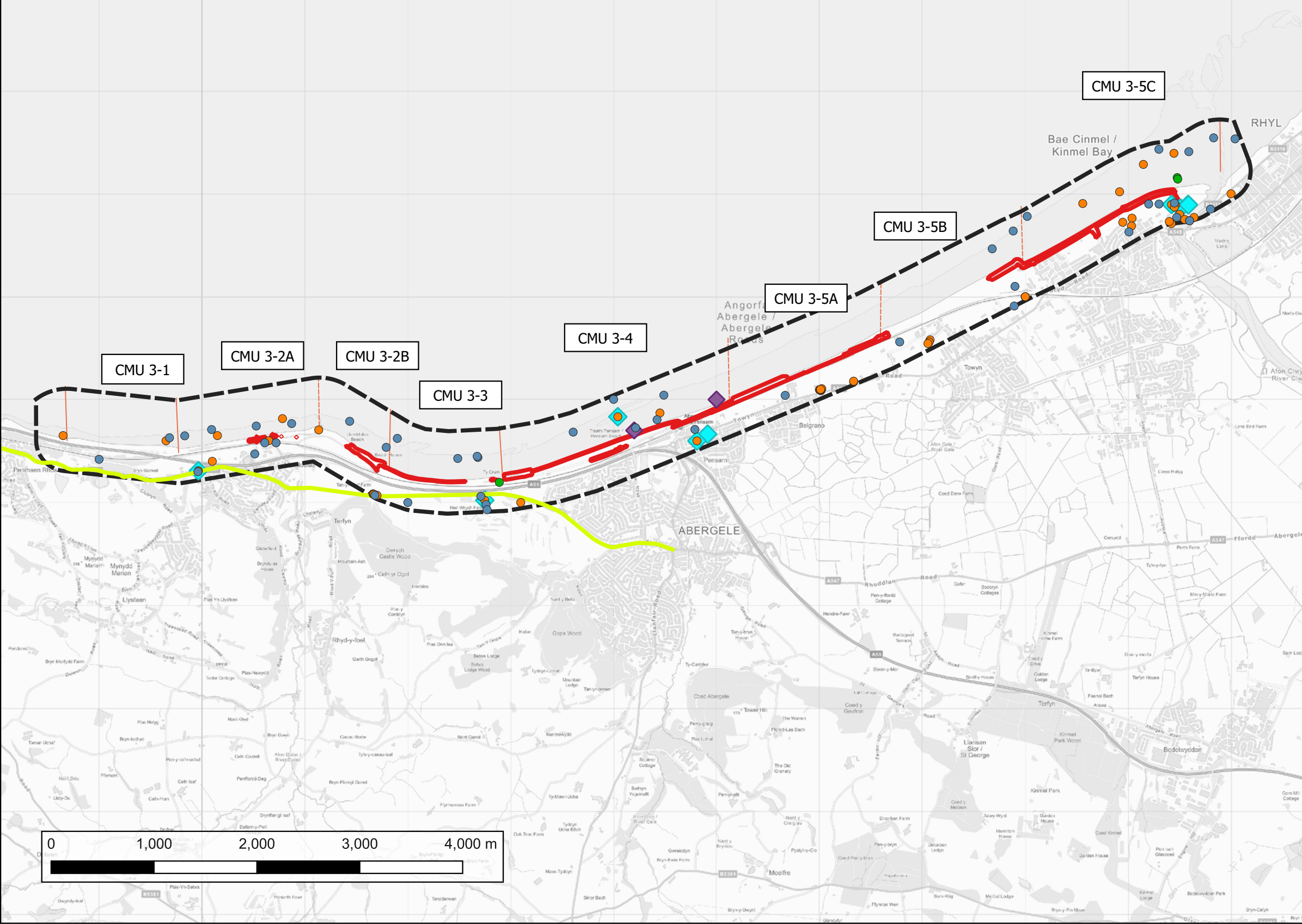
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- Study Area (300m inland and 500m seaward)
- HER Points
- NMRW Points
- ◆ Heritage Event Points
- ◆ PAS Points
- HER Turnpike Roads
- JBA Heritage Assets

Drawn By: Pm **Date:** 20/09/2022 **Scale:**
Checked By: DGM **Date:** 20/09/2022 **1:40,000**
Approved By: KH **Date:** 20/09/2022 **Original at A3**

Figure Title: Figure 3: Non-Designated Assets and Heritage Events Overview

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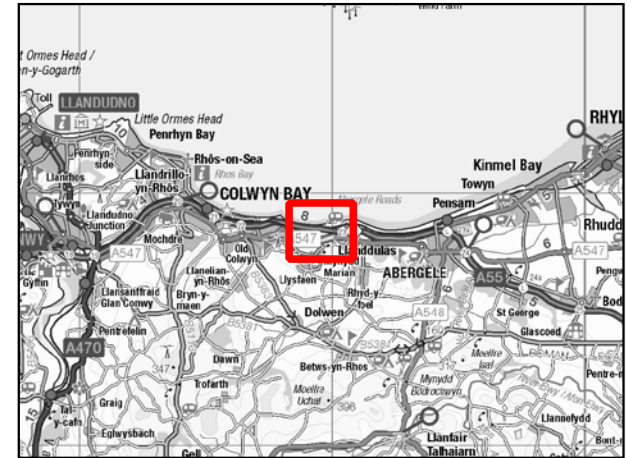
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Llanddulas Kinmel Heritage Statement

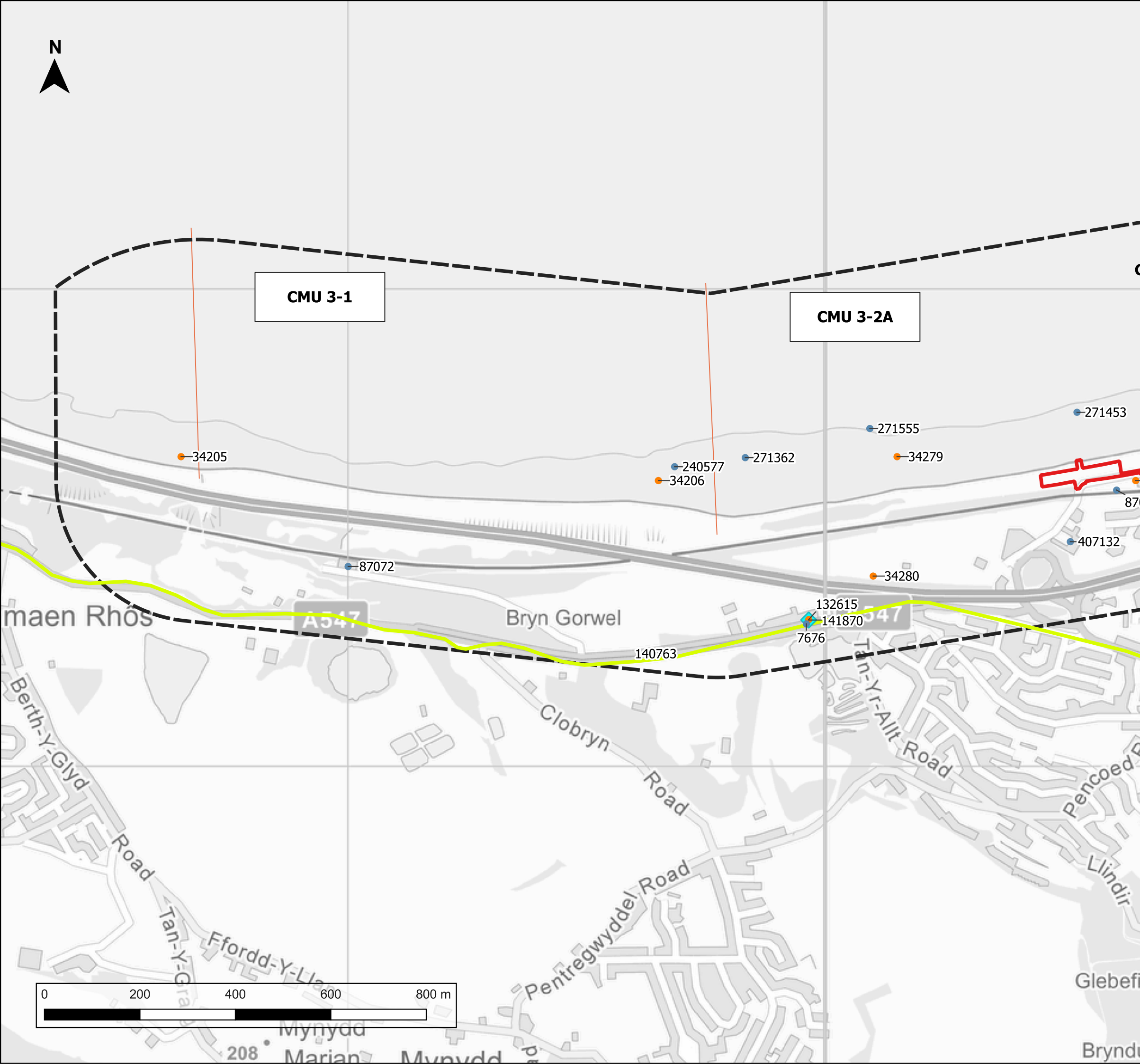
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- Study Area (300m inland and 500m seaward)
- HER Turnpike Roads
- HER Points
- NMRW Points
- HER Heritage Events
- PAS Points
- JBA Heritage Assets

Drawn By:	KE	Date:	01/09/2022	Scale:	
Checked By:	DGM	Date:	01/09/2022		1:7,500
Approved By:	KH	Date:	01/09/2022		Original at A3

Figure Title: Figure 3a: Non-Designated Assets and Heritage Events

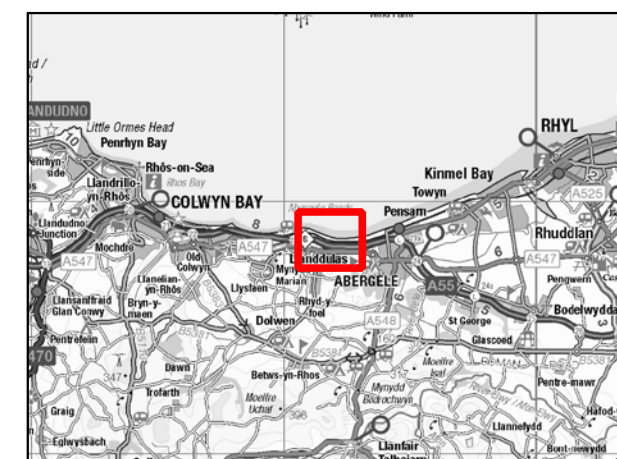
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- Site Boundary
- Study Area (300m inland and 500m seaward)
- HER Turnpike Roads
- HER Points
- NMRW Points
- HER Heritage Events
- PAS Points
- JBA Heritage Assets

Drawn By: KE **Date:** 01/09/2022 **Scale:**
Checked By: DGM **Date:** 01/09/2022 1:7,500
Approved By: KH **Date:** 01/09/2022 Original at A3

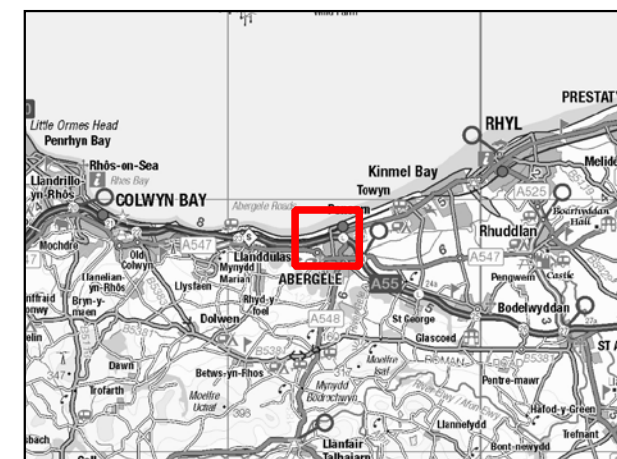
Figure Title: Figure 3b: Non-Designated Assets and Heritage Events

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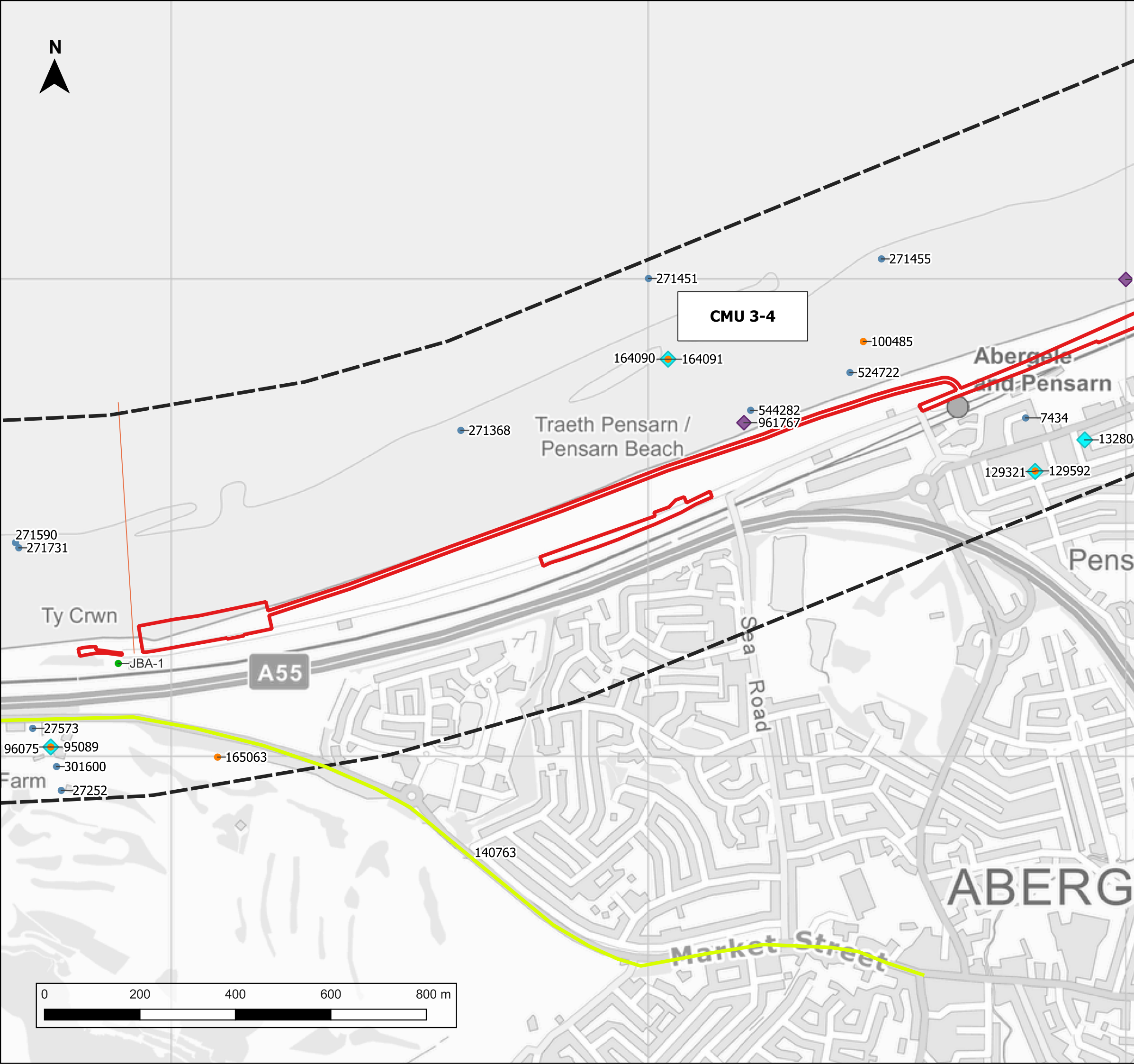
Llanddulas Kinmel Heritage Statement

- Site Boundary
- Study Area (300m inland and 500m seaward)
- HER Turnpike Roads
- HER Points
- NMRW Points
- HER Heritage Events
- PAS Points
- JBA Heritage Assets

Drawn By: KE Date: 01/09/2022 Scale: 1:7,500
Checked By: DGM Date: 01/09/2022 Original at A3
Approved By: KH Date: 01/09/2022

Figure Title: Figure 3c: Non-Designated Assets and Heritage Events

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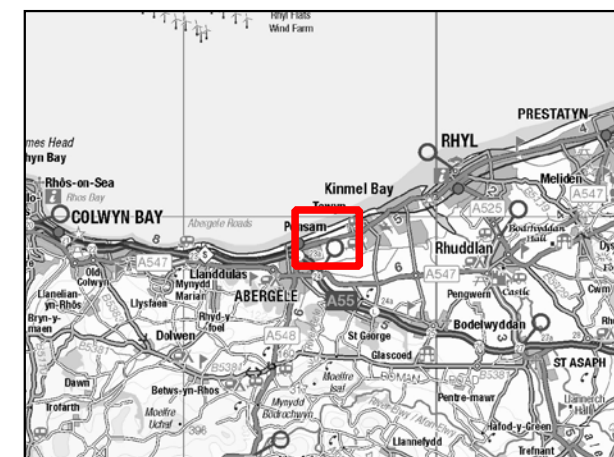


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Angorfa
Abergele /
Abergele
Roads

CMU 3-5A



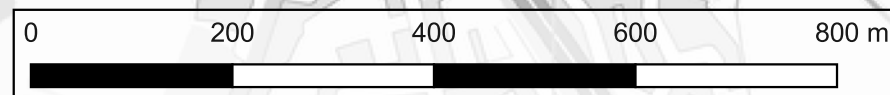
Llanddulas Kinmel Heritage Statement

- Site Boundary
- Study Area (300m inland and 500m seaward)
- HER Turnpike Roads
- HER Points
- NMRW Points
- ◆ HER Heritage Events
- ◆ PAS Points
- JBA Heritage Assets

Drawn By: KE Date: 01/09/2022 Scale: 1:7,500
Checked By: DGM Date: 01/09/2022 Original at A3
Approved By: KH Date: 01/09/2022

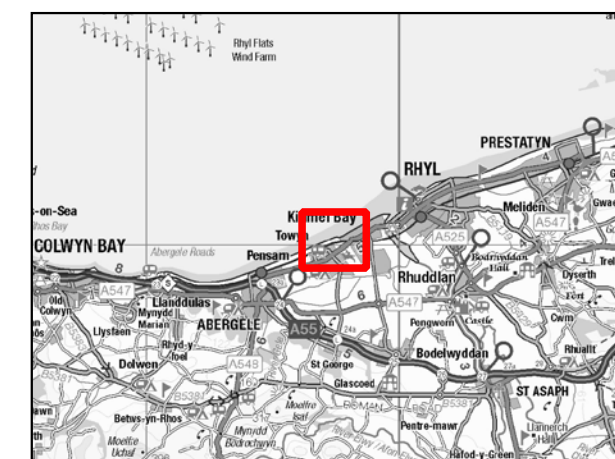
Figure Title: Figure 3d: Non-Designated Assets and Heritage Events

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- Site Boundary
- Study Area (300m inland and 500m seaward)
- HER Turnpike Roads
- HER Points
- NMRW Points
- HER Heritage Events
- PAS Points
- JBA Heritage Assets

Figure Title: Figure 3e: Non-Designated Assets and Heritage Events

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Bae Cinmel / Kinmel Bay

CMU 3-5C

JBA-2 JBA-3

524878

524837

271628

64185

524773

122767

122728

122769

271598

300827

115408

128646

300222

300825

83080

152718

153015

153016

B5118

35826

17613

141798

141856

141797

422476

A548

83559

83521

271360

83555

442

83523

34276

506949

Marine
Lake

Foryd
Road

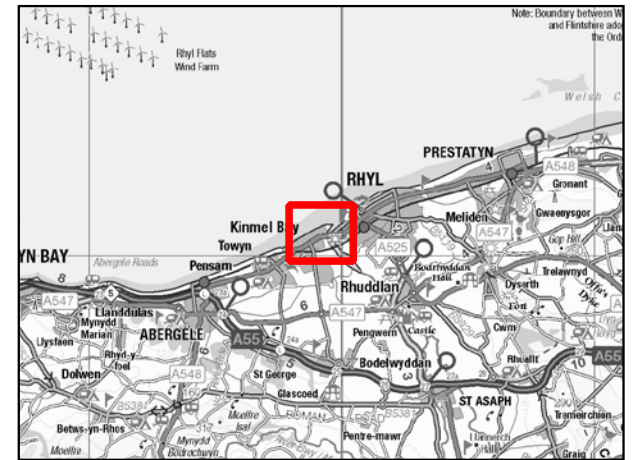
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0 200 400 600 800 m



Llanddulas Kinmel Heritage Statement

- Site Boundary
- Study Area (300m inland and 500m seaward)
- HER Turnpike Roads
- HER Points
- NMRW Points
- HER Heritage Events
- PAS Points
- JBA Heritage Assets

Drawn By: PM Date: 20/09/2022 Scale:
Checked By: DGM Date: 20/09/2022 1:7,500
Approved By: KH Date: 20/09/2022 Original at A3

Figure Title: Figure 3f: Non-Designated Assets and
Heritage Events

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B Gazetteer

B.1 Designated Heritage Assets

CMU	Site ID	NGR	Grade	Description
CMU 3-2B	19040	SH9163478073	II *	Plas Tan-yr-Ogof, including adjoining walls and arches to east and west. A castellated lodge built in c1814, originally conceived as an estate farmhouse and one of a series of similar medievalist buildings erected on the Gwrych Castle Estate. The building, latterly used as a night club, is now residential.
CMU 3-2B	19041	SH9167878068	II *	Tan-yr-Ogof Farmhouse including adjoining arch and walls to east. A castellated lodge dating to the 1820s-1830s, conceived as a Gothic farm complex to serve Gwrych Castle (Grade I Listed). It is probable that many of the lesser turrets and bastions were still being added well into the second half of the 19th century.
CMU 3-2B	19042	SH9169078097	II	Stable and Cart House Range at Tan-yr-Ogof Farm. A medievalist stable block built in c1819 with mid-late 19th century carthouse additions. It was designed as part of the Tan-yr-Ogof farm group in the characteristic Gwrych Castle (Grade I Listed) estate style.
CMU 3-2B	GD58	SH9206077328	Grade II* Registered Historic Park and Garden	Gwrych Castle. The garden's main phases are 1819-1830s. Gothic park walling, lodges, and towers, around the prominent landmark of Gwrych Castle, with a large-scale walled and turretted terraced garden.
CMU 3-3	275		II	Barn, Agricultural Range and associated garden walls and towers at Hen Wyrch Farm. A large rubble barn with semi-ruinous slate roof and stone-coped and kneelered gable parapets. Adjoining the barn to the S and overlapping the L side of its S face, there is a long single-storey, agricultural range dating the second half of the 19th century. Probably erected in the 18th century to serve the house, the predecessor of Gwrych Castle and the ancient seat of the Lloyd family. After 1819, it was

CMU	Site ID	NGR	Grade	Description
				adapted as a home farm complex; the agricultural range, castellated rubble and further brick garden walls relate to this period and were added variously from the second-quarter to the late 19th century.
CMU 3-3	19038		II	Hen Wrych. A mid or third-quarter 16th century storeyed lateral chimney house, with early 17th century additions possibly incorporating an earlier, late- or sub-medieval block. It is of rubble construction with slate roofs and plain chimneys with corncicing. To the 17th century period belong several sandstone mullioned and cross-windows, mostly in situ. The house was reduced and rejustified following the relocation of the seat to the new Gwrych Castle by Lloyd Bamford Hesketh c1819; at that time cosmetic alterations were carried out, including the provision of some Gothic windows. The rear (south side) was further altered in the later 19th century. The house was the childhood home, from 1800 to 1809, of Felicia Hemans (nee Browne), the celebrated poet.
CMU 3-3	19039		II *	Hen Wrych Lodge, including adjoining crenellated boundary walls and towers. A castellated gate lodge conceived as one of a series to serve Gwrych Castle. A castellated scheme was prepared in 1814 and the main work was complete by 1822. The lodge consists of a twin-arched entrance between flanking square, battlemented towers, built of local limestone rubble with limestone dressings. The adjoining walls begin at the east end at a small round turret with corbelled parapet; this is not shown on 1st edition OS map dated 1873.
CMU 3-3	19044		II	Gwrych Estate Boundary Wall from Tan-yr-Ogof to Gwrych Lodge. A long stretch of estate boundary wall, running alongside the road for approximately 1km. It is of local limestone rubble construction. The wall runs at an average height of

