Completing a coastal or physical processes assessment for small-scale projects

Guidance note

Reference number: GN 019

Document Owner: Head of Business, Natural Resources Management

What is this document about?

This guidance outlines the approach and information needed to complete a coastal or physical processes assessment for a small scale marine or coastal project or activity, for example, when one is required for a marine licence application. It summarises more detailed, technical information found in NRW Evidence Report 624: Advice on Physical Processes for Small-scale Marine and Coastal Projects (PDF 1.2MB)

We have prepared this guidance as part of our role as environmental advisor. In this role NRW Advisory provide advice to developers, our staff in the regulatory arm of the organisation (NRW Permitting Service) and other regulatory organisations on likely environmental effects from marine development proposals and activities.

This guidance note does not:

- comprise legal advice and should not be interpreted as such. Project proposers should seek their own independent legal advice on any matters arising in connection with this note in respect of a specific activity or development project.
- prejudice any advice that NRW might provide as part of any application for a specific activity or development project.

Who is this document for?

This guidance is aimed at anyone carrying out an activity where a coastal processes assessment may be required and the project or activity can be considered small-scale. The guidance will also be useful for NRW staff engaged in this area.

Contact for queries and feedback

For technical queries or feedback contact the Marine and Coastal Ecosystems Team: Marine.Coastal.Ecosystems.Team@cyfoethnaturiolcymru.gov.uk

For project-specific procedural queries contact the Marine Area Advice and Management Team: marine.advice@cyfoethnaturiolcymru.gov.uk

Version History

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To report issues or problems with this guidance contact:
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Contents

1. Introduction

This guidance provides the information and procedures that we consider best practice when a ‘small-scale’ marine or coastal project or activity requires a coastal processes assessment as part of a project or activities assessment process, e.g. as part of a marine licence application or Habitat Regulation Assessment.

The terms ‘coastal processes’ and ‘physical processes’ are often used interchangeably, though ‘physical processes’ may be more commonly used away from the coast. Both terms refer to the effect of waves, currents and sediment transport on bathymetry and morphology (and vice versa).

You should provide the correct information at an appropriate level for your project or activity to facilitate determination of your marine licence or any other relevant permission required for your proposed works. Section 1.1 describes projects and activities which are considered ‘small -scale.’ You should note that the term ‘small-scale’ used here does not have the same meaning as when considering ‘small-scale loss’ for Habitat Regulation Assessments.

This guidance summarises key findings from a detailed NRW report, Evidence report 624: Advice on physical processes for small-scale marine and coastal projects (PDF 1.2 MB) (see Section 1.2). You can find guidance about larger, more complex projects on our website: Natural Resources Wales / Marine physical processes and Environmental Impact Assessment (EIA)

You can find details of additional NRW guidance, evidence reports and position statements that may be useful to inform both project planning and coastal processes assessment in Section 1.3. Section 1.3 also provides information about data sources that can be used to help with your assessment.

The basic processs for completing a coastal or physical processes assessment is:

1. Gather the information needed to describe your planned project or activity.

2. Gather information about the baseline (natural, undisturbed) conditions at your project location.

3. Consider the impact of the components of your project (including construction and method) on the physical environment.

4. Use this information to estimate the zone of influence (see Section 3 for definition) of your project.

5. Assess the sensitivity of areas that fall within, or close to, your projects zone of influence and determine mitigation measures.

This guidance note **does not cover** assessments that need to consider water quality or contaminated sediment.

1.1 Definition of small-scale

This guidance is primarily intended to inform projects or activities that do not require EIA but do have a potential to impact upon coastal processes. For example, some activities that require a band 2 marine licence application (see Natural Resources Wales / Applying for a marine licence).

The types of activities that fall below the threshold for an EIA include:

- Dredging and disposal (including beneficial use of dredged sediments)
- Minor works to coastal infrastructure
- Beach re-profiling and sediment recycling
- Clearance of drainage channels and outfalls
- Seaweed harvesting
- Bridge repairs
- Unexploded ordnance (UXO) clearance
- Ground investigation works,
- Structure removal from seabed
- Marina infrastructure installation (moorings, pontoons etc).