CMU	Site ID	NGR	Grade	Description
				approximately 2.5m for roughly 30m; at its starting point is a Tudor-arched entrance with recessed modern steel door. The wall then steps down in two further stages of roughly 30m each to follow the gentle downward incline of the road. The right-hand section of the western part is simply-crenellated, as is the whole of the eastern section. The crenellated wall steps down to a height of about 2.5m to continue as a 'cock-and-hen' coped wall up to where it meets Hen Wrych.
CMU 3-3	GD58	SH9206077328	Grade II* Registered Historic Park and Garden	Gwrych Castle. The garden's main phases are 1819-1830s. Gothic park walling, lodges, and towers, around the prominent landmark of Gwrych Castle, with a large-scale walled and turretted terraced garden.
CMU 3-4	18696	SH9491578662	II	English Presbyterian Church. It was built in 1877-8 by Richard Owens, architect of Liverpool. It is early Gothic style, built of polygonal shaped blocks of limestone with ashlar oolitic dressings, and a blue slate roof with green fish-scale slate bands. The main north front has a gabled porch between raking buttresses, and a pair of doors with a quatrefoil in the arch tympanum over. The north end of the body of the chapel is gabled between pinnacled buttresses, and has a large low-set wheel window, and decorative panelwork in the apex of the gable. The main body of the church is of three bays, the north bay with a hipped roof on a corbel table. Two-light windows with foiled heads. At the south end are transepts with similar triple windows. There is a short square-ended chancel with a five-light window, and the vestry tucked into the south-west angle.
CMU 3-4	18703	SH9461078681	II	Abergele and Pensarn Railway Station Booking Hall. The Chester and Holyhead Railway was opened in 1848. It is built of Buckley brindled brick on a blue engineering brick plinth, with red brick dressings and a slate roof. The first booking hall was originally designed by the chief

CMU	Site ID	NGR	Grade	Description
				architect, Francis Thompson. After the railway was taken over by the London and North Western Railway Company following the Act of Parliament in 1858, the station was extensively modified in 1883, and altered again when the line was widened in 1902. The present building probably dates from the 1883 works.
CMU 3-4	18704	SH9464478741	II	Abergele and Pensarn Station, 'Up' Platform Building. The building was likely constructed in connection with the improvements being made to the line in 1883. The line at the rear, by the beach, was used for camping coaches. It is built of Buckley brindle brick with red brick dressings and a blue brick plinth, with a slate roof.
CMU 3-4	18705	SH9466878707	II	Abergele and Pensarn Station, 'Down' Platform Building. The building was likely constructed in connection with the improvements being made to the line in 1883 when the former Chester and Holyhead Railway was taken over by the London and North Western Railway Company. It is built of Buckley brindle brick with red brick dressings and a blue brick plinth, with a slate roof. The building was altered in 1902 when the track was widened, and the canopy cantilevered over the line was removed some time after 1964.
CMU 3-4	18706	SH9469478740	II	Signal Box at Abergele and Pensarn Railway Station. A LNW Type 4 signal box built c1897. The timber framed box is set on a high red brick basement plinth with five small iron-framed windows each side. It has weatherboarding cladding between the windows and the eaves, and in both gable ends. It has a pitched slate roof with terminal finials.
CMU 3-4	GD58	SH9206077328	Grade II* Registered Historic Park and Garden	Gwrych Castle. The garden's main phases are 1819-1830s. Gothic park walling, lodges, and towers, around the prominent landmark of Gwrych Castle, with a large-scale walled and turretted terraced garden.
CMU 3-5C	311	SJ00308110	Conservation Area	Rhyl, River Street Conservation Area

CMU	Site ID	NGR	Grade	Description
CMU 3-5C	14334	SJ0018181184	II	No 72, West Parade (S Side), Clwyd. Built in stages to form a terrace of purpose-designed boarding houses. Dated 1889. The terrace is of exceptional interest as a purpose-built boarding house development which retains almost all its original detail. The best example of its type in Rhyl, it shows the characteristic multi-storeyed form with prominent bay windows, which served as a model for the sea-side boarding house in the later C19.
CMU 3-5C	14335	SJ0017481177	II	No 73, West Parade (S Side), Clwyd. Built in stages to form a terrace of purpose-designed boarding houses. Dated 1889. The terrace is of exceptional interest as a purpose-built boarding house development which retains almost all its original detail. The best example of its type in Rhyl, it shows the characteristic multi-storeyed form with prominent bay windows, which served as a model for the sea-side boarding house in the later C19.
CMU 3-5C	14336	SJ0016881171	II	No 74, West Parade (S Side), Clwyd. Built in stages to form a terrace of purpose-designed boarding houses. Dated 1889. The terrace is of exceptional interest as a purpose-built boarding house development which retains almost all its original detail. The best example of its type in Rhyl, it shows the characteristic multi-storeyed form with prominent bay windows, which served as a model for the sea-side boarding house in the later C19.
CMU 3-5C	14337	SJ0015881165	II	No 75, West Parade (S Side), Clwyd. Built in stages to form a terrace of purpose-designed boarding houses. Dated 1889. The terrace is of exceptional interest as a purpose-built boarding house development which retains almost all its original detail. The best example of its type in Rhyl, it shows the characteristic multi-storeyed form with prominent bay windows, which served as a model for

CMU	Site ID	NGR	Grade	Description
				the sea-side boarding house in the later C19.

B.2 Non-designated Heritage Assets

CMU	Site ID	NGR	Period	Description
CMU 3-1	34205	SH88657865	Modern	Raynes Quarry Jetty. Modern Jetty.
CMU 3-1	34206	SH89657860	Modern	Llysfaen Quarry Jetty. Modern Jetty.
CMU 3-1	140763		AD 1757	Turnpike Road
CMU 3-1	87072	SH89007842	Post Medieval	Llysfaen. Post Medieval Railway Station.
CMU 3-1	240577	SH89687862	Post Medieval	RICHARD (wreck). The RICHARD was a sailing vessel, which was stranded near the quarry pier, Llandulas in December 1845.
CMU 3-2A	140763		AD 1757	Turnpike Road
CMU 3-2A	132615	SH89967830	Post medieval	Llanddulas, Abergele Road, Caersalem Chapel. A post-medieval chapel, subject of photographic survey (event 141870) in 2010 (Andy Evans, 2014). From RCAHMW record 7677: Caersalem Welsh Independent Chapel was built in 1868 on the site of former Bryn y felin (NPRN 7676). Caersalem was rebuilt in 1890 in the Romanesque style with a gable entry plan. The two entrances, one at each corner, suggests that the pre-1890 plan may have been of the long-wall type.
CMU 3-2A	34280	SH901784	Modern	Llysfaen Quarry Tramway. Modern tramway. Tramway/incline leading from quarry to jetty, now a footpath beneath A55 and railway.
CMU 3-2A	34279	SH90157865	Modern	Llysfaen Quarry Jetty II. Modern Jetty. Remains of a jetty consisting of paired timbers 4.1m apart with 3.5m between pairs. Probably associated with quarry, with possible incline leading to it.
CMU 3-2A	34207	SH90657860	Modern	Llanddulas Lifeboat House. Modern Lifeboat Station. Now converted to a dwelling.

CMU	Site ID	NGR	Period	Description
CMU 3-2A	130299	SH9078278815	Modern	Supermarine Spitfire I X4425 (aircraft wreck). Archaeological remains associated with the loss of this aircraft are not confirmed as present at this location but may be in the vicinity. Designated under the Protection of Military Remains Act 1986. The aircraft crashed in 1943.
CMU 3-2A	214563	SH9113478705	Unknown	Llanddulas and Rhyd-y-Foel, weir. Weir identified by the Amber Barrier Atlas project, 2020. The weir first appears on OS maps dated to 1989. ?Modern
CMU 3-2A	7676	SH89967830	Post Medieval	Bryn-y-felin Independent Chapel (ty'n-y-felin). Post-medieval chapel. Bryn-y-Felin Independent Chapel was built in 1838 and closed in 1858. The site was not exclusively a place of worship and later the site was used for the building of Caersalem (NPRN 7677).
CMU 3-2A	271362	SH89837864	Post Medieval	OCEAN QUEEN (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location, but may possibly be in the vicinity. The OCEAN QUEEN was built as a wooden brigantine by J Tredwen at Padstow in 1858. It was lost in 1890.
CMU 3-2A	271555	SH90097870	Post Medieval	NEWHAVEN (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location, but may be in the vicinity. The NEWHAVEN was a 144nt wooden brig, lost in 1883.
CMU 3-2A	407132	SH90517847	Post Medieval	Moranedd. Was a substantial 2 storey house with front bow and a narrow slate-roofed verandah, running on front and sides of the building.
CMU 3-2A	271453	SH90527874	Post Medieval	DOON (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location, but may be in the vicinity. The DOON was an iron-hulled steamship built by Rhoddee Shipbuilding Company, Chester in 1855. Went ashore in 1903.

CMU	Site ID	NGR	Period	Description
CMU 3-2A	87069	SH90727858	Post Medieval	Dulas Railway Viaduct, Llanddulas. Modern railway viaduct. The original railway viaduct over the river Dulas was brought down by flooding on 17 August 1879. It was replaced by a temporary timber structure, and the viaduct rebuilt by 24 August 1879 by The Railway Company with the employment of 500 men using electric light in one of its first uses for 24-hour construction work.
CMU 3-2A	87071	SH90617858	Post Medieval	Llanddulas Railway Station. Post-medieval railway station on the Chester & Holyhead railway.
CMU 3-2A	519089	SH90877876	Post Medieval	HECLA (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location, but may be in the vicinity. The HECLA was a sailing vessel, which became stranded off Llanddulas on 29 January 1882.
CMU 3-2B	193779	SH9166178084	Post Medieval	Tan-yr-ogof farm. Farm complex identified on OS 2nd edition 25 inch map. Likely to contain traditional farm buildings (CPAT, Farms and Farmsteads, 2021).
CMU 3-2B	194994	SH9166978080	Post Medieval	Tan-yr-ogof farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-2B	194995	SH9170178070	Post Medieval	Tan-yr-ogof farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-2B	100479	SH91677808	Roman	Twn-Yr-Ogo coin. Findspot. Denarius of Vespasian found at Twn-Yr-Ogo (now The Oasis Club) sometime before 1858. No other details known.
CMU 3-2B	140763		AD 1757	Turnpike Road
CMU 3-2B	403535	SH91687807	Post Medieval	Tan Yr Ogof Farm. Farmhouse and outbuildings.
CMU 3-2B	271454	SH9143578789	Modern	CITY OF VERVIERS (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The CITY

CMU	Site ID	NGR	Period	Description
				OF VERVIERS was an iron-hulled steamship built in 1875. At time of loss in 1903, the vessel was carrying limestone from Preston to Ardrossan, when it went ashore on Llanddulas Beach.
CMU 3-2B	240576	SH9179078536	Post Medieval	EAGLE. Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The EAGLE was a pleasure boat belonging to Abergele. In 1876 it was wrecked at Llanddulas.
CMU 3-3	140763		AD 1757	Turnpike Road
CMU 3-3	96075	SH9274878021	Post Medieval	Abergele, Llanddulas Road, Hen Wrych Farm. Outbuilding subject to photographic survey, as a condition of planning permission, in 2005.
CMU 3-3	694	SH9278	Post Medieval	Pensarn Beach, Abergele. No further description in the HER.
CMU 3-3	271450	SH9189878623	Post Medieval	CONWAY'S PRIDE (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The CONWAY'S PRIDE was a 49nt wooden ketch built in 1859. At time of loss in 1897, the vessel was sailing from Runcorn to Port Galmon (Porth Colman?) when it was blown ashore from the Abergele Road, near Llanddulas.
CMU 3-3	525143	SH9248578428	Post Medieval	EAGLE (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location, but may be in the vicinity. The EAGLE was a wooden sloop built at Newquay in 1819. It is likely that the sloop was lost during the Royal Charter Gale, 25-26 October 1859, somewhere near Abergele/Llandrillo yr Rhos, although other sources suggest Conwy.
CMU 3-3	271590	SH9267478449	Post Medieval	THOMAS (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The THOMAS was a

CMU	Site ID	NGR	Period	Description
				wooden sailing vessel on passage from Liverpool to Jamaica in early/mid January 1784. The report noted the vessel was onshore at 'Abergally'.
CMU 3-3	271731	SH9268178438	Post Medieval	NO.4 PILOT BOAT (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. A report printed in Lloyds List on 10 December 1822 noted that the No 4 Pilot Boat had been wrecked near Abergele on the 5 December.
CMU 3-3	27252	SH92777793	Post Medieval	Gwrych House Tower. No further description.
CMU 3-3	27573	SH92717806	Post Medieval	Nursery Cottage, Gwrych. No further description.
CMU 3-3	301600	SH92767798	Post Medieval	Gwrych Cottage, Llanddulas Road, Abergele. No further description.
CMU 3-3	JBA-1	SH9288978196	Post Medieval	Ty Crwn. Cottage. Historic bathing house of the Lloyds of Gwrych, recently restored as a holiday accommodation. Predominantly 19th century building with a modern extension to the rear. Identified during the Feb 2022 JBA site visit for the Llanddulas to Kinmel Bay Coastal Improvement Scheme – Historic Desk-based Assessment.
CMU 3-4	164090	SH9404178833	Post Medieval	PENSARN (wreck). Partially submerged remains of a wooden vessel. The lower elements of the stern, port and starboard futtocks and possible bowsprit are visible. The site was reported to CPAT by a member of public on the 8th of July 2019. A preliminary survey conducted by CPAT on the 1st of August 2019 confirmed the reported feature was a wreck of a wooden vessel.
CMU 3-4	165063	SH931780	Post Medieval	Abergele, milestone, DEN_AGCY01. Post medieval milestone, on the B5443, set in stone wall, Gwrych Castle. Surveyed by the Milestone Society (2019).
CMU 3-4	100485	SH94457887	Prehistoric	Abergele anvil stone. Findspot. Anvil stone of large granite pebble with a ground out circular hollow on one

CMU	Site ID	NGR	Period	Description
				face. Found on old ground surface on the beach at Abergele.
CMU 3-4	129592	SH9481078599	Post Medieval	Pensarn, South Parade, Canolfan Dewi Sant. Church building subject of photographic survey in 2010 (Andy Evans, 2014).
CMU 3-4	271368	SH9360778684	Post Medieval	ENDEAVOUR (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The ENDEAVOUR was a wooden sloop built at Chester in 1817. Technical and configuration specifications are given as 35 tons burthen; 45ft length x 13.5ft breadth x 8ft depth in hold. It was lost in 1854.
CMU 3-4	271451	SH9400079002	Modern	LLYSFAEN (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The LLYSFAEN was a 52nt, composite-built steamship completed in 1867. At time of loss on 3 August 1900, the ship was on passage from Widnes to Llandulas when it ran ashore on Abergele Beach.
CMU 3-4	271455	SH9448879043	Modern	PROGRESS (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The PROGRESS was a 91nt wooden schooner built in 1853 and registered at Dublin. At time of loss in 1904, the vessel was sailing from Garston to Kinsale and went ashore near Pensarn.
CMU 3-4	544282	SH9421478726	Post Medieval	ANT (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The ANT was a wooden sloop built in 1818 at Pwllheli. It was lost in the 1840s.
CMU 3-4	524722	SH9442278805	Neolithic, Mesolithic	Submerged Forest, Abergele. An anvil stone (granite cobble with ground out hollow on one face) has been found lying on an old ground surface/submerged forest. Sources include Bell, M, 2007, Prehistoric

CMU	Site ID	NGR	Period	Description
				Coastal Communities: The Mesolithic in Western Britain, CBA Research Report 14; Bibby, H C, 1940, The Submerged Forests at Rhyl and Abergele, North Wales. Data for the study of postglacial history III, New Phytologist, 39, 220-5.
CMU 3-4	7434	SH94797871	Post Medieval	Pensarn Welsh Calvinistic Methodist Chapel, Ger-Y-Mor, Pensarn; Capel Bach. Pensarn Methodist Chapel was built 1858, in the Lombardic/Italian style of the gable entry type, with prominent flanking turrets. The chapel was closed in 1956 and has since been converted into residential accommodation.
CMU 3-4	961767	SH942787	Post Medieval	Gold fede or fidelity ring. Find spot. The hoop is of flattened D cross-section. The outer face is plain. The inner face of the hoop is inscribed with the text: After consent ever content, in vertical italic script. Internal hoop diameter 15.8 x 16.6mm. Portable Antiquities Scheme number NMGW-354744.
CMU 3-4	651571	SH9579	Neolithic	Neolithic polished stone axehead, findspot. It is complete (with a length of 142.8mm and a weight of 536.3g) and has a consistent polish which has removed all the shaping, presumably through pecking. The butt is blunt and has an even curve (45mm wide).
CMU 3-5A	193731	SH9600679094	Post Medieval	Ty-gwyn farm. Farm complex identified on OS 2nd edition 25 inch map. Likely to contain traditional farm buildings.
CMU 3-5A	194833	SH9602379106	Post Medieval	Ty-gwyn farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-5A	194834	SH9601579086	Post Medieval	Ty-gwyn farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-5A	194835	SH9601379093	Post Medieval	Ty-gwyn farm, farm building. Traditional farm building, or building now containing a traditional farm

CMU	Site ID	NGR	Period	Description
				building, identified from OS 2nd edition 25 inch map.
CMU 3-5A	194836	SH9599979096	Post Medieval	Ty-gwyn farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-5A	194837	SH9600779094	Post Medieval	Ty-gwyn farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-5A	194838	SH9601179099	Post Medieval	Ty-gwyn farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-5A	194839	SH9633279179	Post Medieval	Glan-llyn farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-5A	193732	SH9633379173	Post Medieval	Glan-llyn farm. Farm complex identified on OS 2nd edition 25 inch map. Likely to contain traditional farm buildings.
CMU 3-5A	412066	SH9566779041	Post Medieval	Glan-Dwr; Elwy Hall; North Wales Holiday Camp. The North Wales Holiday Camp, known as 'Elwy Hall', was one of many developed along the coast between Abergele and Rhyl after the Second World War. The main house, surrounded by chalets, was a long, 2-storey building with a red, diamond tiled roof, thought to be the original building named Glan-dwr on earlier mapping.
CMU 3-5B	193733	SH9706779560	Post Medieval	Gainc-fawr farm. Farm complex identified on OS 2nd edition 25 inch map. Likely to contain traditional farm buildings.
CMU 3-5B	194840	SH9707579580	Post Medieval	Gainc-fawr farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.
CMU 3-5B	194841	SH9705479545	Post Medieval	Gainc-fawr farm, farm building. Traditional farm building, or building now containing a traditional farm building, identified from OS 2nd edition 25 inch map.

CMU	Site ID	NGR	Period	Description
CMU 3-5B	97202	SH96787956	Post Medieval	Salem (1) Chapel (Welsh Calvinistic Methodist; Salem in Miller's Cottage), Tywyn. Built in 1818. Status by 2002 is unknown.
CMU 3-5B	240961	SH9788380638	Post Medieval	CYRUS (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The CYRUS was a wooden barque built in 1871. Its register entry was closed with the annotation 'Wrecked on Towyn Sands 18 May 1878'.
CMU 3-5B	271737	SH9767980465	Post Medieval	MARGARET (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The MARGARET was a wooden sailing vessel on passage from Bangor to Chester. The vessel was lost at Rhyrland (adjacent to Rhyddlan Marsh?) in 1815.
CMU 3-5B	300223	SH979801	20th Century, Modern	Holiday Camp, Towyn Road, Rhyl. A rifle range is shown on OS 2nd edition 25 inch mapping. Two 'Mantlet' (mantelet targets) are shown, one at the end of a 600 yard range, the other at end of a shorter 300 yard range. Modern aerial photography shows that the range is now largely built over.
CMU 3-5B	418593	SH97897990	20th Century, Modern	Winkups Holiday Camp. Winkups Holiday Camp is one of ten holiday parks in north Wales owned by the family-run company Lyons, which was founded in 1925. Winkups is situated in Towyn, near Rhyl on the north Wales coast.
CMU 3-5C	101567	SH9880	Medieval	Kinmel Bay Boundary Stone. No further information held in the HER.
CMU 3-5C	132170	SH9880	Modern	Rhyl, Foryd, Army camp. No further information held in the HER.
CMU 3-5C	132184	SH9880	Modern	Rhyl, Foryd, No.3 Manoeuvring Area. No further information held in the HER.
CMU 3-5C	17613	SJ0081	Roman	Rhyl Roman Coin. No further information held in the HER.
CMU 3-5C	34276	SH9956080802	Modern	Foryd Harbour Wreck. No further information held in the HER.

CMU	Site ID	NGR	Period	Description
CMU 3-5C	64185	SH9944581393	Post Medieval	Kinmel Bay Wreck 8243. Shipwreck on the beach at Kinmel Bay, NE of the town. The length of the wreck is recorded as 17m.
CMU 3-5C	83080	SH99468089	Post Medieval	Foryd breakwater. Breakwater depicted on OS 2nd edition 25 inch 1899.
CMU 3-5C	83521	SH99428071	Post Medieval	Foryd Quay. No further information held in the HER.
CMU 3-5C	83522	SH99458087	Post Medieval	Foryd timber yard. The trade in timber appears to have been started with the opening of Evans timber yard in the mid 19th century, which became Charles Jones & Sons from 1878 (Harris 1991, 147-149). The yard was located on the site of the old signal station (PRN 102875). The timber yard remained in use until the 1960s but the site has now been mostly cleared.
CMU 3-5C	83523	SH99648077	Post Medieval	Foryd landing stage. No further information held in the HER.
CMU 3-5C	83555	SH99508080	Post Medieval	Foryd Timber Yard Wharf. Quay constructed in 1866 at the terminus of the Vale of Clwyd Railway, which also serviced the timber yard. This comprised a dressed stone revetted quayside along which were a series of timber and cast iron mooring bollards, together with the cast-iron base for a crane, set on a dressed sandstone base.
CMU 3-5C	83559	SH99408073	Post Medieval	Foryd railway. No further information held in the HER.
CMU 3-5C	122728	SH9891781019	Post Medieval	Kinmel Bay, finger ring. Find spot. An incomplete finger ring of probable post-medieval date. The ring has an oval expanded bezel and broad shoulders. Below the shoulders each side is rounded where it terminates. At the rear of the object a thin rectangular band is soldered on to the bezel.
CMU 3-5C	122767	SH9914881285	Post Medieval	Kinmel Bay, musket ball. Find spot. A lead alloy musket ball dating from the Post-Medieval period, (1500-1800). The object is spherical and weighs 5.8g. The remains of a casting line and sprue are visible. The object has a dark grey patina

CMU	Site ID	NGR	Period	Description
				and is in fair condition. Dimensions: 11.33mm in diameter, 5.8g.
CMU 3-5C	122769	SH9855980905	Unknown	Kinmel Bay, finger ring. Find spot. A copper alloy wire finger ring of uncertain date. The object consists of two strips of wire which is bent round to form the band and then the ends overlap and curl around the band forming two slip knots. The strips of wire are rectangular in cross-section.
CMU 3-5C	128646	SH9942280895	Post Medieval	Foryd Harbour, building. A brick building with slate roof, measuring 14.8m north-east to south-west by 10.8m north-west to south-east. Accessed via a flight of steps at the north-west corner of the south-west wall with a large sliding door at the north-west corner of the north-east wall. The latter provided access for one of the narrow gauge railway tracks which had a turntable immediately outside the building.
CMU 3-5C	141797	SH9903280686	Modern	Rhyl, 600 yards rifle range. Rifle range, west of Foryd, depicted on OS 3rd edition 25" map of 1912. Orientated east-west, 600 yards long, comprising 'Mantlet' (mantelet targets) range indicators and possible marker's hut. Probably replaced by a new range on a different alignment in about 1916 (141850). The area is now largely developed for housing and no remains are expected to survive.
CMU 3-5C	141798	SH9903780762	Post Medieval	Rhyl, 200 yards rifle range. Rifle range, west of Foryd, orientated east-west, depicted on OS 2nd and 3rd edition 25" maps of 1899 and 1912. Length was 200 yards, comprising 'Mantlet' (mantelet targets) and range indicators. Presumably replaced by the new 1916 range (141850). The site has been developed for housing and a caravan park and no remains are expected to survive.
CMU 3-5C	141856	SH9894880722	Post Medieval	Rhyl, 700 yards rifle range. Rifle range, west of Foryd, depicted on OS 2nd edition 25" map of 1899. Length was 700 yards, comprising 'Mantlet' (mantelet targets) and range

CMU	Site ID	NGR	Period	Description
				indicators. Presumably replaced by the 600 yards range before 1912 (141797).
CMU 3-5C	271598	SH9801980780	Post Medieval	WILLIAM (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The WILLIAM was a wooden schooner belonging to the port of Liverpool. The vessel went ashore 1.5 miles west of Rhyl on 9 February 1861.
CMU 3-5C	422476	SH9900880629	Modern	Bettws Private Hotel, Bettws Avenue, Kinmel Bay. Bettws Private Hotel was situated on Bettws Avenue and was brick built with an asphalted flat roof. It had leaded light windows and sun balconies for the 8 bedrooms. Presumed to have been now demolished.
CMU 3-5C	300827	SH992809	Post Medieval	Vorydd; Voryd; Foryd 1848 Telegraph Station, Rhyl. Part of the Liverpool and Holyhead Telegraph (nprn 300822) station built in 1848 to replace the 1836 station (nprn 300826) which was thought to be on the course of the Chester and Holyhead Railway, then under construction. The site is now below the high water level and has been eroded by the sea.
CMU 3-5C	271628	SH9929981432	Modern	BONNY (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The BONNY was a Mersey flat built in 1829 and lost in 1908.
CMU 3-5C	300222	SH993809	20th Century, Modern	Foryd Bridge Holiday Camp, Foryd Road, Rhyl. Believed to date from the 1930s or immediately after the Second World War. The site seems to incorporate earlier mill buildings at least one of which is visible as a substantial two storey stone building under a hipped roof.
CMU 3-5C	300825	SH99458091	Post Medieval	Vorydd; Voryd; Foryd 1828 Telegraph Station, Rhyl. Part of the Liverpool and Holyhead Telegraph (nprn 300822). Built in 1828 as a supplementary station between Voel

CMU	Site ID	NGR	Period	Description
				Nant (nprn 300823) and Llysfaen (nprn 300828). There are no remains. The station was superceded by one built at SH 994 805 (nprn 300826) in 1836.
CMU 3-5C	271360	SH9947280771	Post Medieval	FRITHJOF (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. The FRITHJOF was a wooden schooner built at Svelvig in 1853. Technical and configuration specifications are given as 163gt, 151nt; 93ft 4in length x 22ft 6in depth x 11ft 6in breadth. It was lost in 1898.
CMU 3-5C	442	SH99598073	Post Medieval	City Of Ottawa (wreck). The remains of this vessel lie on a mud bank in Rhyl's Ford Harbour. THE CITY OF OTTAWA was built as a three-masted vessel with square rigging in 1860. Ship was brought to Rhyl in 1906 after taking damage in a storm and was abandoned.
CMU 3-5C	506949	SH99598073	Post Medieval	Unnamed wreck (post-medieval). The wreck is reported to lie with its keel orientated 030/210 degrees and has a length of 44m. The tops of the timbers are just visible above the sand/mud. The wreck was identified on aerial photographs dating to July 1987.
CMU 3-5C	524773	SH9959081409	Neolithic, Mesolithic	Submerged Forest, Rhyl. An exposure of submerged forest is reported near the mouth of the river Clwyd. A mattock and other lithic tools have been found below the peat. An axe has been found within the peat. Sources include Bell, M, 2007, Prehistoric Coastal Communities: The Mesolithic in Western Britain, CBA Research Report 149, pg2; Manley, J, 1988, Rhyl and coastal evolution, Journal of Flintshire Historical Society, 32, 181-9.
CMU 3-5C	35826	SH99808085	Post Medieval	Foryd Hall. A post-medieval dwelling. No longer extant.
CMU 3-5C	524837	SJ00038153	Post Medieval	Albion (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as

CMU	Site ID	NGR	Period	Description
				present at this location but may be in the vicinity. The ALBION was a wooden smack built at Aberystwyth in 1831. It wrecked near Rhyl in 1843 and was 'totally lost'.
CMU 3-5C	524878	SH99838154	Post Medieval	Jane and Mary (wreck). Archaeological remains associated with the loss of this vessel are not confirmed as present at this location but may be in the vicinity. A wooden sloop built at Pwllheli in 1793. 'The vessel totally lost on Rhyl bar 19 August 1869'.
CMU 3-5C	JBA-2	SH9947681157	Post Medieval	Potentially the remains of a wooden groyne system, most likely installed in 1967. Identified during the Feb 2022 JBA site visit for the Llanddulas to Kinmel Bay Coastal Improvement Scheme – Historic Desk-based Assessment.
CMU 3-5C	JBA-3	SH9948181142	Post Medieval	Potentially the remains of a wooden groyne system, most likely installed in 1967. Identified during the Feb 2022 JBA site visit for the Llanddulas to Kinmel Bay Coastal Improvement Scheme – Historic Desk-based Assessment.

B.3 Events

CMU	Site ID	NGR	Year	Description
CMU 3-2A	141870	SH8996578308	2010	Llanddulas, Abergele Road, Caersalem Chapel. Photographic survey undertaken on Caersalem Chapel in 2010.
CMU 3-3	95089	SH9274878021	2005	Abergele, Llanddulas Road, Hen Wrych Farm Site 3. A photographic survey carried out in 2005.
CMU 3-4	129321	SH9481078598	2010	Pensarn, South Parade, Canolfan Dewi Sant. A photographic survey undertaken in 2010 ahead of development.
CMU 3-4	132804	SH9491478664	2014	Pensarn English Presbyterian Church. Photographic survey undertaken in 2014 prior to conversion.
CMU 3-4	164091	SH9404178833	2019	Preliminary survey of the wrecked vessel, Pensarn, Abergele. A member of the public reported the remains of a possible wooden vessel on the shore of Pensarn Beach, Abergele to CPAT. A preliminary survey of the site was conducted by CPAT during evening low tide in 2019. Initial observations suggested that the lower

CMU	Site ID	NGR	Year	Description
				portions of wooden vessel were present. Remaining partially submerged, the lower elements of the stern, port and starboard side of the vessel were visible. The bow appeared to be lost or submerged, although elements of a possible bowsprit were visible. The vessel has been tentatively identified as the Endeavour, a wooden sloop lost in 1854.
CMU 3-5C	115408	SH9942280895	2007	Foryd Harbour Infrastructure Works. A watching brief at Foryd Harbour completed by CPAT in 2007, proving a rapid record of the only surviving timber yard building, together with quayside fixtures such as mooring posts and a crane base. The results from geotechnical investigations and observations during the watching brief provided no indication for any prehistoric deposits in this area and it seems that the area of the former timber yard lies on extensive deposits of sand, shingle and gravel associated with estuarine deposition and the formation of the spit at the mouth of the River Clwyd (Jones, N., 2007).
CMU 3-5C	152718	SH99518086	2012	Kinmel Bay and Towyn, Foryd Harbour. A watching brief carried out by CPAT in 2012 during groundworks associated with a regeneration scheme for the area of Foryd Harbour. No evidence of archaeological features or significant artefacts was revealed during the excavation of trenches at the locations of Anomalies A-C identified by a previous DBA and geophysical investigation of the site by Headland Archaeology. This area was quarried for gravel up to about 1960, and then used to dump rubbish until it silted up. The deposits in this area comprise natural gravels overlain by silts, sands and gravels deposited in the second half of the 20th century.
CMU 3-5C	153015	SH9958380896	2011	Rhyl, Foryd Harbour. A field walking survey summary and schedule for Ford Harbour Transport Bridge by Headland Archaeology in 2011. No further information.
CMU 3-5C	153016	SH9958680892	2005	Rhyl, Foryd Harbour. A geophysical survey for the Foryd Harbour Transport Bridge site by Headland Archaeology in 2010. No further information.
CMU 3-2A	141870	SH8996578308	2010	Llanddulas, Abergele Road, Caersalem Chapel. No further information.

C Site Visit Photographs



Plate 1 – General view of CMU 3-1 looking north east including revetment and coastal cycle path.



Plate 2 – View of the A55 Expressway bounding the south of CMU 3-1 facing north east from the A547.



Plate 3 – Locked access to the Llysfaen Post Medieval Railway Station (87072) facing north east.



Plate 4 – View to the south of the foreshore in CMU 3-1 looking at the A55 and its rock revetment facing south east.



Plate 5 – View of the Raynes Quarry Jetty (34205) from the cycle path facing north west.



Plate 6 – View from the River Dulas facing north west across CMU 3-2A, also taking in the Llanddulas and Rhyd-y-Foel weir (214563) in the foreground.



Plate 7 – View facing north east from CMU 3-2A.



Plate 8 – View facing north West across CMU 3-2A



Plate 9 – View facing south east of CMU 3-2A looking at the Llanddulas Lifeboat House (34207) and the railway viaduct (87069).



Plate 10 – The View with Llanddulas Lifeboat House (34207) to the left overlooking Llanddulas beach facing north west.



Plate 11 – The Dulas Railway Viaduct (87069) facing north.



Plate 12 – The view facing north west along CMU 3-2B.



Plate 13 – The view facing south east towards the Gwrych Castle Estate buildings.



Plate 14 – The view facing north from the Gwrych Castle Estate buildings towards the coastal frontage.



Plate 15 – The view facing north west across the frontage of CMU 3-3.



Plate 16 – The new heritage asset identified in CMU 3-3, Ty Crwn (JBA-1), the historic bathing house of the Lloyds of Gwrych, facing south west.



Plate 17 – Views from Ty Crwn (JBA-1) looking east.



Plate 18 –Hen Wrych Lodge (19039) facing south west.



Plate 19 – The views facing north from Hen Wrych Lodge (19039) towards the A55 Expressway.



Plate 20 – Gwrych Estate Boundary Wall and surrounding views (19044) facing north east.



Plate 21 – View from the eastern side of CMU 3-4 facing west.

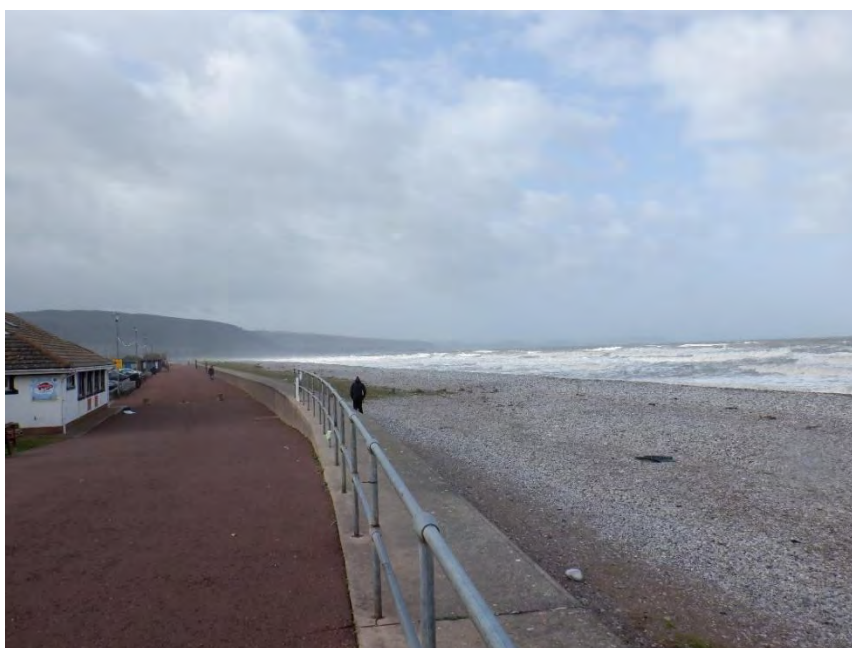


Plate 22 – View from promenade in CMU 3-4 facing west.



Plate 23 – Abergele and Pensarn Railway Station Booking Hall (18703) facing north west.



Plate 24 – **Abergele and Pensarn Railway Station "Up" Platform building** (18704) facing north.



Plate 25 – Abergele and Pensarn Railway Station “Down” Platform building (18705) facing south east.



Plate 26 – Abergele and Pensarn Railway Station Signal Box (18706) facing north east.



Plate 27 – The view from the Abergele and Pensarn Railway Station Booking Hall (18703) facing north east.



Plate 28 – The view from the railway bridge overlooking the foreshore and Abergele and Pensarn Train Station



Plate 29 – The view from the sea wall looking back at the Abergele and Pensarn Train Station facing south.



Plate 30 – The English Presbyterian Church (18696) facing south east.



Plate 31 – The views towards the foreshore from the English Presbyterian Church (18696) facing north.



Plate 32 – The vista looking north west across CMU 3-5A.



Plate 33 – The farm buildings at Ty-gwyn farm facing north west.



Plate 34 – The views towards the foreshore from the farm buildings at Ty-gwyn farm, facing north.



Plate 35 – The view looking west across CMU 3-5B



Plate 36 – The view looking east across CMU 3-5B



Plate 37 – The view looking east across CMU 3-5C back towards Kinnel Bay.



Plate 38 – The view looking west across CMU 3-5C back along Kinnel Beach.



Plate 39 – Remains of a groyne system that were identified in the eastern side of the CMU facing north east at Foryd Harbour



Plate 40 – The view from Foryd Harbour towards the coastal frontage facing north.



Plate 41 – The Listed Buildings on the frontage of the River Street Conservation Area (311) facing south.



Plate 42 – The view from the River Street Conservation Area (311) facing south towards Kinmel Bay.



Plate 43 – The view from Kinmel Beach towards the River Street Conservation Area (311) facing south east.

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G Contaminated Land

G.1 Phase 1 Contaminated Land Assessment

Contaminated Land Desk Study Llanddulas to Kinmel Bay, North Wales

Draft

August 2022

www.jbaconsulting.com

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Contract

This report describes work commissioned by the Environment Agency. Parvaneh Aghajani and Tim Stubley of JBA Consulting carried out this work.

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Purpose

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1 Introduction

1.1 Background

JBA Consulting (JBA) have been commissioned by the Amey Consulting to undertake a desk based contaminated land assessment which presents all available relevant information in relation to the coastal defence improvements along the coastal frontage between the village of Llanddulas and the seaside resort of Kinmel Bay, on the North Wales coast.

The existing coastal defences comprise a combination of timber groynes, rock revetment, cobbled beaches, sea walls and floodgates. The stretch is subject to frequent wave over-topping of the primary defences leading to flooding of nearby homes and local infrastructure. The objectives of the Llanddulas to Kinmel Bay Scheme are:

- Reduce flood damages to residential and non-residential properties
- Ensure community and stakeholder 'buy-in' for the Scheme
- Develop a scheme that is deliverable within engineering time constraints
- Develop a scheme that is adaptable to change; and
- Sustain and /or improve the tourist and amenity benefits through continued operation of the beach and the North Wales Coastal route.

The design life of the scheme is 100 years.

Development of the coastal defence scheme is being led by the Amey Consulting on behalf of the Conwy County Borough Council (CCBC) and Natural Resources Wales.

This desk-based assessment is required to assess any geo-environmental risks associated with the proposed works.

1.2 Aim and scope of study

The purpose of this desk study report is to determine the likely presence and extent of any potential environmental (contamination related) risks associated with the proposed scheme. This is achieved through:

- review of the current environmental setting, establishing any potential environmental pathways and receptors;
- assessment of potential contamination sources through analysis of environmental regulatory data and historical land uses; and,
- a qualitative Preliminary Risk Assessment (PRA) based upon current UK guidance (applicable to Wales): Land Contamination Risk Management (Environment Agency (EA) 2020¹) for any potential sources that have been identified, following the production of a conceptual site model, using the source-pathway-receptor methodology. This corresponds to a Stage 1 Risk Assessment under the above EA guidance framework.

Any conclusions and recommendations will then be given based on the results of this assessment. It should be noted that ecological and geotechnical assessments (ground stability) are excluded from this report and no specific geoenvironmental site walkover visit has been undertaken at this stage. Also, this assessment excludes assessment of above ground infrastructure at the site for the potential presence of Asbestos Containing Materials, or assessment of the presence of potential invasive plant species.

¹ <https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks/stage-1-risk-assessment>

1.3 Data sources

The data used in the desk study were obtained from the following sources:

- Topography and general mapping:
 - OS Open Data, Terrain 50 DTM, LiDAR 1/2m DTM (EA Open Data); and,
 - Aerial photography (Google Earth and Bing Maps).
- Geology and Soils:
 - BGS 1:50,000 Geology Mapping
 - BGS digital geology mapping,
 - BGS online borehole database (BGS website),
 - BGS online Lexicon (BGS website),
 - 1:250,000 soils mapping (Soil Survey of England and Wales, 1983),
 - Soil Landscapes Online Viewer (DEFRA, 2022),
 - DEFRA's Magic Map, The National Soil Resources Institute (NSRI),
 - Coal Authority online viewer.
- Hydrogeology:
 - Aquifer classification (Envirocheck Report),
 - Groundwater vulnerability (Envirocheck Report),
 - Source Protection Zones (Envirocheck Report); and,
 - Flood Risk Viewer
(<http://lle.gov.wales/catalogue/item/NationalFloodRiskMaps/?lang=en>),
 - BGS 1:625000 Hydrogeology Mapping of Wales.
- Environmental records and historical mapping (Landmark Envirocheck Report, 2022 - Appendix A).

2 Environmental setting

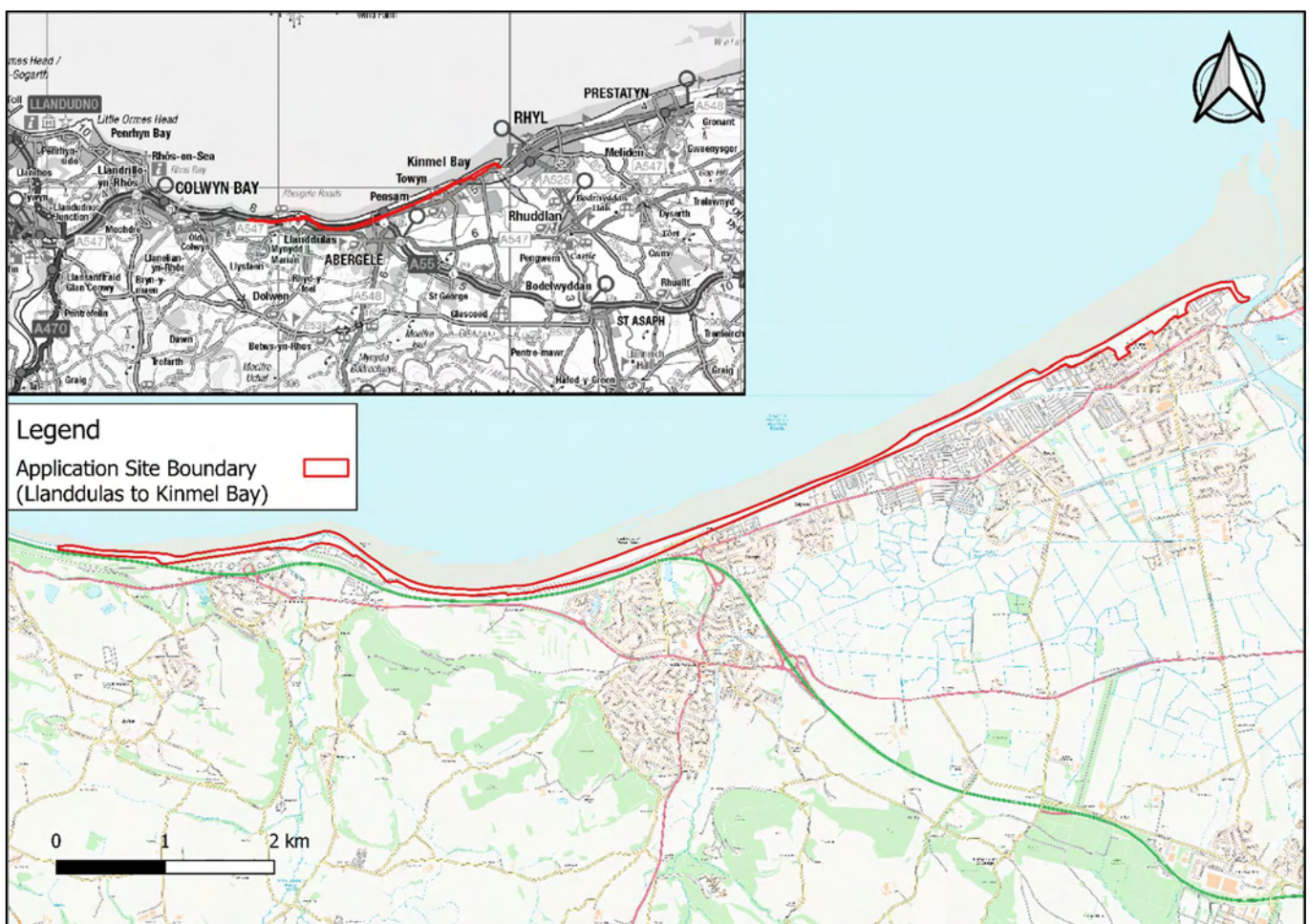
2.1 Introduction

The section presents a summary of JBA's understanding of the environmental setting of the site and local area, including aspects such as the hydrology, geology and ecology. This analysis will enable the identification of vulnerable receptors (such as productive aquifers, sites of ecological importance etc.) and potential pathways (such as migration through surface and sub-surface water flow).

2.2 Site area and location

The study area comprises the coastal frontage between the village of Llanddulas and the seaside resort of Kinmel Bay, on the North Wales coast. The lie approximately 12km and 0.8km east of the town of Rhyl, Denbighshire. The study area includes the town of Kinmel Bay and surrounding areas, a section of the river Clwyd (up to NGR 303317, 376180) and also the line of sea defences stretching to Raynes Jetty in Llanddulas (NGR 288703, 378604). The study area is provided in Figure 2-1.

Figure 2-1: Site Location



2.3 Topography

The topography of the site is shown in Figure 2-2, with a mean elevation across the site of approximately 1 to 10mAOD. In the wider area ground levels gradually dip northwards towards the Irish Sea. Further west, along the narrow section of southern boundary, surface elevation rises in level to around 26mAOD.

Figure 2-2: Topography



2.4 Current Land Use

The proposed site of the coastal defence scheme is situated along the existing coastal frontage of Llanddulas Beach, Pensarn Beach and Sandy Cove (Kinmel Bay), which extends approximately 12km from Llanddulas in the west to the Kinmel Bay in the east, protecting the communities of Llanddulas, Abergele, Towyn and Kinmel Bay.

Llanddulas Beach is a rock and pebble beach with an area of wet sand exposed at low tide. From the beach there are views over Colwyn Bay. A section of the North Wales Coastal Cycleway runs close by. This 34 mile long route is mainly off-road and can also be used by pedestrians.

The shingle beach of Pensarn is situated in front of the town of Abergele. A promenade runs along much of the beachfront and Pensarn is also located on the Wales Coastal Path.

As well as the Wales Coastal Path the area is also serviced by Cycle Route 5 which skirts along the beach. Part of the Pensarn Beach was designated as Traeth Pensarn

Site of Special Scientific Interest (SSSI) in 1977 as it was fine example of a vegetated shingle bank. Several plants that are not found elsewhere in Wales can be seen here, such as Ray's knotgrass, Sea kale and Sea radish.

Also known as Sandy Cove, the sandy beach of Kinmel Bay lies on the western side of the River Clwyd just across the estuary from Rhyl. The beach is a good spot for special animal species such as grey seal, skylarks, kestrel and a variety of wading birds. The sandy beach is also used by watersport enthusiasts all year round. Alongside the beach is a narrow promenade which passes the Kinmel Dunes Nature Reserve, which provides a habitat for a number of maritime plants including sea holly, rest harrow and bird's foot trefoil.

The existing coastal frontage comprises hard coastal defences, with a shingle beach and timber groynes. Access to the beach is via the public highway A55 (North Wales Expressway) and road A548 which run alongside the beach from Llanddulas to Kinmel Bay. A tarmac footpath (promenade) runs along the beachfront within the whole site. The Wales Coast Path and Sustrans National Cycle Network Route 5 run along the promenade through most of the study area. A number of public footpaths run along or perpendicular to the promenade in several locations. North Wales Coastline Railway (L&NWR) passes adjacent to the southern site boundary. Several caravan parks, picnic areas, leisure parks, holiday parks and car parks (such as The Beach Caravan Park, Castle Cove Holiday Park, Castle Cove Caravan Park, Kingsley Holiday Park, Lyndale Holiday Park, Knightley's Funfair and a number of more leisure parks car parks) can be found along this stretch of the coast.

The majority of the site comprises shingle banks that protect local infrastructure and the residential communities. Behind these defences are Llanddulas Limestone and Castle Wood SSSIs (250m to the south of the site boundary), Mynydd Marian SSSI (1km to the south of the site boundary) and Coed Y Gopa SSSI (1km to the south of the site boundary) which are nationally and internationally important sites.

In February 1990 a storm and high tide caused extensive flooding to the east of here, especially at Towyn and Kinmel Bay. New coastal defence works were built along 7 miles of coast from Old Colwyn to the River Clwyd. At Llanddulas these consist of Dolos concrete (a wave-dissipating concrete block).

2.5 Surface water hydrology

The main watercourses in the area are River Dulas (upper Dulas, lower Dulas and Nant y Fedw), River Gele, River Clwyd and coastal North Wales waterbody. An assessment of surface water bodies for ecological and chemical quality is maintained by the NRW under the Water Framework Directive and is viewable through their online Catchment Data Explorer.