The above list is not exhaustive, some projects with a different focus would still be considered as small scale and can make use of this guidance.

You should also note that, depending on project specifics:

- some instances of projects or activities in the above categories will require more detailed assessments; for example, not all dredging activities are below the EIA threshold
- some very small-scale examples of activities from this list may not require a coastal processes assessment.

It is vital to recognise that the severity of environmental impact depends on both:

- the scale of the project or activity and expected change to the physical environment
- the proximity and pathways to sensitive habitats or other receptors.

In other words, a small project or activity that is close to and directly impacts on a protected habitat may need a more detailed assessment than a larger project or activity far away from any sensitive receptors.

Where it is uncertain whether a project should be considered ‘small-scale,’ this guidance document should be followed to calculate the size of the ‘zone of influence’ (Section 3). If a large zone of influence is identified or the zone of influence suggests potential for significant impact on a sensitive habitat, you should then follow the guidance for EIA scale assessment. You can find this on our website: Natural Resources Wales / Marine physical processes and Environmental Impact Assessment (EIA). If you are still unsure of the appropriate level of assessment, you can contact our discretionary advice service. Details of this service are on our website: Natural Resources Wales / Our service to developers

1.2 NRW Evidence Report 624 ‘Advice on physical processes for small-scale marine and coastal projects’

This guidance is based on NRW Evidence Report 624, which is available on our website: Natural Resources Wales / Marine and coastal evidence reports. The report, 'Advice on physical processes for small scale marine and coastal projects' (PDF 1.2MB), covers suggested approaches to conduct a physical processes assessment. The steps are detailed in Sections 2 – 4 of this guidance note. It also provides background to why we need to conduct an assesment (Evidence report Section 2) and the types of changes that might occur (Evidence report Section 3), both of which are summarised below.

Changes to marine and coastal physical processes have the potential to both directly and indirectly impact on a wide range of areas, including flood risk, coastal leisure and tourism, coastal habitats and coastal ecology. Therefore, it is important that activites which affect physical processes are adequately assessed. The areas that are affected are termed ‘receptors.’ Impact can be considered using the source – pathway – receptor model. Typically, the source is the proposed activity, the pathway (in this case) is the physical process (e.g suspended sediment plume) and the receptor is the factor affected. Example pathways are given in Figure 1 of Evidence Report 624: 'Advice on physical processes for small scale marine and coastal-projects (PDF 1.2MB).'

The report distinguishes between three types of change: ‘sediment disturbance’; ‘changes to seabed level’; and, ‘blockage:’

- ‘Sediment disturbance’ relates to mobilisation of sediment through an activity such as dredging or installation of infrastructure on the seafloor.
- ‘Changes to seabed level’ refers to the formation of pits or mounds and generally occurs through clearing of seabed features prior to construction, dredging, or deposition of dredged sediment.
- The concept of ‘blockage’ refers to the interruption of natural processes by the presence of an obstacle, with the obstacle being part of the new development. An example would be the changes to a pier that reduced currents through the pier and hence changed sediment transport pathways. Scour around structures also falls under the heading of blockage.

The combined extent of these changes make up the ‘zone of influence’ of the project or activity; the area that is affected by changes caused by the project or activity (Section 3).

1.3 Other relevant guidance and data sources

As clearly stated in the previous sections, larger marine and coastal projects, should follow the guidance on physical process assessment for Environmental Impact Assessments (EIAs). This guidance can be found on our website: Natural Resources Wales / Marine physical processes and Environmental Impact Assessment (EIA). This guidance is based on two evidence reports, both of which can be found on our website (Natural Resources Wales / Marine and coastal evidence reports):

- Evidence Report No. 208: Advice to Inform Development of Guidance on Marine, Coastal and Estuarine Physical Processes Numerical Modelling Assessments (PDF 3.5MB)
- Evidence Report No. 243: Guidance of Best Practice for Marine and Coastal Physical Processes Baseline Survey and Monitoring Requirements to Inform EIA of Major Development Projects (PDF 1.9MB)

These two evidence reports provide more detail and background to these topics than provided in the guidance note. Even though aimed at large and EIA projects, some details may be helpful to inform smaller scale assessments.