The River Dulas, the westernmost watercourse in Llanddulas, flows around Cloliau height next to "Llyn Ty'n y Llyn SSSI" towards the north to where it outflows on Colwyn Bay. The watercourse is approximately 13km in length and passes through the site in Llanddulas Beach before joining the Irish Sea. The lower River Dulas waterbody belongs to Conwy Catchment and has 'poor' ecological status, 'good' chemical status and 'poor' overall status under the Water Framework Directive's classifications. The upper River Dulas waterbody has 'good' ecological status, 'good' chemical status and 'good' overall status and The Nant y Fedw (Dulas) River has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's classifications.

The River Gele, a tributary of the River Clwyd, flows north-eastwards approximately 1.2km to the southern site boundary before joining the River Clwyd. The watercourse is approximately 12km in length and joins River Clwyd at approximately 1.5km south of the south-east edge of the site. The river used to empty into the sea direct through the town of Abergele, but the Rhuddlan Marsh embankment act of 1794, diverted the

river from the south of the town in an eastwards direction across the south of Rhuddlan Marsh and into the River Clwyd at Towyn. A short distance of the river mouth is tidal. The River Gele waterbody belongs to the Conwy Catchment and has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's classifications.

The River Clwyd, the easternmost watercourse, rises in the Clocaenog Forest, 8km northwest of Corwen. Its total length is 56km. Around 2km north of St Asaph, the river is joined by a tributary as large as the main river, the River Elwy. At the confluence of the Elwy and the Clwyd, the river becomes tidal and enters a narrow estuary with much wildlife before meeting the Irish Sea at Rhyl. The River Clwyd marks the boundary between Rhyl and Kinmel Bay. The transitional (between riverine and coastal) water body near the river mouth has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status under the WFD's classifications. The river waterbody of the River Clwyd has 'moderate' ecological status, 'good' chemical status and 'moderate' overall status and the tributary, River Elwy, has 'good' ecological status, 'good' chemical status and 'good' overall status.

The coastal North Wales waterbody within and adjacent to the study area has 'moderate' ecological, 'failing' chemical and 'moderate' overall status under the WFD's classifications.

There are also a number of ponds surrounding the area. Most of these very small, shallow, freshwater ponds are formed by restoration of historical quarry workings.

2.5.1 Surface water abstractions

There are 4 surface water abstraction licences from River Gele recorded by the EA within 2km of the site boundary. Three of 4 abstractions are used for general agricultural purposes (spray irrigation), and the other one is used for other industrial/commercial/public services. The nearest surface water abstraction is situated at 1115m from the site boundary.

2.6 Geology

2.6.1 Summary

Information on the soils and geology of the site and surrounding area has been derived from the Soil Survey of England and Wales (1970), 1:50,000 British Geological Survey geology mapping (BGS online map viewer), 1:50,000 BGS geology mapping (Sheet 95 Rhyl) and the BGS online borehole archive (GeoIndex). The geology underlying the site is summarised in Table 2-1.

Table 2-1: Stratigraphy of lithologies underlying the site

Age	Formation/Group	Description	Thickness
Quaternary Period	Topsoil (From west to east)	Slightly acid loamy and clayey low carbon soils with impeded drainage which drains to stream network.	0-0.1m***
		Loamy and clayey medium carbon soils of coastal flats with naturally high groundwater (naturally wet) which drains to local groundwater.	No data available
	Made Ground	Firm to stiff, red-brown becoming slightly red-brown, silty, fine sandy clay with sub-angular to sub-rounded fine, medium and occasional coarse gravel and also	0-2m***

			including brown sand, limestone chips and dust. ***	
	Superficial Deposit	Marine Beach Deposits - Sand	Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the form of dunes, sheets or banks; in association with the marine environment.	No data available
		Storm Beach Deposits - Gravel	Low rounded ridge of coarse materials (gravels, cobbles and boulders) piled up by very powerful storm waves at the inland margin of a beach, above the level reached by normal spring tides.	0-1.4m***
		River Terrace (Undifferentiated) Deposits – Sand and Gravel	Sand and gravel, locally with lenses of silt, clay or peat.	No data available
		Tidal Flat Deposits – Clay, Silt and Sand	Tidal flat deposits, including mud flat and sand flat deposits, are deposited on extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat. Characteristically low relief.	10.2-15.09m***
		Tufa (Travertine) Deposits	Sedimentary rock composed of calcium carbonate or silica, formed by evaporation as a thin, surficial, soft, spongy, semifriable encrustation around the mouth of springs, seeps or along streams carrying calcium carbonate in solution, and exceptionally as a thick deposit along lake shores. Travertine is a hard, dense variety of tufa; it also occurs in caves as stalactites and stalagmites.	No data available
		Blown Sand Deposits	Blown sand is sand that has been transported by wind, or sand consisting predominantly of wind-borne particles.	~20m***
		Till, Devensian - Diamicton	Unsorted and unstratified drift, generally overconsolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier. It consists of a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape (diamicton).	15.0-46.30m***
		Submerged Forest - Peat	Remains of stumps and trunks of trees visible between tide marks or detected below low water mark, still in place of growth usually in peaty	No data available

			soil or peat. Peat and organic rich silty clay, commonly with fossil trees preserved in 'life' positions.	
Triassic Period	Bedrock Geology	Kinnerton Sandstone Formation – Sandstone	Sandstone, red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified. Dominantly aeolian.	Up to 150m**
Permian and Carboniferous Periods	Bedrock Geology	Warwickshire Group – Mudstone, Siltstone and Sandstone	Predominantly red, brown or purple-grey sandstone, siltstone and mudstone, some grey strata, coals not common, local conglomerates, localised beds of Spirorbis limestone.	Up to 1225m**
Carboniferous Period	Bedrock Geology	Clwyd Limestone Group – Limestone / Dolomitised Limestone and Dolomite	Diverse range of limestone facies with subordinate sandstone and mudstone units and exhibiting local dolomitisation. Records the initiation and growth of a carbonate platform along the northern flank of the Wales-Brabant Massif.	Up to 900m**
Sources: *Ground Investigation by JBA **BGS Online Lexicon of Named Rock Units ***BGS Borehole Records				

2.6.2 Soils

The Soil Landscapes Online Viewer (DEFRA, 2022) indicates that two soil types exist throughout the area of interest. These soil types are defined as deep soils which can be easily dug to a depth of more than 1 metre. From west to east, the soil types include:

- Slightly acid loamy and clayey low carbon soils with slightly impeded drainage which drains to stream network. The landcover is arable and grassland. The farmland is drained and therefore vulnerable to pollution run-off and rapid through-flow to streams. Surface capping can trigger erosion of fine sediment.
- Loamy and clayey medium carbon soils of coastal flats with naturally high groundwater (naturally wet) which drains to local groundwater. The landcover is arable with some grassland. The soils are mostly drained. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution from nutrients, pesticides and wastes applied to land.

2.6.3 Superficial deposits

The BGS GeoIndex indicates that the superficial deposits across and the site and surrounding area comprise Beach (Marine and Storm Beach) and Tidal Flat Deposits, overlain by River Terrace, Blown Sand, Tufa, Till and Submerged Forest-Peat (very small area) Deposits (Figure 2-3 and Figure 2-4).

The majority of the site is underlain by Storm Beach Deposits with some Blown Sand Deposits in the east, Tidal Flat deposits in the centre and Till Deposits in the west of the site. Uppermost of the northern boundary is dominated by Marine Beach Deposits.

The British Geological Survey (BGS) records very limited Made Ground deposits across the site, including firm to stiff, red-brown becoming slightly red-brown, silty, fine sandy clay with sub-angular to sub-rounded fine, medium and occasional coarse gravel and also brown sand, limestone chips and dust.

BGS borehole records covering the superficial deposits described the following characteristics:

- Modern Beach Deposits (mainly Storm Beach Deposits) – Loose to moderately loose, light-brown, fine, medium and coarse sand, sub-angular to rounded, fine, medium and coarse gravel, cobbles and boulders. The Modern Beach Deposits are formed up to 3mya in Quaternary Period.
- Till Deposits – Stiff to very stiff red-brown silty clay, fine sandy in places with sub-angular to rounded fine, medium and coarse gravel and occasional cobbles formed up to 2mya in Quaternary Period.
- River Terrace – Sand and gravel, locally with lenses of silt, clay or peat formed up to 3mya in Quaternary Period.
- Blown Sand – Coarse, medium and fine sand with medium and fine gravel and traces of shells formed up to 3mya in Quaternary Period.
- Tidal Flat Deposits – Soft to firm light-brown/grey/red-brown silty sandy clay and peat formed up to 2mya in Quaternary Period.

Figure 2-3: Superficial Deposits- West Section

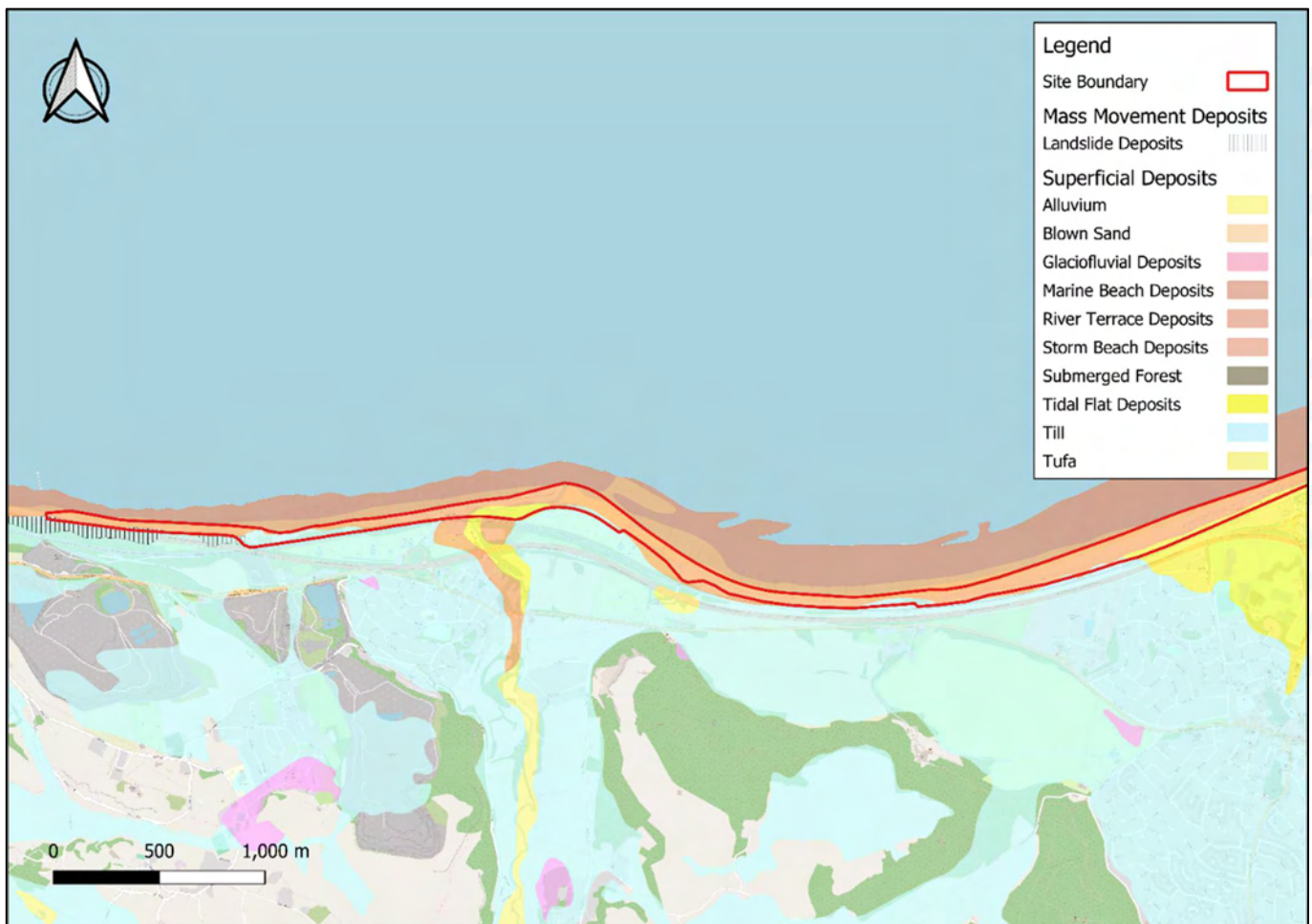
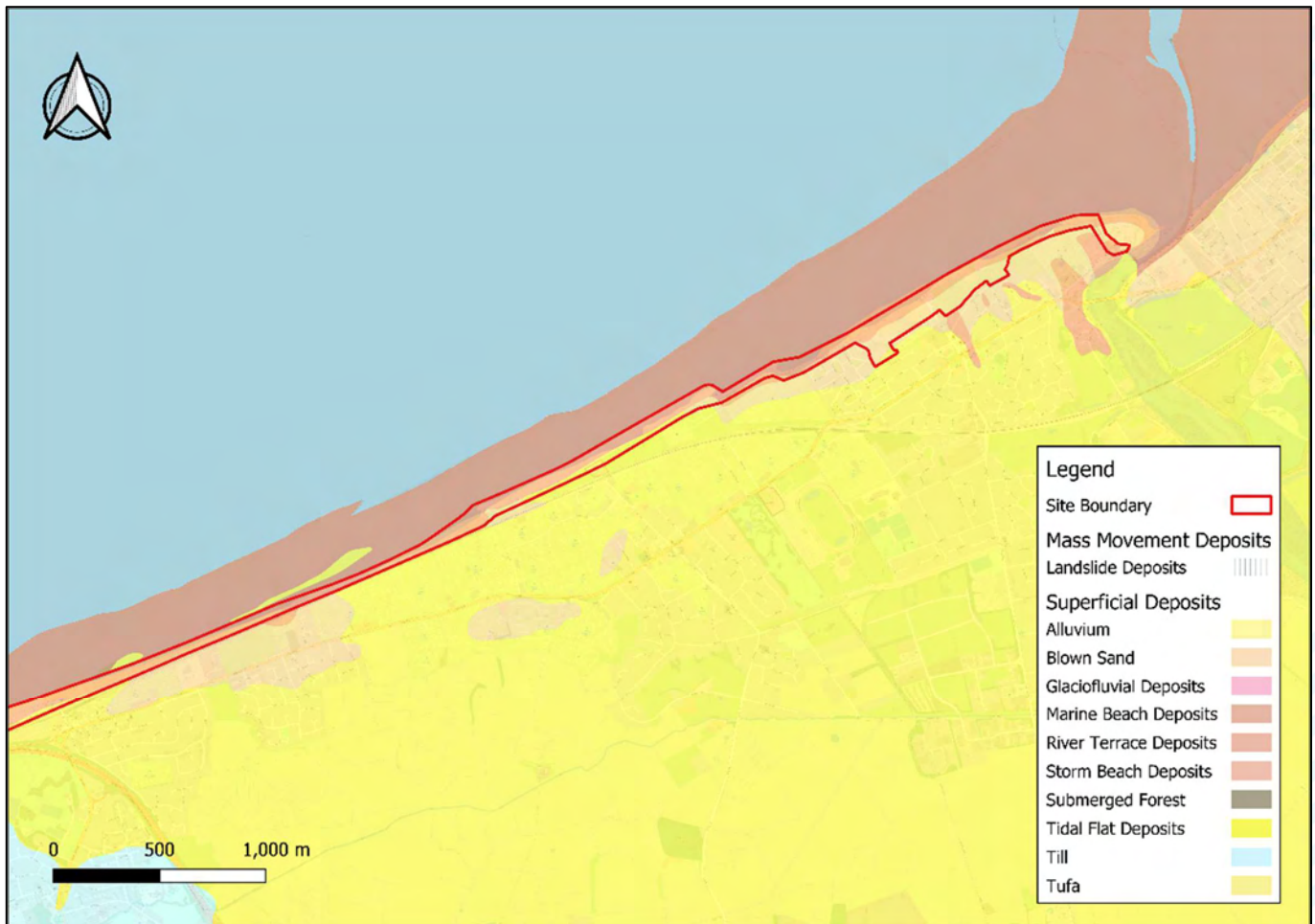


Figure 2-4: Superficial Deposits - East Section

2.6.4 Bedrock geology

The bedrock geology of the site comprises three lithologies of Early Triassic Kinnerton Sandstone Formation (east section), Permian and Carboniferous Warwickshire Group (middle section) and Carboniferous Clwyd Limestone Group (west section) (See Figure 2-5).

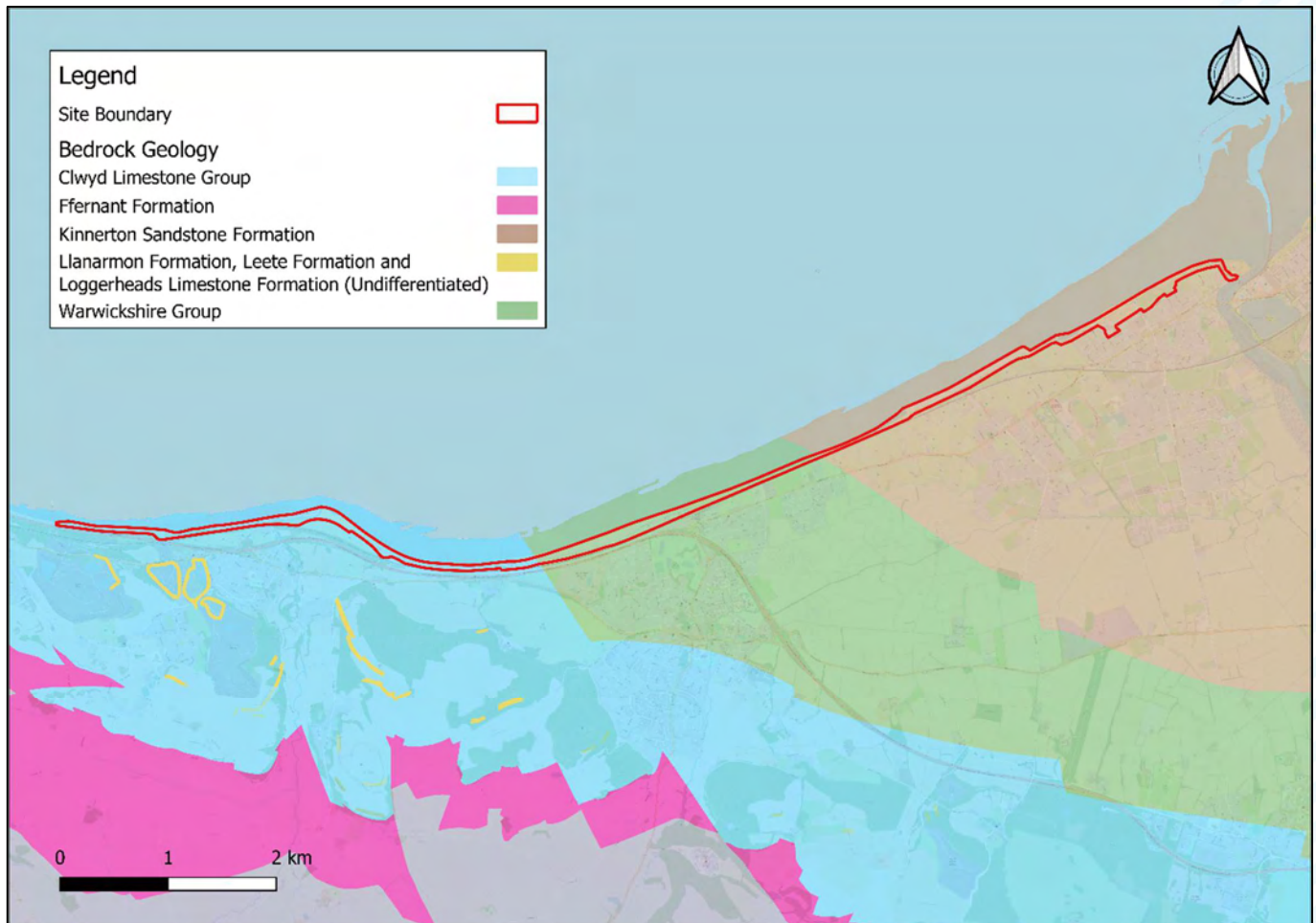
Kinnerton Sandstone Formation comprises up to 150m thick red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified sandstone which is dominantly aeolian formed approximately 247 to 252 million years ago in the Triassic Period.

Warwickshire Group comprises predominantly red, brown or purple-grey sandstone, siltstone and mudstone with some grey strata (coals not common), local conglomerates and localised beds of Spirorbis limestone formed approximately 272 to 318 million years ago in the Permian and Carboniferous Periods. The maximum thickness of the strata varies from 1225m in Warwickshire, to 1192m thick in the Stoke-on-Trent area.

Clwyd Limestone Group comprises up to 900m diverse range of limestone facies with subordinate sandstone and mudstone units and exhibiting local dolomitisation formed approximately 329 to 347 million years ago in the Carboniferous Period. The strata records the initiation and growth of a carbonate platform along the northern flank of the Wales-Brabant Massif. BGS borehole described the Clwyd Limestone Group as

Slightly weathered, highly to moderately jointed, strong, grey, crystalline Limestone, with joints mostly tight with some red clay and slight evidence of solution, and local penetration of purple red colouration into rock mass (BGS borehole Ref: SH87NE167).

Figure 2-5: Bedrock Geology



2.7 Coal and non-coal mining

The Coal Authority's online interactive viewer has been reviewed for the area. The eastern part of the site from Abergele to the east is within North Wales Coal Mining Reporting Area. The Coal Mining Reporting Area, also known as CON29M Coal and Brine Consultation Areas, is the known extent of coal mining activity and is used to determine whether a coal mining report is required for property transactions and the conveyance process.

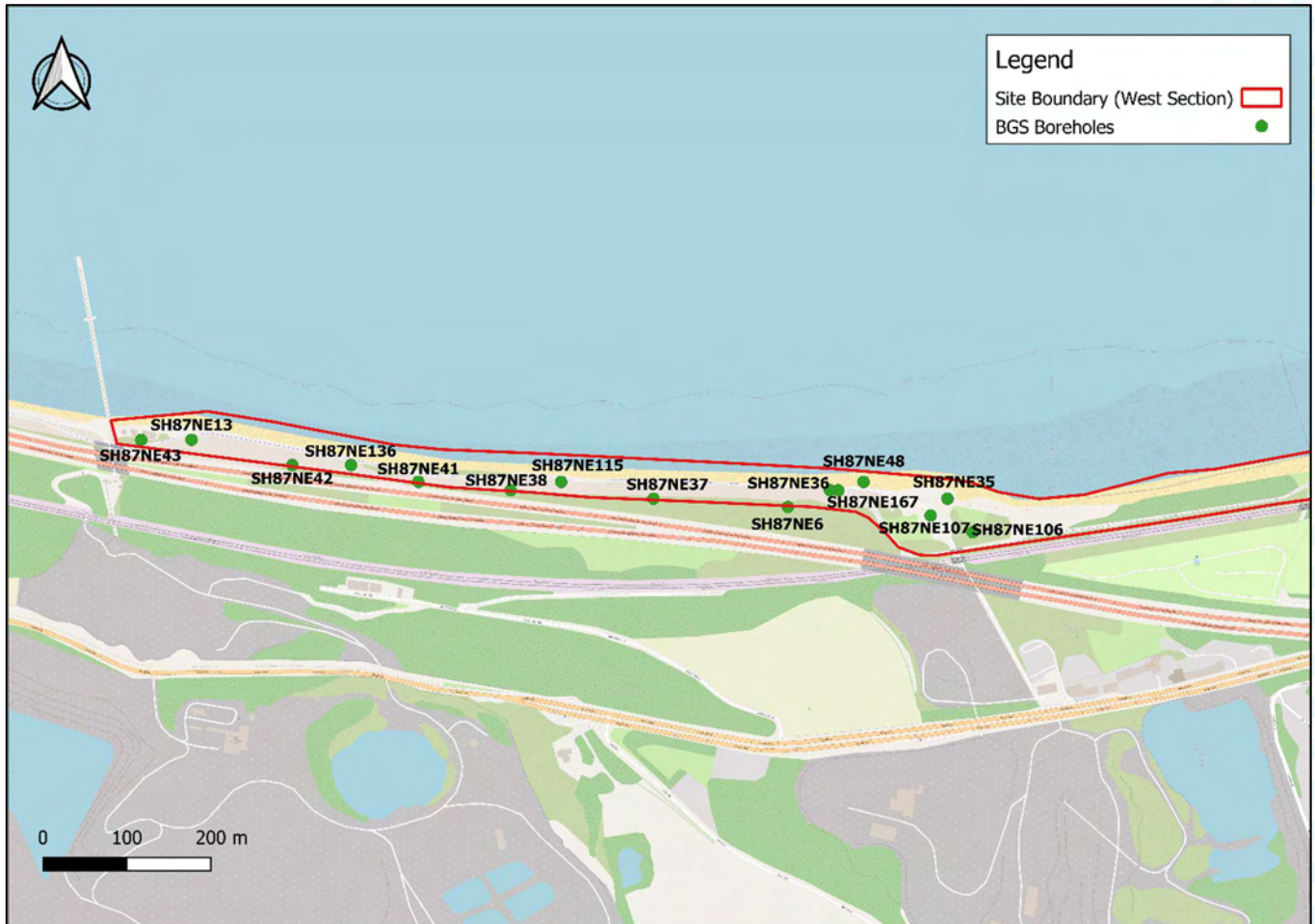
2.8 BGS GeoIndex

There are fourteen (14no.) historical boreholes present within the western part of the site. However, within the eastern part of the site there are no borehole records. Multiple historical boreholes have been undertaken within 500m of the site and records are available on the BGS GeoIndex. The location of the historical boreholes undertaken is presented in Appendix A (Envirocheck Report). The borehole records are broadly consistent with the information presented within BGS maps of the area.

The geological information within the boreholes has been evaluated and compared with the geological maps. Based on the information provided in records from the boreholes presented in Figure 2-6, a preliminary geological model for the site has been

developed and is presented in Table 2-1. Groundwater was encountered at 5-6mbgl and 12.5-15mbgl.

Figure 2-6: Historical borehole locations



2.9 Hydrogeology

2.9.1 Aquifer designation

The drift deposits covering the site including Beach Deposits, River Terrace Deposits and Blown Sand Deposits are classified as a 'Secondary A Aquifer', which is described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. These are generally aquifers formerly classified as minor aquifers.

The Till Deposits and Tidal Flat Deposits, located in some sections throughout the site, are designated Secondary Undifferentiated aquifers – meaning it has not been possible to attribute either category A or B. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the geology type.

The underlying bedrock unit of Warwickshire Group is also classified as Secondary A Aquifer.

The underlying bedrock units of the Kinnerton Sandstone Formation and Clwyd Limestone Group are classified as a Principal aquifers, which are described as layers of rock that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage and transmission. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifers. Aquifer units are presented in Table 2-2.

Table 2-2: Aquifer designations

Group	Formation	Classification
Superficial (drift) Deposits	Till Deposits	Secondary Undifferentiated Aquifer
	Modern Beach Deposits (Storm and Marine Beach Deposits)	Secondary A Aquifer
	River Terrace Deposits	Secondary A Aquifer
	Blown Sand Deposits	Secondary A Aquifer
	Tidal Flat Deposits	Secondary Undifferentiated Aquifer
Bedrock	Kinnerton Sandstone Formation	Principal Aquifer; Highly productive aquifer
	Warwickshire Group	Secondary A Aquifer; Moderately productive aquifer
	Clwyd Limestone Group	Principal Aquifer; Moderately productive aquifer
Explanation of aquifer classes (from Environment Agency website) Principal aquifers - "may support water supply and/or baseflow to rivers on a strategic scale." Secondary A aquifers - "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers." Secondary B aquifers - "predominantly lower permeability layers which may store and yield limited amounts of groundwater." Secondary Undifferentiated aquifers – "the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type."		

2.9.2 Aquifer vulnerability and water quality

The BGS's aquifer vulnerability mapping indicates underlying superficial deposits and bedrock lithologies are marked as having high vulnerability, meaning they are high priority groundwater resources that have limited natural protection. This results in a high overall pollution risk to groundwater from surface activities. Operations or activities in these areas are likely to require additional measures over and above good practice pollution prevention requirements to ensure that groundwater isn't impacted.

The underlying bedrock units in this area falls under the WFD groundwater body 'Clwyd Permo-Triassic Sandstone Water Body'. The water body is classified as having 'good' chemical status, 'good' quantitative status and 'good' overall status as of 2019.

2.9.3 Groundwater abstraction

There are 2 groundwater abstraction licences provided by the EA within 2km of the site boundary. Both abstractions are used for industrial, commercial and public services purposes (general washing/process washing). The nearest groundwater abstraction borehole is situated at approximately 1100m from the site boundary.

2.9.4 Aquifer properties and groundwater flow

The Kinnerton Sandstone Formation belongs to undifferentiated Permo-Triassic rocks comprising sandstone with some conglomerated and is a highly productive aquifer. The aquifer yields up to 25 L/s in Eden and Clwyd valleys.

The Warwickshire Group, a moderately productive aquifer, is a regional, cyclic multi-layered aquifer with moderate to large yields from sandstone units.

The Clwyd Limestone Group belongs to undifferentiated Dinantian (Carboniferous) rocks comprising karstic limestone aquifer with rapid response to rainfall and is a moderately productive aquifer. The aquifer yields variably from dry to 40L/s.

The general regional groundwater gradient can be expected to reflect the topographic gradient, with groundwater flowing north towards the coast.

2.9.5 Groundwater source protection zones

Source Protection Zones (SPZs) are used to protect areas of vulnerable groundwater that is used for abstraction and where water quality is of high importance (such as drinking water abstractions). SPZs are categorised into three zones, 1-3, with 1 being of highest risk of contamination, and 3 representing the lowest risk but still within the groundwater catchment.

There are no SPZs recorded within 1km of the site. The nearest SPZ is located approximately 8km to the south-east of the eastern edge of the site boundary.

2.10 Ecological and other designations

Site of Special Scientific Interest are the finest sites for wildlife and natural features, supporting many characteristics, rare and endangered species, habitats and natural features. There are four SSSI within 1km of the site.

- Traeth Pensarn SSSI located within the site boundary – The area was designated a SSSI in 1977 as it was fine example of a vegetated shingle bank. Several plant that are not found elsewhere in Wales can be seen here, such as Ray's knotgrass, Sea kale and Sea radish.
- Llanddulas Limestone and Gwrych Castle Wood SSSIs located approximately 250m to the south – The area is of special interest for limestone (calicolous) grassland, heath and woodland communities, the first two of which comprise some of the largest examples in Clwyd, as well as its populations of vascular plants, bryophytes, butterflies, moths and a winter roost of lesser horseshoe bat *Rhinolophus hipposideros*.
- Mynydd Marian SSSI located approximately 1km to the south – The area is a small limestone ridge on the edge of the village of Llysfaen between Colwyn Bay and Abergele. The grassland flora, hoary rockrose, spring cinquefoil, silver-studded blue butterfly and the tall, wafting upright brome grasses all contribute to its designation as a Site of Special Scientific Interest. It has also high limestone cliffs which are popular with rock climbers.
- Coed Y Gopa SSSI located approximately 1km to the south – The area is Located on a prominent limestone hillside in the Vale of Clwyd. Coed y Gopa is a popular wood managed by the Woodland Trust, with a wide variety of wildlife, coastal views, and features of historical interest. Mine adits and natural caves provide roosts for bats and the second largest lesser horseshoe bat hibernaculum in North East Wales is present at the site. The site is also home to ospreys and goshawks.

There are no Special Areas of Conservation (SAC) within 5km of the site boundary. The nearest SACs are 'Dee Estuary (Wales) SAC', 8km to the east of the eastern site boundary, and 'Menai Strait and Conwy Bay SAC', 8km to the west of the western site boundary.

The Special Protection Area of 'Liverpool Bay SPA' is located approximately 200m to the north of the whole northern boundary through the coastline.

The 'Dee Estuary (Wales) SPA/RAMSAR' is located approximately 8km to the east of the eastern site boundary.

The Local Nature Reserve of 'Kinmel Dunes LNR' is located within the site boundary. There are also 54 Ancient Woodlands within 1km from the site boundary.

2.11 Summary of potential environmental receptors

A summary of environmental receptors that may be present in or near to the site is given in Table 2-3. This shows receptor types and their associated sensitivity.

Table 2-3: Summary of potential environmental receptors

Receptor Type	Receptor	Sensitivity	Reasoning
Human receptors	Future site users and workers involved in site development	High	At this stage JBA understand that the proposed works may potentially involve excavation and other ancillary groundworks.
Groundwater	Secondary undifferentiated aquifer (Till and Tidal Flat Deposits)	Low	High vulnerability secondary aquifer underlying soil/Made Ground.
	Secondary A aquifer (Beach, River Terrace and Blown Sand Deposits)	Medium	High vulnerability secondary aquifer underlying soil/Made Ground.
	Principal aquifer (Clwyd Limestone Group)	High	High vulnerability Principal aquifer, exposed under the drift deposits of Beach, River Terrace and at least 15m of Till deposits in the western part of the site. Approximately 100m to the south of the western section the Clwyd Limestone outcrops and therefore in this area it is classified as very high vulnerability aquifer.
	Secondary A aquifer (Warwickshire Group)	Medium	High vulnerability Secondary aquifer underlying Beach and Tidal Flat deposits in the middle part of the site.
	Principal aquifer (Kinnerton Sandstone Formation)	High	High vulnerability Principal aquifer, exposed under the drift deposits of Blown Sand, Tidal Flat and Beach deposits in the eastern part of the site. Potential for infiltration of contaminants from Made Ground into the aquifer.
	Abstractions	Medium	Two groundwater abstraction licences within 2km of the site boundary. Both are used for industrial, commercial and public services purposes. The groundwater abstraction boreholes are situated at approximately 1100m from the site boundary.
Surface water	River Dulas (upper Dulas, Lower Dulas, Nant y Fedw)	Medium	Flows pass through the site northwards at its outlet on the coast. Potential for contaminants to reach receptor via surface

			and groundwater flow. • Upper Dulas – Good ecological status; Good chemical status; Good overall status • Lower Dulas – Poor ecological status; Good chemical status; Poor overall status • Nant Y Fedw – Moderate ecological status; Good chemical status; Moderate overall status
	River Gele	Medium	Flows past the site's southern boundary approximately 1100m eastwards towards River Clwyd. Potential for contaminants to reach receptor via surface and groundwater flow. Ecological status: Moderate Chemical status: Good Overall status: Moderate
	River Clwyd	High	Flows past the site's eastern boundary at its outlet on the coast. Potential for contaminants to reach receptor via surface and groundwater flow. Ecological status: Moderate Chemical status: Good Overall status: Moderate
	Coastal North Wales Waterbody	High	Located immediately offshore of the site. Potential for contaminants to reach this receptor via surface runoff. Ecological status: Moderate Chemical status: Failing Overall status: Moderate
	Abstractions	Medium	Four surface water abstraction licences from River Gele within 2km of the site boundary. Three out of 4 abstractions are used for general agricultural purposes (spray irrigation), and the other one is used for other industrial/commercial/public services. The nearest surface water abstraction is situated at 1115m from the site boundary.
Ecological Receptors	Traeth Pensarn SSSI	High	Located within the site boundary. Potential for contaminants to reach this receptor via surface runoff.
	Llanddulas Limestone and Gwrych Castle Wood SSSI	High	Located 250m to the south, upgradient.
	Mynydd Marian SSSI	High	Located 1km to the south, upgradient.
	Coed Y Gopa SSSI	High	Located 1km to the south, upgradient.
	Liverpool Bay SPA	High	Located immediately offshore of the site (north). Potential for contaminants to reach this receptor via surface runoff.

3 Potential contamination sources

3.1 Introduction

An analysis of potential contamination sources has been completed through review of various data sources. This includes regulatory data (such as waste management licences, trade directories and pollution incident records), historical mapping and the National Hazard Directory. Regulatory data and historical mapping were sourced through a Landmark Envirocheck Report and can be found in Appendix A.

3.2 Regulatory and environmental data

A summary of the regulatory and environmental data concerning the site and local area is given in Table 3-1 and is sourced from the Envirocheck Report.

Table 3-1: Summary of regulatory and environmental data

Data source	Details
Explosive sites	None within 1km.
Contaminated land register entries	None within 1km.
BGS Recorded Mineral Sites	3 sites (limestone quarries) situated within 250m, 11 sites (1 sand and gravel, 10 limestone quarries) situated between 251-500m, and 10 sites (1 blown sand, 2 lead and 7 limestone quarries) situated between 501-1000m from the site.
Landfill sites	3 historical landfill sites (all related to the same location) situated within the site boundary: - Jennings Plant Services Limited; Deposited Waste included Inert and Household Waste; Last input 1993; NGR 291701 378319 - Jennings Plant Services Limited; Deposited Waste included Industrial, Commercial and Household Waste; Last input 1974; NGR 291701 378319 - Jennings Plant Services Limited; Deposited Waste included Inert and Household Waste; Last input 1993; NGR 292621 378193 2 historical landfill sites and one BGS recorded landfill site situated within 250m from the site: - G W Knowles; Deposited Waste included Inert Waste; Last input 1986; NGR 288338 378520 - Llanddulas Quarry; Deposited Waste included Industrial and Commercial Waste; Last input 1975; NGR 290066 378241 - Llanddulas Quarry (BGS); No threat to ground/surface water; Above Limestone aquifer (700ft); NGR 290066 378241 7 historical landfill sites and two BGS recorded landfill sites situated between 501-1000m from the site: - Colwyn Borough Council; Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste; Last input 1991; NGR 290452 377736 - Greenways; Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste; Last input not supplied; NGR 290491 377613 - Marsh Road Tip (BGS); No threat to ground/surface water; NGR 300093 380131 - Kinmel Bay, Land Near Clwyd Bank; Deposited Waste included Inert, Industrial and Household Waste; Last input 1945; NGR 299399 380143 - Marsh Road, Rhyl, Flintshire; Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste; Last input

	1985; NGR 300093 380131 - Marsh Road Tip (BGS); No threat to ground/surface water; NGR 300196 380287 - Kinmel Bay, Land Near Clwyd Bank; Deposited Waste included Inert, Industrial and Household Waste; Last input 1945; NGR 299406 380207 - Marsh Road, Rhyl, Flintshire, Marsh Road Tip; Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste; Last input 1985; NGR 300310 380501 - Rhydwen Drive, Rhyl Cut; Deposited Waste included Industrial and Household Waste; Last input not supplied; NGR 300477 380511
Other waste management sites	3 licensed waste management facilities (locations) situated within 250m, 4 locations situated between 251-500m, and 17 locations situated between 501-1000m from the site.
Hazardous substances	None within 1km.
Planning Hazardous Substance Consents	None within 1km.
Registered Radioactive Substances	None within 1km.
Fuel station entries	One fuel station entry situated within 250m, 3 entries situated between 251-500m, and 2 entries between 501-1000m from the site.
Contemporary trade directory entries	32 entries situated within 250m of the site (10 active), 178 other entries situated between 251-1000m from the site.
LAPPC	One permit situated within 250m, 6 permits situated between 251-500m, and 5 permits situated between 501-1000m from the site.
IPC/IPPC	One effective IPPC situated between 251-500m, and 6 IPPC (1 valid) situated between 501-1000m from the site.
Discharge consents	19 discharge consents located within the site boundary (5 effective), 85 other discharge consents between 251-1000m from the site.
Recorded pollution incidents to controlled waters	12 pollution incidents (1 major, 8 significant, 3 minor) situated within 250m, 6 incidents (2 significant, 4 minor) situated between 251-500m, and 17 incidents (3 significant, 14 minor) situated between 501-1000m of the site.
Radon	11 radon affected areas (8 higher probability radon areas (10 to 30% of homes are estimated to be at or above the Action Level) and 3 a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level)) and 8 full radon protection measures in place within the site.
Notes: IPC = Integrated Pollution Control; IPPC = Integrated Pollution Prevention & Control; LAPPC = Local Authority Pollution Prevention & Controls	

3.3 Historical Land Use

The historical land uses on and adjacent to the site have been determined from a review of historical OS mapping supplied as part of the Landmark Envirocheck Report (Appendix A) and a summary is outlined in the sections below. The mapping includes scales of 1:2,500, 1:10,560 and 1:10,000 were produced between 1851 to 2020. A summary of historical land uses within the site is given in Table 3-2.

Table 3-2: Historical land use

Map year	Land use on site	Land use off site (within 1km)	Potential contamination sources
1875; 1879- 1880	West Section: Rock, pebble and shingle beach; Footpath along and across the beach in some sections; Jetties within the western part of the site; Tramways connecting quarries to jetty. East Section: Shingle and sandy beach; Footpath along and across the beach in some sections; Rough grassland along the coastline in some areas.	West Section: Predominantly agricultural land, farms, cottages, roads, subways and footpaths as well as forests and woodland surrounding the site; Llanddulas, Terfyn and Abergele villages within 1km to the south of the site with cottages and properties, roads and wooded area; Limestone quarries (Llanddulas quarries, Merllyn quarry, old quarry, unnamed ones) and gravel pits, tramways and shafts within 250m and 500m to the south; Reservoir within the Llanddulas quarries; Jetty 500m to the west; L&NWR railway, embankments and tunnel 100m to the south parallel to the southern boundary; Llysfaen station and signal box 250m to the south; Corn mill next to the River Dulas 500m to the south; Beach house and lifeboat house adjacent to the southern boundary; Reservoir 500m to the south. East Section: Predominantly agricultural land, farms, cottages, roads and footpaths of Abergele and Towyn villages surrounding the site; Foryd railway passes southwards approximately 850m to the south at Foryd and L&NWR junction; Foryd harbour approximately 250m to the south; Rhyl village within 500m to the south-east with cottages, farms, roads and wooded area; Gas works and boat house approximately 550m to the south-east; Ship building yard approximately 250m to the south; Two landing stages within 250m to the south; Ryle bridge and life boat house within 500m to the south; Vale of Clwyd railway passes southwards within 250m to the south.	Made Ground associated with residential properties, beach house and life boat house, landing stages, jetties, tunnels and embankments; Limestone quarries and shafts; Gravel pits; Railways, stations and tramways; Corn mill; Gas works; Electrical substations; Pumping stations.
1900	West Section: Rough grassland along the coastline in	West Section: Old Colwyn Station 1km to the west;	Made Ground associated with jetties, fire station,

	some areas. East Section: Springs and fire station within the beach; Jetty crosses the site.	Llanddulas and Abergele/Pensarn stations adjacent to the southern boundary; Residential properties within 1km to the south southwest; Llanddulas urban expansion, residential properties replacing the farms; Old shafts (Lead) approximately 750m to the south (south of Gwrych Castle Wood). East Section: Level crossings, springs and fire station adjacent to the southern boundary; Foryd station approximately 300m to the south; Morfa isolation hospital next to the Foryd station; Foryd saw mills approximately 75m to the south.	residential properties, level crossings and embankments; Old shafts (lead); Railway stations; Foryd saw mill.
1913; 1914- 1915	West Section: No significant changes. East section: Sewage tanks (Abergele and Penisarn U.D. Council) and outlets to the sea next to the sewage tanks; Jetty crosses the site.	West Section: Urban development of Llanddulas within 1km to the west and south including residential and commercial properties, churches, schools, play grounds, roads; Sewage tanks 250m to the south; Small ponds, Sheepfold and hydraulic ram (within agricultural lands) within 250m to the south. East Section: Breakwaters adjacent to the northern boundary; Groynes and breakwaters approximately 50m to the north; Sheepfolds within 1km in the farms; Urban development of Rhyl village; Band stand within 1km to the east; Life boat house is removed.	Made Ground associated with jetty, breakwaters, groynes, residential and commercial properties, band stand and removed life boat house; Sewage tanks and outlets.
1937; 1938- 1953	West Section: No significant changes. East Section: No significant changes.	West Section: Continuing urban expansion including residential properties, roads, playing fields, clubhouse, cemetery, within 1km to the west and south. East Section: Holiday/caravan camps within 250m to the south; Foryd station is removed; Ryle bridge is deconstructed and moved approximately 50m northwards; Continuing urban development of Rhyl including residential properties, roads, play grounds;	Made Ground associated with residential properties, caravan/holiday camps, former Foryd station, former Ryle bridge and former ship building yard.

		Ship building yard is removed.	
1953-1954; 1957	West Section: No significant changes. East Section: No significant changes.	West Section: No significant changes. East Section: Brick works within 250m to the south; Boat house is removed.	Made Ground associated with brick works and former boat house.
1961; 1964; 1969	Western Section: One of the jetties is deconstructed; The trams are replaced by conveyors. East Section: Majority of cottages along the beach is converted to holiday/caravan park; Small pond adjacent to the southern boundary; Groynes along the beach; Sewage tanks are removed; Jetty is deconstructed; Drains passes across the site; More footpath along the beach; Breakwaters along the beach.	West Section: Llysfaen Station is removed; Llanddulas station is replaced by caravan site; A55 road is constructed approximately 100m to the south; Groynes along the coastline within 250m to the north; Conveyors, tunnels and subways replaced the trams within quarries; A pond is formed within excavated area of Llanddulas quarry 250m to the south; Drains within 250m and 500m to the south; Broughs Beach caravan camp adjacent to the southern boundary; Caravan camps and shelters within 250m and 500m to the south; Extensive urban development of Llanddulas including residential properties, roads, drains, tennis court, golf course, football grounds, allotment gardens, club house, nursery; Small ponds within 250m to the south; Sheepfold and hydraulic ram are removed; Shafts (Lead) are disused. East Section: Extensive urban development of Abergele including residential properties, roads, drains, play grounds, allotment gardens; Electricity substation approximately 250m to the south; Pipe lines within 250m to the north; Sewage pumping station approximately 50m to the south; Brick works is removed; Towyn village urban development (slight) including residential properties, pay grounds, roads and drains; Some farm lands are replaced by caravan/holiday camps; Water works and pumping station approximately 200m to the south; Kinmel Bay is constructed with extensive urban development including residential properties, factories, small ponds, drains, parks, holiday/caravan	Made Ground associated with breakwaters, groynes, A55, urban development, conveyors, tunnels and subways, deconstructed landing stand, deconstructed jetty, former band stand, former brick works, former trams, former Llysfaen and Llanddulas stations; Disused shafts (Lead) - infilling with Made Ground; Water works and pumping station; Pipelines; Sewage pumping station; Electricity substation.

		camps; Pipeline within 250m into the sea; One of the landing stages are deconstructed; Band stand is replaced by residential properties.	
1967-1970; 1972-1978	West Section: No significant changes. East Section: Electricity substation and pumping station.	West Section: Continuing urban expansion within 500m to the west and south including extending A55 (and embankments in some sections), pathways, lanes, schools, police station; More caravan parks and service areas within 250m, 500m and 1km to the south; Depots within 250m to the south; Pumphouse and tank (covered) within 250m to the south; Two electricity substations within 500m to the south; Lake is formed over the excavated area of the Raynes (Merilyn) Quarry; Jetty 500m to the west is removed. East Section: Continuing Towyn urban development; Two electricity substations approximately 200m to the south; Vale of Clwyd railway is dismantled; Three electricity substations within 300m to the south.	Made Ground associated with urban expansion, jetty and dismantled Vale of Clwyd railway; Electricity substations, pump house and tank, pumping station.
1971-1989; 1977-1987;	West Section: No significant changes. East Section: Groynes along the coastline.	West Section: No significant changes. East Section: Electricity substation next to sewage pumping station 150m to the south; Six electricity substations approximately 300m to the south; Tank approximately 450m to the south; Two pumping stations and one electricity substation approximately 900m to the south; Electricity substation approximately 150m to the south; Foryd railway is dismantled; Gas works is removed.	Made Ground associated with groynes, dismantled railway and former gas work; Electricity sub stations; Pumping stations and tank.
1989; 1990; 1991-1992	West Section: Coastal path and cycle route along the beach; Car park within the site; Groynes along the coastline within the site. East Section:	West Section: More caravan sites within 250m from the western edge and 1km to the south; More car parks adjacent to the southern boundary; Continuing urban development within 500m to the west and south; Northern towers, cave, Lady Emily's tower, roads and footpaths within	Made Ground associated with residential properties, caravan sites, car parks, groynes, towers within Gwrych Castle Wood and deconstructed saw mill; Pumping station; Electricity substation.

	No significant changes.	Gwrych Castle Wood 500m to the south; Two more ponds are formed within Llanddulas quarry and the existing one is expanded; Ponds within Pentre Mawr Park; Pumping station within 250m to the south. East Section: Electricity substation approximately 200m to the south; Continuing urban development of Kinmel Bay including roads, residential properties, caravan parks, car parks; Saw mill is deconstructed.	
1993	West Section: No significant changes. East Section: No significant changes.	West Section: No significant changes. East Section: Extensive urban development in Kinmel Bay; Groynes adjacent to the northern boundary.	Made Ground associated with urban development and groynes.
2000	West Section: More car parks and cycle track within the site. East Section: More car parks and cycle track within the site.	West Section: No significant changes. East Section: More ponds are formed near Kinmel Bay within 1km to the south.	Made Ground associated with car parks and cycle track.
2022	West Section: Promenade (tarmac footpath) and National Cycle Route 5 along the beach. East Section: Promenade (tarmac footpath) and National Cycle Route 5 along the beach.	West Section: More lakes are formed over the excavated area of the Raynes (Merllyn) Quarry. East Section: No significant changes.	Made Ground.

4 Preliminary Environmental Assessment

4.1 Introduction

This preliminary environmental risk assessment is based on a source-pathway-receptor methodology, which is described in Appendix B. This section summarises the findings for each component of this analysis, which then culminates in the development of a conceptual site model. This model is then used to develop a risk rating for any given potential contamination source that has been identified.

4.2 Identified Sources

The potential sources of contamination have been identified from regulatory data and historical and current land uses on the site and surrounding area. The primary potential sources are shown in Table 4-1. The area is divided into four sections (**Error! Reference source not found.**) and the locations of potential contamination sources within each section are shown in Figure 4-2 to Figure 4-5. The legend of the potential contamination sources maps is presented in Figure 4-6.

Table 4-1: Identified potential contamination sources

Source	Potential contaminants of concern	Location and Likely / Anticipated Distribution
On site		
Historical landfills	A range of potential metallic, inorganic, and organic (hydrocarbon-based) contaminants may be present.	Deposited waste included industrial, commercial and household waste within the site boundary.
Industrial Works (historical and current)	General contamination that may be present from historical land uses: - Heavy metals. - Total petroleum hydrocarbons (TPH).	- the historical electrical substation; - the historical pumping station. - the historical sewage tank and outlets;
Made Ground	- Polycyclic aromatic hydrocarbons (PAH). - Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). - Asbestos containing materials (ACMs) in non-natural soils. - PCBs (electrical substation).	Potentially contaminated Made Ground underlying: - the line of holiday/caravan parks, car parks and fire station adjacent to the beach - the promenade and cycle path, breakwaters, jetties and groynes - tramways and conveyors
Off site, up to 1km from the site.		
Historical landfills	A range of potential metallic, inorganic and organic (hydrocarbon-based) contaminants may be present. Potential fugitive ground gases (e.g. carbon dioxide, methane).	2 historical landfills between 250-500m and 8 within 500-1000m from the site boundary – to the south-west and south-east.

Historical and current quarries infilled with Made Ground		24 BGS recorded mineral sites including Lead (2), Limestone (21), Sand and Gravel (1) quarries within 1km, the closest being Llanddulas limestone quarry adjacent to the southern boundary
Industrial Works (historical and current)	General contamination that may be present from historical land uses: - Heavy metals. - Total petroleum hydrocarbons (TPH). - Polycyclic aromatic hydrocarbons (PAH). - Volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). - Asbestos containing materials (ACMs) in non-natural soils. - PCBs (electrical substation).	- The historical electrical substations; - the historical pumping station and water works - the historical sewage pumping station, outlet and pipelines in close proximity to the southern boundary - the historical gas works - multiple railways in close proximity to the southern boundary - tramways and conveyors within the quarries and connecting quarries to jetties - historical factory and industrial work - historical brick works
Made Ground		Potentially contaminated Made Ground underlying: - the line of residential and commercial properties, holiday/caravan parks and car parks - historical ship building yard, boat house, band stand, life boat house and Ryle bridge - railway and road embankments - historical railway stations and landing stages - tramways and conveyors - historical corn mill and saw mill

Figure 4-1: Contaminant source maps layout plan

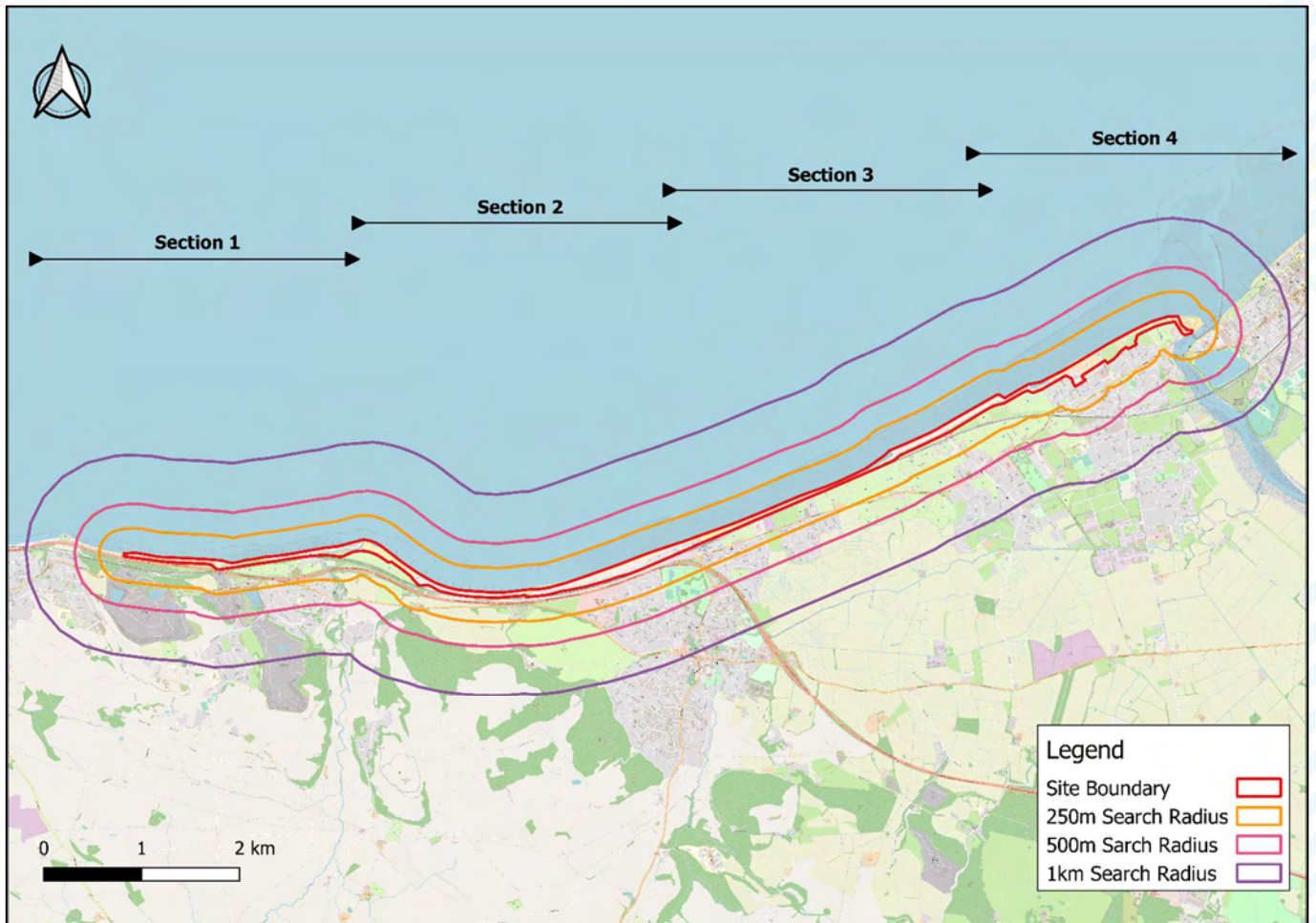


Figure 4-2: Potential contamination sources - section 1

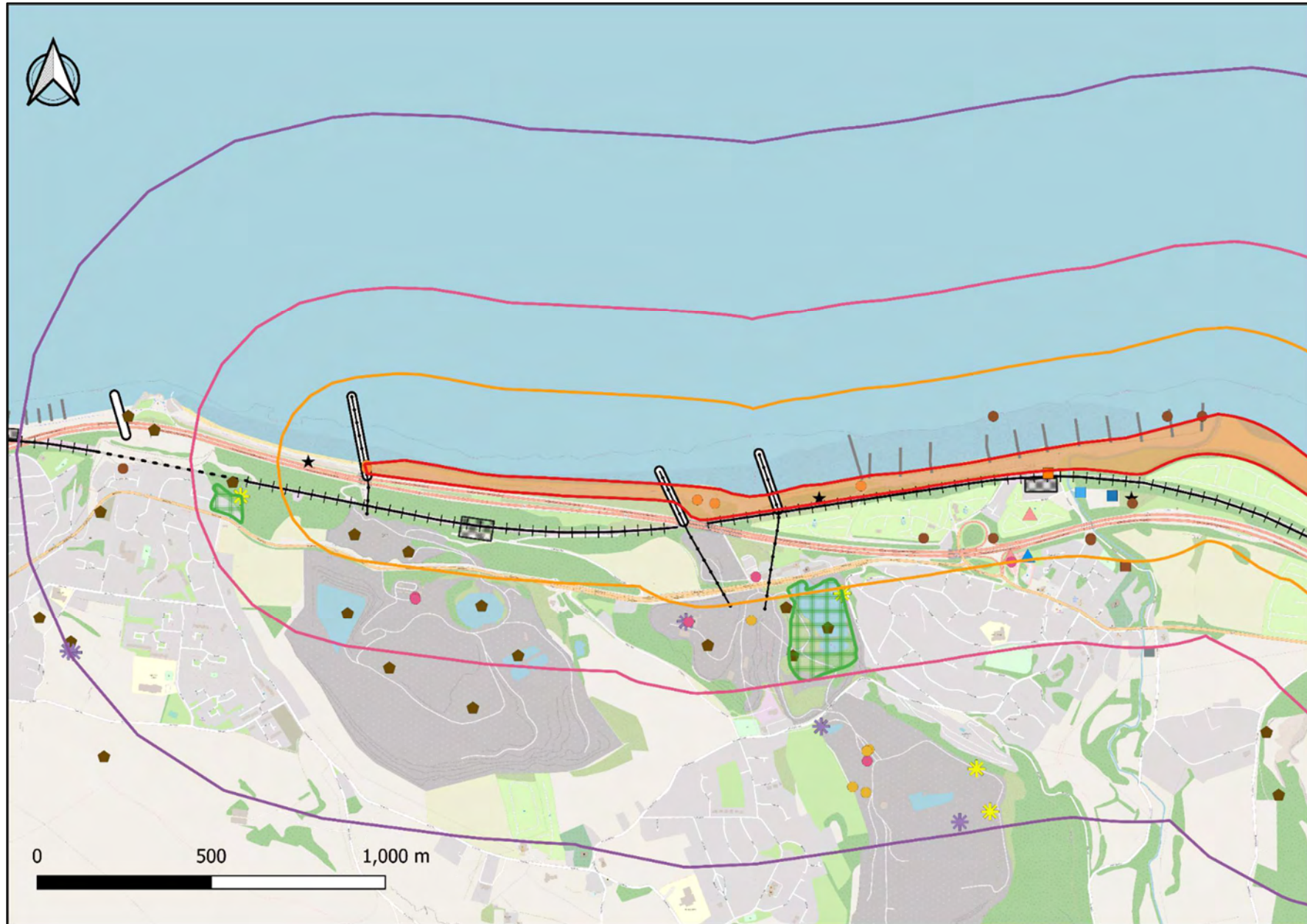


Figure 4-3: Potential contamination sources - section 2

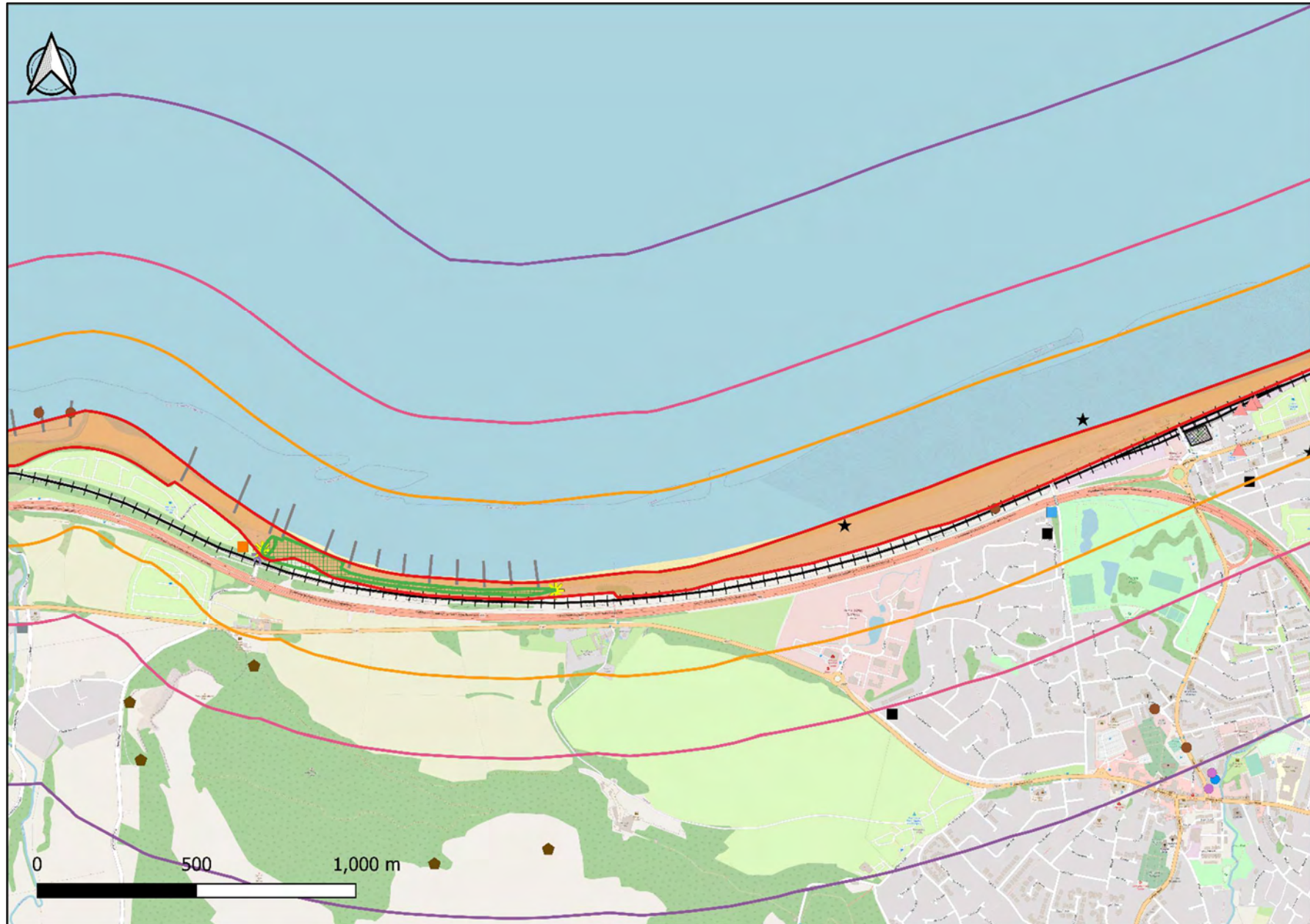


Figure 4-4: Potential contamination sources - section 3

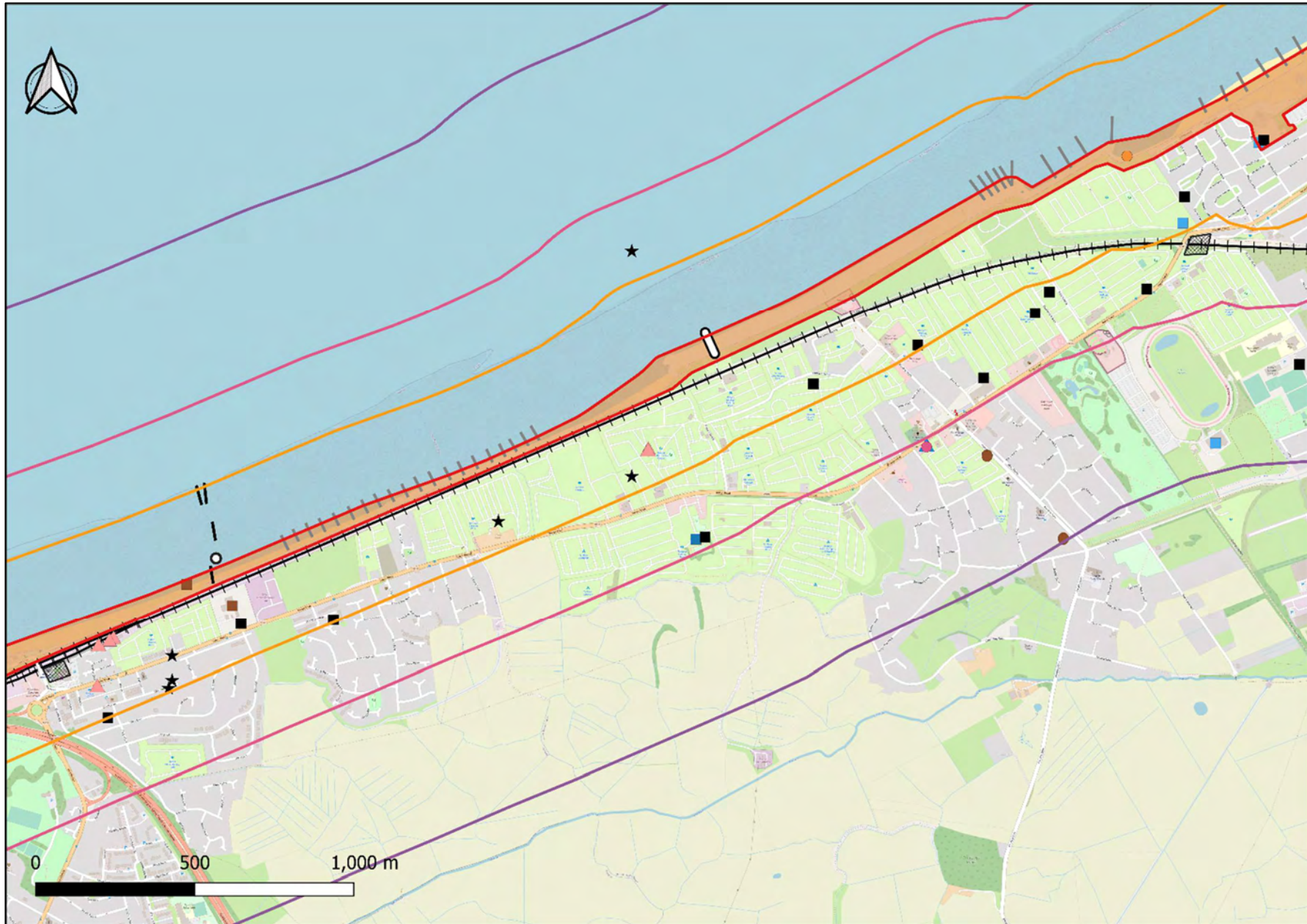


Figure 4-5: Potential contamination sources - section 4

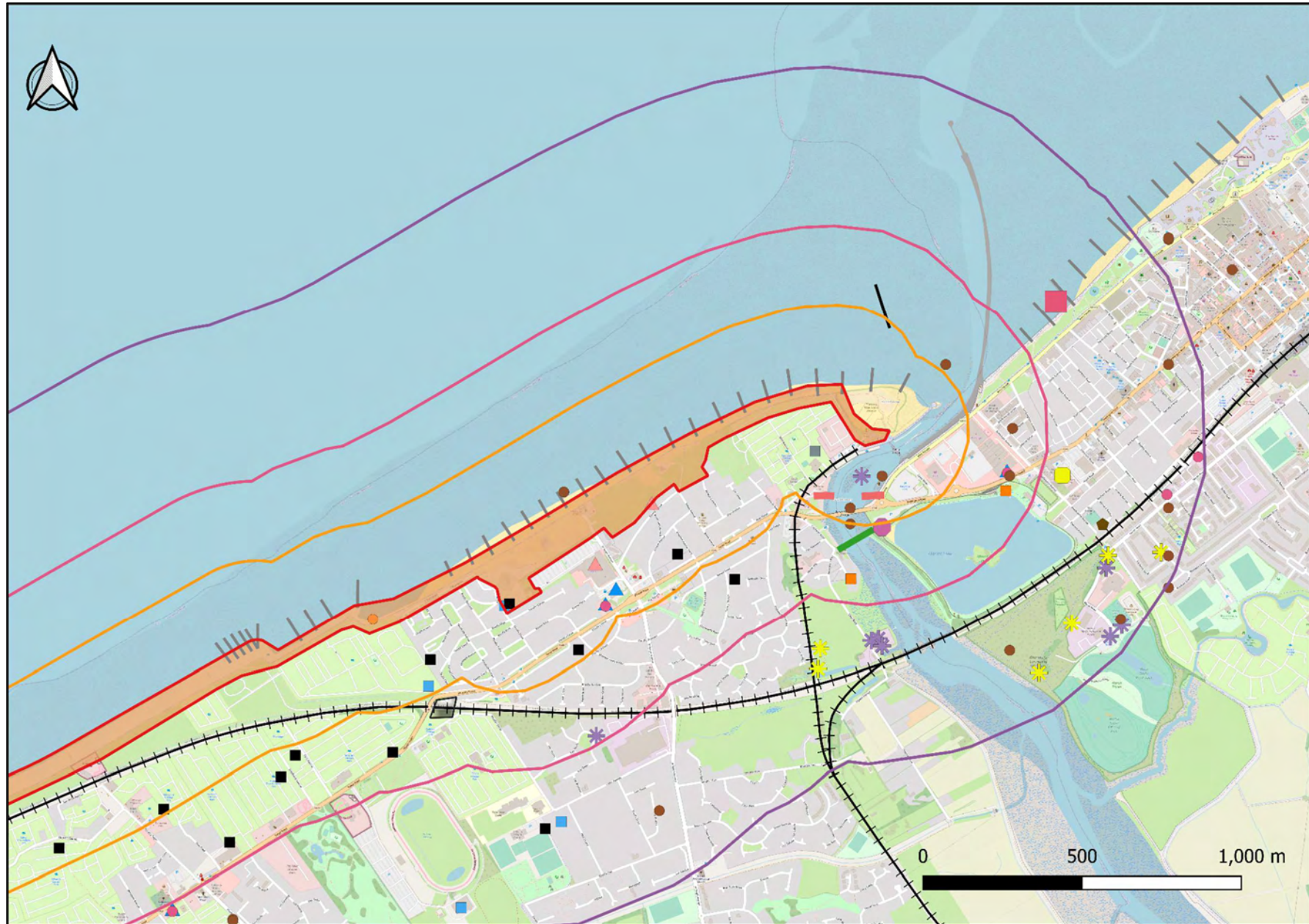


Figure 4-6: Legend of potential contamination sources maps

Legend		EnviroCheck Regulatory Data	
Site Boundary		Pollution Incidents	
250m Search Radius		Radon	
500m Search Radius		Discharge Consents	
1km Search Radius		IPC-IPPC	
Potential Contamination Sources		LAPPC	
Historic Landfill Sites		Contemporary Trade Directory Entries (Active)	
Ship Building Yard		Landfill Sites	
Outlet		Other Waste Management Sites	
Pipe lines		BGS Recorded Mineral Sites	
Electricity Substation		Fuel Station Entries	
Tank			
Pump House			
Gas Works			
Corn Mill / Saw Mill			
Sewage Tank; Sewage Pumping Station			
Boat House;Beach House; Life Boat Station			
Bridge			
Landing Stage			
Band Stand			
Groynes			
Tramway			
Train Station			
Railway			
Jetty			
Tunnel			

4.3 Pathways and Receptors

Potential receptors and possible pathways for contaminants to reach these receptors are summarised below:

- Current and future site users and construction workers [direct contact, inhalation, accidental ingestion, migration of fugitive gases onto site];
- Groundwater (superficial Secondary A and Secondary Undifferentiated aquifers and bedrock Principal and secondary A Aquifers) [migration via leaching and infiltration to permeable strata]; and,

- Surface water (River Dulas (Upper Dulas, Lower Dulas, Nant y Fedw); River Gele; River Clwyd; Coastal North-Wales waterbody; small ponds) [overland flow, migration via drainage, groundwater baseflow].

4.4 Conceptual Site Model

A preliminary conceptual model for the site and surrounding environment has been developed based on the information available and described in the section below. The conceptual site model is used to identify potential pollutant linkages by identifying the following:

- Potential contamination source(s) - a contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution;
- Environmental pathways - a route by which a receptor is or could be affected by a contaminant; and,
- Environmental receptors - that could be adversely affected by a contaminant, e.g. construction workers, future site users, controlled waters, ecological receptors etc.

A pollutant linkage must be present for there to be a Source-Pathway-Receptor linkage. Without a pollutant linkage, there is not a risk - even if a potential source of contamination is present.

The main features of the conceptual model are as follows:

- Within the site boundary, deposits of Made Ground are likely to be found at:
 - cycle path and tarmac footpath (promenade),
 - beach house, holiday/caravan parks and car parks,
 - water breaks, groynes and jetties,
 - conveyors and the remain of old trams,
 - electricity substation and pumping station,
 - sewage pumping station, outlet and pipelines,
 - historical landfill.

There is potential for the ground in these areas to be contaminated. Construction workers involved in coastal defence improvements, or future site users could be exposed to residual contamination from such sources, were they to be present.

- Within 1km of the site boundary, contaminated Made Ground is also likely to be found at:
 - residential and commercial properties, holiday/caravan parks and car parks
 - historical ship building yard, boat house, band stand, Ryle bridge and landing stages
 - historical corn mill and saw mill
 - ten historical landfills
 - 24 historical quarries, including 2 Lead, 1 Sand and Gravel and 21 Limestone quarries. The three former ones are likely to be backfilled with material of an unknown nature while many of the limestone quarries are still active.
 - historical industry including
 - 17 electricity substations
 - 5 pumping station and waterworks
 - 2 sewage pumping stations, outlet and pipelines
 - a gas works

- multiple railway lines and stations
- multiple tramways and conveyors
- a brick works

The range of historical land uses which could have led to the presence of contamination are displayed in Figure 4-2 to Figure 4-5.

- Materials within the infilled lead quarries upgradient of the site may potentially contain non-natural Made Ground deposits. It is possible that there is a pollution pathway (e.g. for leachates or fugitive gases) to the site as the regional groundwater flow direction is to the north. This is likely to be through bedrock aquifer and higher permeability layers within the overlying superficial deposits. However, the sand and gravel quarry is likely to have no impact on site since it is located on the other side of River Clwyd.
- Superficial deposits underlying the site are categorised as:
 - till deposits: low-moderate secondary undifferentiated aquifer
 - modern beach deposits: moderate-high permeability secondary A aquifer
 - river terrace deposits: moderate-high permeability secondary A aquifer
 - blown sand deposits: moderate-high permeability secondary A aquifer
 - tidal flat deposits: low-moderate secondary undifferentiated aquifer
- The bedrock deposits underlying the site are categorised as
 - Clwyd Limestone Group: high permeability, highly vulnerable Principal aquifer and is therefore classified as a highly sensitive receptor
 - Warwickshire Group: moderate to high permeability, highly vulnerable, secondary A aquifer
 - Kinnerton Sandstone Formation: high permeability, highly vulnerable Principal aquifer and is therefore classified as a highly sensitive receptor
- Hydrology in the area comprises the catchment areas of three main watercourses which are likely to capture most overland flows: River Dulas and its tributaries (Upper Dulas, Lower Dulas and Nant y Fedw) in the west, River Gele in the south and River Clwyd in the east of the site. River Dulas and River Clwyd flow northwards to where they discharge at the coastline. River Gele flows eastwards and discharges at the River Clwyd and consequently at the coastline. Groundwater within the bedrock aquifers is likely to flow towards the coast to the north and towards the River Clwyd to the north-east.
- Groundwater within the superficial aquifers is likely contained within localised perched aquifer systems, where higher permeability sandy horizons are interbedded with lower permeability clay dominated layers. It is likely that a groundwater pathway exists between the superficial deposits and underlying bedrock, through the higher permeability sand dominated layers.
- Groundwater within the bedrock aquifer follows the regional topography, flowing towards the north and north-east. It is possible that there is some hydraulic connection between surface waters, the local perched water tables within the superficial deposits, and the shallow bedrock aquifer where it is not overlain by superficial deposits.
- Designated sites include:
 - Traeth Pensarn SSSI within the site boundary
 - Llanddulas Limestone and Gwrych Castle Wood SSSI located between 250-1000m upgradient to the south, hence low sensitivity
 - Liverpool Bay SPA approximately 200m north along the northern site boundary
 - Kinmel Dunes LNR within the site boundary

- 54 Ancient Woodlands within the site boundary

4.5 Significant Pollutant Linkages

Based on the conceptual model presented above the following potential contamination sources have potential pollutant linkages and are identified to be considered with the qualitative risk assessment:

- On-site:
 - historical landfill
 - historical tramways and current conveyors
 - historical sewage pumping station, outlet and pipelines
 - potentially contaminated Made Ground due to beach development including cycle path, tarmac footpath, beach house, holiday/caravan parks and car parks
 - Made Ground associated with water breaks, groynes and jetties
 - Made Ground underlying historical electricity substations and pumping station
- Off-site (within 1km):
 - historical landfills (potential for fugitive gases though situated > 500m from site)
 - historical quarries infilled with Made Ground
 - historical gas works
 - historical electricity substations and pumping stations
 - historical and current railway lines, stations, tramways and conveyors
 - historical sewage pumping stations
 - potentially contaminated Made Ground due to urbanisation

4.6 Uncertainties

The conceptual site model has the following uncertainties:

- A detailed site walkover to identify potential visual evidence of contamination has not been undertaken.
- The presence of contamination within the underlying Made Ground has not been verified by a Phase 2 ground investigation. This includes on-site and off-site sources, such as nearby electrical substations, pumping station, infilled historical quarries and landfill.
- Ground conditions within the area of proposed works, including geological profile and groundwater characteristics have been inferred from available mapping and local borehole records.
- Assessment of historical landfills is based on review of recorded sites. There is the potential for unrecorded landfills to be present within or near to the study area.

5 Qualitative Risk Assessment

A tabulated summary of the risk assessment process can be seen in Table 5-1. This firstly describes the sources, pathways and receptors derived from the baseline desk study and conceptual model. The assessment methodology for the Preliminary Risk Assessment (PRA) described in Appendix B is then utilised to derive the potential severity of the given potential contamination source on any identified potential receptors. Finally, the likelihood of said contamination source reaching the receptor is given, which in conjunction with the potential severity is used to state a final risk value for each receptor. A full breakdown of potential contaminants associated with each source is shown in Table 4.1.

Table 5-1: Qualitative risk assessment summary

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
ON SITE: Historical landfill	A range of potential metallic, inorganic, and organic (hydrocarbon-based) contaminants and ACMs may be present.	Direct contact, inhalation, accidental ingestion of soil. Potential for exposure to contaminants during groundworks.	Current and future site users and construction workers.	Moderate. Harm to a designated receptor is possible. However, it is either relatively unlikely that the harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is likely to be required to clarify the level of potential liability and risk.	(Severity: Medium, Probability: Likely) Desk based evidence indicated historical landfill within the site boundary. There is a potential pollution linkage, and all the elements are present and in the right place, meaning it is probable that a pollution event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
		Migration via leaching and infiltration to ground. Potential for creation of direct migration pathways (e.g. deep piling or excavations extending to bedrock as	Groundwater – Secondary A superficial aquifers.	Moderate/Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Mild, Probability: Likely) Desk based evidence indicates that infiltration to the secondary A superficial deposits (beach deposits, river terrace and blown sand deposits) through historical landfill site is possible. There is a potential pollution linkage, and all the elements are present and in the right place, meaning it is probable that a pollution event will occur. Circumstances are such that an event is not inevitable,

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
		part of any future planned interventions).			but possible in the short term and likely over the long term.
			Groundwater – Principal and secondary A bedrock aquifers.	Moderate/Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Medium, Probability: Low) Desk based evidence indicates that infiltration to the principal and secondary A bedrock aquifers through historical landfill site is possible. However, the bedrock aquifer is directly overlain by relatively thick layers of superficial deposits through the site. There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
		Overland flow, migration via drainage.	Surface Water – River Dulas, Coastal North Wales waterbody and small ponds	Moderate Harm to a designated receptor is possible. However, it is either relatively unlikely that the harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is likely to be required to clarify the level of potential liability and risk.	(Severity: Medium, Probability: Likely) There is potential for a migration pathway between contaminants arising from landfill to the nearby coastal waterbody, particularly if the landfill is disturbed during the proposed works There is a pollution linkage, and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
ON SITE: Historical industry (a sewage pumping station, an electricity substation and a pumping station);	A range of potential metallic, inorganic, and organic (hydrocarbon-based) contaminants and ACMs may be present.	Direct contact, inhalation, accidental ingestion of soil. Potential for exposure to contaminants during groundworks.	Current and future site users and construction workers.	Low. Harm to designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Mild, Probability: Low) Desk based evidence indicated that the site features historical and present day industry related to sewage pumping station, electricity substation and pumping station within the site boundary.

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
					There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
		Migration via leaching and infiltration to ground. Potential for creation of direct migration pathways (e.g. deep piling or excavations extending to bedrock as part of any future planned interventions).	Groundwater – Secondary A superficial aquifers.	Low. Harm to designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Mild, Probability: Low) Desk based evidence indicates that infiltration to the secondary A superficial deposits (beach deposits, river terrace and blown sand deposits) through historical and present day industry sites is possible. There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
			Groundwater – Principal and secondary A bedrock aquifers	Moderate / Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Severe, Probability: Unlikely) Desk based evidence indicates that infiltration to the principal and secondary A bedrock aquifers through historical and present day industry sites is possible. However, the bedrock aquifer is directly overlain by relatively thick layers of superficial deposits through the site. There is a pollution linkage, but circumstances are such that it is improbable that an even would occur even in a very long-term.
		Overland flow, migration via drainage.	Surface Water – River Dulas, River Gele, River Clwyd, Coastal North Wales waterbody and small ponds	Moderate / Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this	(Severity: Medium, Probability: Low) Desk based evidence indicates a migration pathway is likely to exist between contaminants arising from historical and present day industry (sewage pumping station, electricity substation and pumping station) to the

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
			Ecological Receptors – Traeth Pensarn SSSI, Llanddulas Limestone and Gwrych Castle Wood SSSI, Liverpool Bay SPA, Kinmel Dunes LNR and Ancient Woodlands	stage.	nearby watercourses of Coastal waterbody and designated sites of Kinmel Dunes LNR and to the Traeth Pensarn SSSI and Liverpool Bay SPA. There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
ON SITE: Made Ground from a range of sources (tramways and conveyors, groynes, water breaks and jetties, caravan parks and car parks, footpath and cycle path)	A range of potential metallic, inorganic, and organic (hydrocarbon-based) contaminants and ACMs may be present.	Direct contact, inhalation, accidental ingestion of soil. Potential for exposure to contaminants during groundworks.	Current and future site users and construction workers.	Moderate/Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Medium, Probability: Low) There are deposits of Made Ground from a range of sources potentially containing a range of contaminants. The sensitivity of the site setting for human health is considered low, being largely open space. There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
		Migration via leaching and infiltration to ground. Potential for creation of direct migration pathways (e.g. deep piling or excavations extending to bedrock as part of any future planned interventions).	Groundwater – Secondary A superficial aquifers.	Moderate / Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Mild, Probability: Likely) Desk based evidence indicates that infiltration to the secondary A superficial deposits (beach deposits, river terrace and blown sand deposits) through Made Ground deposits is possible. There is a potential pollution linkage, and all the elements are present and in the right place, meaning it is probable that a pollution event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
			Groundwater – Principal and	Moderate / Low.	(Severity: Severe, Probability: Unlikely)

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
			secondary A bedrock aquifers.	Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	Desk based evidence indicates that infiltration to the principal and secondary A bedrock aquifers through Made Ground deposits is possible. However, the bedrock aquifer is directly overlain by relatively thick layers of superficial deposits through the site. There is a pollution linkage, but circumstances are such that it is improbable that an even would occur even in a very long-term.
		Overland flow, migration via drainage.	Surface Water – River Dulas, River Gele, River Clwyd, Coastal North Wales waterbody and small ponds Ecological Receptors – Traeth Pensarn SSSI, Llanddulas Limestone and Gwrych Castle Wood SSSI, Liverpool Bay SPA, Kinmel Dunes LNR and Ancient Woodlands	Moderate/Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Medium, Probability: Low) Desk based evidence indicates a migration pathway is likely to exist between contaminants arising from Made Ground to the nearby watercourses of River Dulas, River Clwyd and Coastal waterbody and designated sites of Kinmel Dunes LNR, to the Traeth Pensarn SSSI and Liverpool Bay SPA. However it is considered likely that the majority of made ground in the area will be landscaped or covered in hard standing and as such potential for migration will be limited. There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
OFF SITE (within 1km): Historical landfills (2 within 500m, 4 within 1000m on the same side of River Clwyd as the site, 4 within 1000m on the other side of River Clwyd)	A range of potential metallic, inorganic, and organic (hydrocarbon-based) contaminants and ACMs may be present.	Direct contact, inhalation, accidental ingestion of soil.	Current and future site users and construction workers.	Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Medium, Probability: Unlikely) Desk based evidence indicated historical landfill sites within 1km from the site boundary. It is considered unlikely that offsite contamination would pose a substantial risk to on site human health. Harm to a designated receptor is possible but is likely to be mild at worst.

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
					Further investigation is not required at this stage.
		Migration via leaching and infiltration to ground.	Groundwater – Secondary A superficial aquifers,	Low. Harm to designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Medium, Probability: Unlikely) Desk based evidence indicates that infiltration to the secondary A superficial deposits (beach deposits, river terrace and blown sand deposits) through historical landfill sites is possible. There is a pollution linkage, but circumstances are such that it is improbable that an even would occur even in a very long-term.
			Groundwater – Principal and secondary A bedrock aquifers.	Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage..	(Severity: Medium, Probability: Unlikely) Desk based evidence indicates that infiltration to the principal and secondary A bedrock aquifers through historical landfill sites is possible. Although the Kinnerton Sandstone principal aquifer in the eastern section is overlain by relatively thick (at least 10m) low permeability superficial deposits (and therefore less vulnerable), the Clwyd Limestone principal aquifer in the western section has outcrops just below the landfill sites. Whilst there is potential for the offsite landfills to cause pollution in the local area of the underlying aquifers, it is considered unlikely there would be contaminant migration that would cause elevated risks at the site. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.
		Overland flow, migration via drainage.	Surface Water – River Dulas, River Gele, River Clwyd, Coastal North	Moderate/Low Harm to a designated receptor is possible but is likely to be mild at	(Severity: Medium, Probability: Low) Desk based evidence indicates a migration pathway is likely to exist

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
			Wales waterbody and small ponds Ecological Receptors – Traeth Pensarn SSSI, Llanddulas Limestone and Gwrych Castle Wood SSSI, Liverpool Bay SPA, Kinmel Dunes LNR and Ancient Woodlands	worst. Further investigation is not required at this stage.	between contaminants arising from landfills to the nearby watercourses of River Dulas, River Clwyd and consequently Coastal Waterbody and designated site of Llanddulas Limestone and Gwrych Castle Wood SSSI, Kinmel Dunes LNR and (consequently) Liverpool Bay SPA. Whilst there is potential for the offsite landfills to cause pollution in the local surface waters, it is considered unlikely there would be contaminant migration that would cause elevated risks at the site. There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
OFF SITE (within 1km): Historical industry (quarried, gas works, sewage pumping station, electricity substation and pumping station, mills, railways, tramways, conveyors and brick works)	A range of potential metallic, inorganic, and organic (hydrocarbon-based) contaminants and ACMs may be present.	Direct contact, inhalation, accidental ingestion of soil.	Current and future site users and construction workers.	Moderate / Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Medium, Probability: Low) Desk based evidence indicated that the site features historical and present day industry related to railways, sewage pumping station, brick works, mills, electricity substation and pumping station within 1km from the site boundary. There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
		Migration via leaching and infiltration to ground.	Groundwater – Secondary A superficial aquifers,	Moderate / Low. H Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this	(Severity: Medium, Probability: Low) Desk based evidence indicates that infiltration to the secondary A superficial deposits (beach deposits, river terrace and blown sand deposits) through historical and present day industry sites is possible.

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
				stage.	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
			Groundwater – Principal and secondary A bedrock aquifers.	Moderate / Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Severe, Probability: Unlikely) Desk based evidence indicates that infiltration to the principal and secondary A bedrock aquifers through historical and present day industry sites is possible. However, the industrial sites are over the Made Ground and relatively thick (10-15m) superficial deposits. There is a pollution linkage, but circumstances are such that it is improbable that an even would occur even in a very long-term.
		Overland flow, migration via drainage.	Surface Water – River Dulas, River Gele, River Clwyd, Coastal North Wales waterbody and small ponds Ecological Receptors – Traeth Pensarn SSSI, Llanddulas Limestone and Gwrych Castle Wood SSSI, Liverpool Bay SPA, Kinmel Dunes LNR and Ancient Woodlands	Moderate/Low. Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.	(Severity: Medium, Probability: Low) Desk based evidence indicates a migration pathway is likely to exist between contaminants arising from historical and present day industry (sewage pumping station, mills, railways, electricity substation and pumping station) to the nearby watercourses of River Dulas, River Clwyd, Coastal waterbody and designated sites of Kinmel Dunes LNR and to the Traeth Pensarn SSSI, Llanddulas Limestone and Gwrych Castle Wood SSSI and Liverpool Bay SPA. Whilst there is potential for the offsite made ground to cause pollution in the local surface waters, it is considered unlikely there would be contaminant migration that would cause elevated risks at the site.

Source	Potential contaminants	Pathway	Receptor	Risk	Comment
					There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.

6 Conclusions

6.1 Site History & Potential Sources of Contamination

Review of historical mapping indicates that the site and local area have a history of extensive urban (commercial and industrial) development from the mid-19th Century onwards. Within the site boundary, the following historic features were identified:

- road, cycle track, tarmac footpath
- beach house and life boat house
- holiday/caravan parks and car parks
- tramways
- jetties, groynes and breakwaters
- sewage pumping station, outlet and pipelines
- fire station, electricity substation and pumping station
- landfill

Also, within 1km of the site boundary, the following historic features were identified:

- quarries
- roads, footpaths
- residential, commercials and factories
- holiday/caravan parks and car parks
- railways, tramways and conveyors
- jetties, groynes and breakwaters
- sewage pumping stations
- gas works, brick works and mills
- electricity substation and pumping station
- waste management sites and landfills

Potential sources of contamination at the sites and surrounding areas are associated with the following activities:

- Historical Landfill present within the site boundary;
- Made Ground within the site, associated history of commercial and urban development and coastal defences (breakwaters and groynes) within site footprint;
- Historical industrial works (including gas works, sewage pumping stations, electricity sub stations, pumping stations and railway line), and associated Made Ground within 1km of the site;
- Historic quarries, and associated Made Ground, at various locations within 1km of the site;
- Historical landfills, and associated Made Ground, at various locations within 1km of the site.

6.2 Environmental Risk Assessment Summary

The following conclusions can be drawn from the preliminary environmental risk assessment undertaken for the site under present conditions:

- The risk to construction workers and future site users is assessed as being **Moderate / Low**:
 - **Moderate** regarding historical landfill sites;
 - **Low** regarding historical industrial sites;
 - **Moderate** regarding Made Ground from a range of sources;

There is the potential for encountering contaminated Made Ground within the site. The main risk is to site construction workers who may undertake earthworks in areas of potentially contaminated Made Ground as part of the development works. Contamination may pose a short-term (acute) or long-term (chronic) risk to workers during construction and maintenance. However, potential risks can be mitigated through adoption of good working practices on site as part of wider site management during construction.

It is recommended that any disturbance of the historical landfill present within the site boundary is avoided in the course of the works, this would reduce the risks potential posed by distancing the receptor from the source.

- The risk to groundwater within superficial deposits is assessed as being **Moderate / Low**:

Development proposals could in certain circumstances lead to the creation of new migration pathways to the superficial aquifers (e.g. through groundworks, excavation, piling works etc.). This should be taken into account during the design of the proposed works.

- The risk to groundwater within bedrocks is assessed as being **Moderate / Low**:

Development proposals could in certain circumstances lead to the creation of new migration pathways to the bedrock aquifers (e.g. through groundworks, excavation, piling works etc.). This should be taken into account during the design of the proposed works.

- The risk to surface water is assessed as being **Moderate / Low**:

There is the possibility that any earthworks in potentially contaminated Made Ground could expose contaminated soils and introduce a new pathway to surface waters, this should be considered during the design of any proposed works. The control of sediment run off during any proposed works should also be considered to be protective of surface waters. This is particularly the case with the historical landfill present within the site boundary, and as such any disturbance of the landfill should be avoided and a suitable standoff applied at the design stage.

Based upon the findings of this Desk Study and Preliminary Risk Assessment pollutant linkage with the potential to cause harm to human health has been identified.

It is recommended that care is taken during any proposed excavation works in made ground, and that a plan should be put in place in case any unexpected contamination is encountered.

It is also recommended that environmental sampling is carried out within soils and groundwater encountered during ground investigation works within the areas of proposed development. Sample analysis should be carried out for a broad suite of potential contaminants highlighted within the PRA in order to refine the findings of this risk assessment and where necessary identify appropriate risk mitigation measures.

It is likely that an intrusive investigation such as that outlined above could be combined with a geotechnical investigation.

Appendices

A Envirocheck Report

B Methodology for Preliminary Environmental Assessment

The methodology for this assessment is based on the Environment Agency's Land Contamination Risk Management (LCRM, which replaces previous guidance within CLR11). Stage 1: Risk Assessment requires that a Tier 1 Preliminary Risk Assessment is carried out ahead of development to assess the potential risk. The methodology used to establish the preliminary risk assessment is described below.

B.1 Site History

Ordnance Survey maps of Britain are available from the late 1880s to the present time. These maps provide an excellent record of historical uses of a site. This can be very important in assessing the potential for environmental liabilities associated with a site, since the site owner may be held responsible for historic pollution which could be released, even if it is not caused by current activities operating on the site. Historical maps can show if the facility was, for example, the location for a former industrial site, mineral working or landfill. Historic map extracts supplied by Landmark Information Group were reviewed. Details of the maps studied are contained in Appendix A.

B.2 Site sensitivity

The vulnerability of the site with respect to the potential for contamination of the surface and subsurface aqueous environments was assessed using British Geological Survey (BGS) data and Environment Agency (EA) data on groundwater and surface water sensitivity. With respect to groundwater, and wherever possible surface water, likely receptors in the form of abstractions have been obtained from the Landmark Information Group (Envirocheck report contained in Appendix A). Information, pertaining to the classification of the aquifer, nature and direction of groundwater flow, distance to licensed abstractions, nature of overlying strata and whether the site was located within a groundwater protection zone was sought from EA and available map information from the BGS, in order to determine the hydrogeological sensitivity. The 1:25,000 Ordnance Survey sheet for the area was used to determine the location of surface watercourses, the quality of which were then determined through consultation with EA data. The combination of distance to the watercourse and its quality were used to assess its sensitivity to pollution. Based on all the available information a summary assessment of vulnerability to contamination of surface and sub-surface waters was made.

B.3 Public registers

In relation to this site, and due to the time constraints of this exercise, the information from the public register was accessed from a commercially available database operated by the Landmark Information Group (Appendix A). The data supplied covers a 1 km buffer area around the site boundary. This is the only method by which the required information can be gathered in the time available. This database contains the information supplied to it by EA, and the other statutory authorities; however, for the purposes of this report JBA does not accept any liability for the accuracy or otherwise of the information obtained from the Landmark Information Group.

B.4 Qualitative Risk Assessment Methodology

Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risks to receptors. The receptor may be human health, a water resource, a sensitive local ecosystem or even future construction materials. Receptors can be connected with the hazard under consideration via one or several exposure pathways (e.g. the pathway of direct contact). Risks are generally managed by isolating or removing the hazard, isolating the receptor, or by intercepting the exposure pathway.

Without the three essential components of a source (hazard), pathway and receptor, there can be no risk. Thus, the mere presence of a hazard at a site does not mean that there will necessarily be attendant risks. The following risk assessment thus focuses on those parts of the site where hazards or potential hazards have been identified and is not general to the whole site.

B.5 Hazards

Potential sources of contamination are identified for the site, based on a review of the current and previous site uses. Not only the nature but also the likely extent of any contamination is considered, e.g. whether such contamination is likely to be localised or widespread.

B.6 Receptors

The varying effects of a hazard on individual receptors depends largely on the sensitivity of the target. Receptors include any people, animal or plant population, or natural or economic resources within the range of the source which are connected to the source by the transport pathway. Receptors can, in addition, extend to remediation processes and future construction materials that may be adversely affected by on-site contamination. In general, however, receptors can be divided into a number of groups, dependant on the final use of the site.

B.7 Pathways

The mere presence of contamination does not infer a risk. The exposure pathway determines the dose delivered to the receptor and the effective dose determines the extent of the adverse effect on the receptor. The pathway which transports the contaminants to the receptor or target generally involves conveyance via soil, water or air.

B.8 Exposure Assessment

By considering the source, pathway and receptor, an assessment is made for each contaminant on a receptor-by-receptor basis with reference to the significance and degree of the risk. In assessing this information, a measure is made of whether the source contamination can reach a receptor, determining whether it is of a major or minor significance. The exposure risks are assessed against the present site conditions. The assessment of risk presented here has been based upon the procedure outlined in DEFRA Circular 01/2006. In addition, DEFRA, with the Collaborative Centre of Excellence in Understanding and Managing Natural and Environmental Risks, Cranfield University, has published guidance on risk assessment (Guidelines for Environmental Risk Assessment and Management). A guide to good practice for contaminated land risk assessment has also been produced by CIRIA (CIRIA C552 2001). This guidance from DEFRA and CIRIA states that the designation of risk is based upon a consideration of both:

- The severity of the potential consequence [takes into account both the potential severity of the hazard and the sensitivity of the receptor].
- The likelihood of an event (probability); [takes into account both the presence of the hazard and receptor and the integrity of the pathway].

Table C-1 provides a classification of the potential severity of contamination risks occurring at the site, while Table C-2 summarises the probability classifications.

Table B-1: Classification of associated hazard [potential severity] (modified from CIRIA C552)

Classification	Associated hazard [potential severity]
Severe	Short-term (acute) risks to human health likely to result in significant harm. Short-term risk of pollution to a sensitive water resource or ecosystem. Catastrophic damage to crops/buildings/property/infrastructure, including off-site soils. Short-term risk to a particular ecosystem or organism forming part of such an ecosystem.
Medium	Chronic damage to human health. Risk of pollution of sensitive water resource or ecosystem. Significant change in a particular ecosystem. Significant damage to crops/buildings/property/infrastructure (on or off-site). Contamination of off-site soils.
Mild	Pollution of non-sensitive water resources. Significant damage to crops/buildings/property/infrastructure (on or off-site).
Minor	Harm, although not necessarily significant harm which may result in a financial loss. Easily preventable, non-permanent health effects on humans, or no effects. Easily repairable damage to crops/buildings/property/infrastructure.

Table B-2: Classification of probability

Classification	Definition of probability
High	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage, and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.

Once the classification of consequence and probability has been assigned to a pollution linkage, the risk associated with it can be evaluated. Table C-3 shows how a risk category is assigned based on the consequence and probability. Definitions of each risk category and the investigation actions that are likely to be necessary in each case are given in Table C-4. These definitions and the risk matrix are based upon CIRIA C552.

Table B-3: Contamination risk matrix

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High	Very high risk	High risk	Moderate risk	Moderate / low risk
	Likely	High risk	Moderate risk	Moderate / low risk	Low risk
	Low	Moderate risk	Moderate / low risk	Low risk	Very low risk
	Unlikely	Moderate / low risk	Low risk	Very low risk	Very low risk

Table B-4: Description of the risk classifications and likely action required

Classification	Definition and likely actions required
Very high	There is a high probability of severe harm to a defined receptor, or there is evidence that severe harm is currently taking place. The risk is likely to result in a substantial liability. Urgent investigation (if not already undertaken) and remediation is likely to be required.
High	Harm to a designated receptor is likely. The risk, if realised, is likely to present a substantial liability. Urgent investigation (if not already undertaken) is likely to be required.
Moderate	Harm to a designated receptor is possible. However, it is either relatively unlikely that the harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is likely to be required to clarify the level of potential liability and risk.
Low	Harm to a designated receptor is possible but is likely to be mild at worst. Further investigation is not required at this stage.
Very low	There is a low possibility of harm to a designated receptor occurring, and if it were to be realised it would be likely to be mild at worst. Further investigation is not required at this stage.

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H Outline Construction Environmental Management Plan

Kinmel Bay Outline Construction Environmental Management Plan

Final Report

November 2022

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Contract

This report describes work commissioned by Amey Consulting. JBA Consulting carried out this work.

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Purpose

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Table 3-1: Outline Construction Environmental Management Plan

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1 Introduction

1.1 Purpose

Kinmel Bay Coastal Defence Improvement Scheme is designed to alleviate flood risk and prevent flood damage to homes, businesses and critical infrastructure. The interventions span along a 2.5 km stretch from Towyn to Kinmel Bay. The proposed scheme comprises of rock revetments, raising the height of the sea wall, and upgrades to the existing flood gate. The proposal is supported by multiple public realm and ecological enhancements across the frontage.

This Outline Construction Environmental Management Plan (CEMP) summarises the key construction-phase and operational environmental management and mitigation actions for the proposed scheme as identified in the associated Environmental Statement (ES) report. It sets out environmental management objectives and associated actions to be delivered during construction of the developments, and post-construction, and assigns these to specific members of the team responsible for the delivery of the project.

1.2 Roles

For each environmental management action, the appropriate project team member with responsibility for ensuring that action is implemented is identified. Monitoring of the actions identified in the CEMP would be undertaken by the appointed construction contractor(s), although it is recommended support is provided by an Ecological Clerk of Works (ECOW). This CEMP may be used by the contractor(s) when implementing their own Environmental Management Systems (EMS).

1.3 Environmental audits

It is recommended that site audits are undertaken by the contractor(s) on a regular basis, to ensure compliance with planning conditions and regulatory requirements.

1.4 Environmental incident reporting

As part of any contractor(s)' EMS, any environmental issues or incidents would be reported using their incident reporting system.

2 The sites, environmental receptors, and scheme proposals

2.1 Scheme backgrounds

The Kinmel Bay Coastal Defence Improvement Scheme extends along 2.5km of the frontage from Towyn to Kinmel Bay, located with Conwy County Borough. This stretch of coastline is experiencing significant flood risk.

The existing coastal defences comprise a combination of rock revetments, cobbled beaches, sea walls and floodgates. The proposed scheme has been designed to avoid significant impediment of views whilst achieving a significant reduction of flood risk and minimising the need for ongoing maintenance over the lifetime of the scheme.

The main objectives of the scheme, as outlined within the Outline Business Case (OBC) are as follows:

1. To reduce flood damages to residential and non-residential properties currently at risk in the Walkaway scenario.
2. Ensure community and stakeholder engagement to ensure 'buy-in' for the scheme, thus delivering social benefits by raising awareness and increasing community resilience.
3. To develop a scheme that is deliverable within engineering and time constraints.
4. To develop a scheme that is adaptable to change.
5. Encourage innovative solutions that deliver multiple benefits. Specifically for this scheme to sustain and/or improve the tourist and amenity benefits through continued operation of the beach and the North Wales Coastal route.

2.2 Description of the proposed scheme

The interventions proposed have been divided between two Coastal Management Units (CMUs). The proposed works across each CMU are described below:

CMU 3-5B: Towyn Revetment

The proposed upgrade in CMU3-5B will increase the level of coastal flood protection offered by the current rock armour unit. The new design will keep the 1 in 4 slope angle of the current rock armour unit but increase the crest width and height so that a Standard of Protection (SoP) of 1 l/s/m is achieved for a 1 in 200-year event up to the year 2041. The new design will reuse and repurpose the current rock armour material. The existing sea wall will be raised by 0.75m, up to 8mOD and the new rock armour will be raised to a height of 7.2mOD (the height of existing sea wall) to a crest width of 6m.

Additional to the coastal flood protection offered by the new rock armour design, there has also been considerations to the environmental benefit of the upgrade. This will involve the creation of artificial striation and cores in the rock surface to encourage colonisation of the material by marine invertebrates. The rocks with surface texture will be located within the Mean High-Water Spring (MHWS) of the rock armour.

The public realm proposals for the Towyn revetment are:

- Enhancement of the areas of existing coastal grassland
- A proposed parklet (a small seating area) at the eastern end of the Towyn Revetment. The parklet will comprise of:
 - o Lounging seats
 - o Picnic tables
 - o Decorative paving
 - o Cycle parking
- Improvement will be made to the existing access points adjacent to the Golden Sands Caravan Park.

CMU 3-5C: Kinmel Bay Beach

The coastal defence upgrade along this section requires several actions comprising an increase in the height of the seawall along the entire CMU by 0.5m, and upgrade/replace flood gate at the St Asaph Avenue car park to match the new sea wall level. The level of the new seawall crest

will provide improved wave overtopping flood protection to Kinmel Bay, accounting for Sea Level Rise up to 2041.

The proposed works also includes re-profiling the level of the entrance to the St Asaph Avenue car park. This localised change in elevation will provide flood protection landwards by preventing water entering the main town. Any flood water will be returned to the sea through the flood gates.

The existing rock armour at the eastern end of Kinmel Bay Beach will be enhanced and upgraded. The existing seawall behind the rock armour will be raised by 0.5 m and the rock armour in front will be reprofiled and raised. The new rock armour profile will have the same crest level as the raised wall, a crest width of 5.6 m and a slope angle of 1 in 3. The length of the new rock armour unit will be approximately 420 m, terminating at the sand dunes east of Kinmel caravan park.

Re-instate sand dunes where necessary along the stretch to the east of the car park at the end of St Asaph Avenue, where gaps exist along the landward side of the foot/cycle path.

Maintenance involving periodical recharge will be required at the western end downdrift the enhanced revetment at Towyn, where downdrift erosion may reach the seawall.

The reduction of the overtopping of this CMU is characterised by the enhancement of the existing revetment at the eastern end.

Kinmel Bay is where most of the public realm enhancements are proposed, these are as follows:

A parklet at Kinmel Bay West which includes:

- Cycle parking
- Cycle maintenance and charging facilities
- Lounge seating
- Informal play equipment
- Shelter for informal use
- Decorative paving

Widening the footpath to 4.5m between Sandy Cove and Baysville Grill.

The existing St Asaph Avenue car park will be enhanced to act as a beach side hub for the community incorporating:

- Enhanced car park with rain gardens and electric car charging points
- A new toilet facility building
- A shelter where Oriel Mor¹ can programme art installations
- Cycle parking, maintenance and charging facilities
- Oriel Mor signage
- Picnic tables and benches
- Play climbing equipment
- Lawn planting with two proposed trees.
- Decorative paving

¹ Oriel Môr – Conwy Culture. [Online] Available at: https://conwyculture.com/content/files/Oriel_M%C3%B4r.pdf

Beach Access Improvements for Kinmel Bay Beach include:

- Retention of 1 flood gate access point
- enhanced access points to be fully accessible and DDA compliant
- 6 enhanced access points with stepped access.
- 10 access points in total: 1 retained, 9 enhanced.

Informal rest area near Baysview Grill providing:

- Bench
- Litter Bin

Upgrade to the existing pedestrian crossing.

Figure 2-1: Red line boundary of the proposed scheme



3

Outline CEMP

The CEMP is a live document that will be updated as the project progresses through the consenting process and pre-construction phase and throughout the construction of the schemes. A construction contractor has not yet been appointed. The following outline CEMP (see Table 3-1) has been produced to support the planning application. It will be developed further by the construction contractor prior to the start of construction to address any consent conditions imposed and to reflect the detailed construction methodology.

Table 3-1: Outline Construction Environmental Management Plan

Ref.	Environmental Objective	Action Proposed	Relevant development site	Responsibility	Reference to further information	Further comment
Ecology Impact Assessment						
ECIA1	Prevent pollution impacting ecological designations.	Abiding by relevant pollution prevention measures e.g. CIRIA Guidance: Control of water pollution from construction sites, Guidance for consultants and contractors (C532D) (Masters-Williams, 2001). Information useful for Toolbox Talks on working near water and pollution prevention can be found on the CIRIA website. Additional prevention of accidental oil and fuel leaks, detailed in HRA.	All sites	Construction contractor	Environmental Statement Section 4.7	
ECIA2	Avoid impacts on ecological receptors	Small sections of dune habitat within the Kinmel Dunes will be temporarily disturbed during the construction works. The area impacted will be limited to as small a footprint as possible and all sand temporarily removed will be replaced within the LNR under the supervision of an ECoW.	All sites	Construction contractor	Environmental Statement Section 4.7	
ECIA3	Avoid impacts on ecological receptors	Appropriate environmental management measures will be implemented prior to the construction phase to ensure that water quality is not adversely affected through pollution incidents and the release of contaminants from the construction site. These measures will be recorded in a detailed CEMP and agreed with the local planning authority and NRW prior to works taking place. To minimise disturbance and habitat degradation, plant will keep to agreed haul routes and not stray outside of these areas. It is considered that in this case, the haul routes will rapidly recover following the completion of the works.	All sites	Construction contractor	Environmental Statement Section 4.7	

ECIA4	Avoid impacts on ecological receptors	A small amount of Sabellaria alveolata has been recorded to the east of the scheme, however, the species was not recorded within Kinmel Bay. Given the ephemeral nature of the species there is the potential for it to colonise the scheme area before construction takes place. A survey will be undertaken prior to works being undertaken in the littoral zone to ensure that the species is not present.	All sites	Construction contractor	Environmental Statement Section 4.7	
ECIA5	Avoid impacts on ecological receptors	Vegetation removal for the scheme will be minimal and it is considered unlikely that there will be impacts to nesting birds. Areas that have been identified as important for nesting Ringed Plover will not be directly impacted upon by the proposed works. The works will not require the removal of trees suitable for nesting birds, however, should it become necessary to remove small sections of scrub for access, all vegetation clearance will be undertaken outside of the main breeding season (typically between September and end February). If this is not possible, all vegetation clearance will be supervised by an experienced ecologist. Any identified nests will be safeguarded until the chicks have fledged to ensure there are no direct impacts upon nesting birds.	All sites	Construction contractor	Environmental Statement Section 4.7	
ECIA6	Avoid impacts on ecological receptors	The works will not result in the permanent removal of habitats suitable for reptiles. For the most part the works are unlikely to impact upon habitats suitable for reptiles. However, where works cannot avoid suitable reptile habitat (i.e. dunes, ecotones, rough grassland), vegetation clearance will be conducted in a sensitive manner to avoid direct harm to reptiles. Two-staged vegetation clearance will be conducted under watching brief by an Ecologist between September – October to fit between the bird breeding season and prior to reptile hibernation. All contracted site workers will be made of aware of how to identify Common Lizard, the legal protection	All sites	Construction contractor	Environmental Statement Section 4.7	

		afforded to this species and the following actions including what to do if Common Lizard or other reptiles are found. Should large numbers of reptiles be found during site clearance works, works are to be stopped immediately and working methods evaluated and adjusted as necessary to prevent further impacts to reptiles.				
ECIA7	Avoid impacts on ecological receptors	There is the potential for a scheme to impact upon fish species during the construction phase. Fine sediment mobilisation has the potential to impact upon on fish species as a result of reduced foraging efficiency of visual predators and cause minor gill irritation. The works will be carried out at low tide in the dry and therefore the proposals should not cause any noise or vibration impacts to the marine environment.	All sites	Construction contractor	Environmental Statement Section 4.7	
ECIA8	Invasive species management	No INNS were identified within the works footprint, however, a biosecurity management plan will be required to ensure that no species introduced the works area. Measures will need to be put in place to ensure that there is no spread of invasive non-native species or diseases. The Check-Clean-Dry approach should be followed, ensuring that all PPE and equipment is cleaned before leaving site . These measures should be recorded in the Environmental Management Plan.	All sites	Construction contractor	Environmental Statement Section 4.7	
Coastal processes						
CP1	Prevent introduction of construction materials into the water column	Potential coastal process impacts would be mitigated through the adoption of good construction practices. Construction activities will be conducted under dry conditions during periods of low water to minimise the mobilisation of sediments and construction materials.	All sites	Construction contractor	Environmental Statement Section 6.12	

CP2	Prevent introduction of construction materials into the water column	To further reduce the potential for sediment mobilisation within the adjacent waterbody small sections of the toe trench should be excavated within a tidal window with all arisings being placed, where possible, above the MHWS mark.	All sites	Construction contractor	Environmental Statement Section 6.12	
CP3	Prevent introduction of construction materials into the water column	Excavation of beach material to formation level to accommodate the rock revetment should be undertaken during dry conditions, i.e., periods of low water when tide levels expose the working areas.	All sites	Construction contractor	Environmental Statement Section 6.12	
CP3	Support colonisation by intertidal species	Ecological enhancements will be incorporated into the scheme in the form of modified rock armour boulders that incorporate textured surface features (e.g., striations). These will provide surface topographic complexity on otherwise unfavourable habitat substrates and promote colonization by intertidal marine species enhancing the ecological benefits of the scheme.	All sites	Construction contractor	Environmental Statement Section 6.12	
CP4	Maintain the natural profile of the beach	Beach monitoring (e.g., topographic surveys) of the area is already undertaken on an annual basis along the coastal frontage to record periodic changes in beach morphology. It is recommended that the current programme of monitoring continues, post-construction, at the same/similar time each year to identify changes in beach slope gradient and elevation. Monitoring of beach gradients in front of the defence structures at Towyn and Kinmel Bay will provide valuable data on the morphological response to the implemented flood defence measures and insight to any potential impacts.	All sites	Construction contractor	Environmental Statement Section 6.12	
CP5	Prevent the introduction of materials into the water column	All work schedules should be assessed two weeks in advance to confirm compliance with the stated mitigation measures. Works should cease during storm events, where increased wave activity could	All sites	Construction contractor	Environmental Statement Section 6.12	

		mobilise sediments and present hazardous working conditions.				
Hydrology and Hydrogeology						
HG1	Prevent the contamination entering watercourses	Where presence of contaminated materials is known or suspected, testing of soil samples in advance of construction can be used to further clarify baseline conditions.	All sites	Construction contractor	Environmental Statement Section 7.6	
Cultural Heritage						
CH1	Avoid impacts on cultural heritage	A toolbox talk (TBT) should be given as part of the works induction process and form part of the Construction Management Plan to help familiarise the project team with the cultural heritage of the area.	All sites	Construction contractor	Environmental Statement Section 8.6	
Socio-economic						
SE1	Avoid impacts on local community	Ensure the contractors are voluntary members of the Considerate Constructors Scheme (CCS).	All sites	Construction contractor	Environmental Statement Section 10.5	
SE2	Avoid impacts on local community	Ensuring that multiple channels of communication are utilised so that as many stakeholders as possible are informed of the programme should be undertaken. This could include measures such as advertising in a newspaper, local radio stations, promotion on social media platforms as well as providing local newsletters containing translations in Welsh and Braille and placing information in local community centres such as libraries and tourist information centres.	All sites	Construction contractor	Environmental Statement Section 10.5	
Traffic and Transportation						
TT1	Avoid impacts on road users	Active community engagement is undertaken as part of the Considerate Constructors Scheme. Advanced public advertisement of the works, including the construction material delivery routes.	All sites	Construction contractor	Environmental Statement Section 11.6	
Noise and Vibration						

NV1	Minimise impact of noise and vibration on local residents	Isolate plant when not operating.	All sites	Construction contractor	Environmental Statement Section 12.6	
NV2	Minimise impact of noise and vibration on local residents	Acoustic screening of plant	All sites	Construction contractor	Environmental Statement Section 12.6	
Other Construction Related Effects						
AQ1	Avoid air quality impacts from dust on local residents	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ2	Avoid air quality impacts from dust on local residents	Display the name and contact details of the person(s) accountable for air quality and dust issues on the site boundary and head or regional office information.	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ3	Avoid air quality impacts from dust on local residents	Develop and implement a Dust Management (DMP) which may include measures to control other emissions, approved by the Local Authority	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ4	Avoid air quality impacts from dust on local residents	Record all dust complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. Record any exceptional incidents that cause dust and/or air emissions either on or off site and the action taken to resolve the situation in a log book. Make the complaints log available to the local authority when requested.	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ5	Avoid air quality impacts from dust on local residents	Carry out regular site inspections to monitor compliance with the DMP, record inspection results and make the inspection log available to local authority when asked.	All sites	Construction contractor	Environmental Statement Section 13.7	

AQ6	Avoid air quality impacts from dust on local residents	Increase the frequency of site inspections for air quality and dust when activities with a high potential to produce dust are being carried out or during dry or windy conditions	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ7	Avoid air quality impacts from dust on local residents	Erect screens or barriers around dusty activities.	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ8	Avoid air quality impacts from dust on local residents	Ensure all vehicles switch off engines when stationary – no idling vehicles. Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (these speeds may be increased on long haul roads with suitable additional control measures subject	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ9	Avoid air quality impacts from dust on local residents	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	All sites	Construction contractor	Environmental Statement Section 13.7	
AQ10	Avoid air quality impacts from dust on local residents	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment.	All sites	Construction contractor	Environmental Statement Section 13.7	
CE1	Minimise carbon emissions	Rock used for the scheme should be as locally sourced as possible - reducing the embodied carbon of the scheme involved in the transport of heavy materials. Where quarried rock for rock armour has an Environmental Product Declaration that suggests the rock source comes has a low embodied emissions factor –any savings maintained by using local sourcing should be disregarded as these will in most cases be outweighed by low carbon production. The scheme should remain flexible as to the choice of rock within coastal defences – opting for less energy and carbon-intensive rock where possible, whilst retaining structural standards.	All sites	Construction contractor	Environmental Statement Section 13.7	

CE2	Minimise carbon emissions	Utilising different, less-emissive plant fuel types where possible to reduce the carbon intensity of the construction works.	All sites	Construction contractor	Environmental Statement Section 13.7	
CE3	Minimise carbon emissions	Recycled materials should be used where possible e.g., recycled aggregate, aluminium and steel.	All sites	Construction contractor	Environmental Statement Section 13.7	
CE4	Minimise carbon emissions	The scheme could utilise low (or non) OPC (Ordinary Portland Cement) concrete in low-risk areas, leading to significant carbon reduction where used, whilst maintaining the lifecycle of the scheme.	All sites	Construction contractor	Environmental Statement Section 13.7	
CE5	Minimise carbon emissions	Ecological enhancement of coastal engineering structures could be explored, as some passive enhancement techniques may sequester carbon and provide biodiversity gain.	All sites	Construction contractor	Environmental Statement Section 13.7	
Habitat Regulations Assessment						
HRA1	Avoid pollution impacting ecological designations	Following relevant guidance e.g. CIRIA Guidance: - Control of water pollution from construction sites. Guidance for consultants and contractors (C532D) (Masters-Williams, 2001), including the delivery of toolbox talks to site staff. - Any chemical, fuel and oil stores will be located on impervious bases within a secured bund with a storage capacity 110% of the stored volume. Biodegradable oils and fuels will be used where possible. - Drip trays will be placed underneath any standing machinery to prevent pollution by oil/fuel leaks. Refuelling of vehicles and machinery will be carried out on an impermeable surface in one designated area well away from any watercourse or drainage (at least 10m) with capture of any spillages. - Emergency spill kits will be available on site and staff trained in their use. - Operators will check their vehicles on a daily basis before starting work to confirm the absence of leakages. Any leakages will be reported immediately.	All sites	Construction contractor	Habitat Regulations Assessment Section 5.1 CIRIA Guidance: control of water pollution from construction sites	

		Daily checks will be carried out and records kept on a weekly basis and any items that have been repaired/replaced/rejected noted and recorded. Any items of plant machinery found to be defective will be removed from site immediately or positioned in a place of safety until such time that it can be removed. This mitigation is industry standard practice and as a result, will be incorporated into the project through the Environmental Management Plan (EMP).				
Water Framework Directive Assessment						
WFD1	Avoid impacts on WFD waterbody status	It is recommended that the proposed scheme seeks to contribute to any future requirement for additional mitigation measures. This should principally focus on opportunities to provide further ecological enhancement of the rock armour revetment.	All sites	Construction contractor	Water Framework Directive Section 5	
WFD2	Avoid impacts on WFD waterbody status	Proposed ground investigation works, and subsequent sediment analysis should be used to determine the presence of any existing contamination within the footprint of the site. Should sampling analysis highlight the presence of contaminants of concern at concentrations above the stipulated Cefas Action Levels then mitigation measures will be required to reduce the potential mobilisation of any harmful contaminants which may be detrimental to the current and/or future WFD Status.	All sites	Construction contractor	Water Framework Directive Section 5	
WFD3	Avoid impacts on WFD waterbody status	A Construction Environmental Management Plan (CEMP) should be prepared, which sets out the actions that will be implemented to control construction of the proposed scheme so as to avoid adverse impacts on the environment. The CEMP should form part of the construction contract. It should adhere to construction best practice for works on the coast so as to reduce the risk of environmental contamination during construction	All sites	Construction contractor	Water Framework Directive Section 5	

		and include biosecurity procedures to prevent the spread of INNS.				
WFD4	Avoid impacts on WFD waterbody status	Visual monitoring of the construction area should be undertaken daily during the construction period to identify any signs of sewage debris or any other contaminated materials, which should be removed offsite for disposal. This will minimise the risk of bacterial contamination adversely affecting beach users and construction personnel.	All sites	Construction contractor	Water Framework Directive Section 5	
WFD5	Avoid impacts on WFD waterbody status	Where construction works coincide with the development of future proposed coastal defence and infrastructure projects within the wider sub-cell, caution should be employed to limit any potential cumulative, in-combination effects.	All sites	Construction contractor	Water Framework Directive Section 5	

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