If your project involves the movement or removal of sediment you should refer to our favoured sediment management approaches,as detailed on our website: Natural Resources Wales / Managing sediment: marine coastal and estuarine.

If your project is at the coast in a Special Area of Conservation (SAC) or a Special Protected Area (SPA), you will need to assess coastal squeeze. Information about coastal squeeze and how to assess it, can be found on our website: Natural Resources Wales / Assessing Coastal Squeeze

You may find it useful to consider the guidance on benthic marine habitat surveys, which can be accessed from our website: Natural Resources Wales / Benthic habitat assessments for marine developments. This webpage contains links to separate PDFs for an over-arching guidance note, an introduction and chapters relating to specific habitats.

Where coastal structures or assets are being installed or modified as part of your project, you could consider inclusion of ecological enhancement techniques. The document Guidance to support the use of ecological enhancement features on coastal defence structures and assets (PDF 6.5MB) provides details on how this might be achieved. Information about other nature-based solutions can be found on our website at Natural Resources Wales / Nature based solutions for coastal management.

There are a wide range of data sources available that will aid your coastal processes assessment; these typically cover bathymetry, wave, tidal and weather. A table of relevant data sources with links is provided in Appendix B of Evidence report 624 (PDF, 1.2MB). Additionally, a range of data can be found on the website Marine Data Exchange, bathymetry data can also be obtained from the Admiralty Seabed Mapping Service and the Wales Coastal Monitoring Centre website; and, wave data is available from Cefas Wavenet. Useful information can be found on the following NRW webpages: Natural Resources Wales / Shoreline management plans and the Natural Resources Wales / Check your coastal erosion risk (National Coastal Erosion Risk Management map).

2. The information required for your coastal processes assessment

You should collate and assess relevant information at an appropriate scale to help complete your coastal processes assessment.

If your project or activity is included in the activities listed in Section 1.1, you should follow the project or activity specific topic card that can be found in Appendix A of Evidence report 624 (PDF 1.2MB).

Alternatively, if your project or activity is not listed, you should follow the generic topic card provided in Appendix A of this guidance note.

In the absence of more detailed, site specific information, you will be able to find high level answers to the topic card questions in the references provided with each topic card.

3. Establishing the zone of influence

The zone of influence is defined by calculating and superimposing the spatial extents of the different types of change (Section 3.1) caused by your project or activity on one map. The zone of influence is total area covered by these spatial extents. This mapping can often be most easily achived using a Geographical Information System (GIS), but scale drawing on a map or chart is also appropriate. Appendix B provides a hypothetical example illustrating this concept. The information collected (Section 2) should enable calculation of the size of different spatial extents. Table 1 in Evidence report 624 (PDF 1.2MB) will help you ascertain which types of change should be considered for your project or activity; if in doubt, calculate areas associated with all types of changes.

Once the zone of influence has been calculated, the sensitivity of the zone of Influence can be assessed (Section 3.2). This is important to understand the magnitude of impact your project is likely to have and allow consideration of mitigation strategies (Section 4).

3.1 Types of change

The types of change that you should consider are:

- Sediment disturbance related change (suspended sediment plumes and subsequent deposition of suspended sediment)
- Changes to morphology, currents and waves caused by changes to the bed level (e.g. through dredging and disposal)
- Near field blockage related changes (scour)
- Far-field blockage related change (changes to waves, currents and sediment transport pathways by your project or activity).
- You should follow the set of easily applicable methods to assess the spatial extent of the different types of change, which are given in Section 4.5 of Evidence report 624 (PDF 1.2MB)

3.2 Sensitivity of the zone of influence

The sensitivity of the zone of influence is critical to understanding the impact of likely effects caused by changes to marine and coastal processes. Your coastal processes assessment needs to clearly state, and provide maps, when the zone of influence of your project or activity overlaps with, or is in close proximity to, a sensitive area.

Sensitive areas include designated sites, recreational areas and other areas where alteration could be considered detrimental to nature or human activity (see Section 4.7 of Evidence report 624):

- Designated nature conservation sites (see NRW Environmental webGIS and DataMapWales)
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Ramsar
- Marine Conservation Zone (MCZ)
- Site of Scientific Interest (SSSI)
- Sensitive habitats outside of designated sites
- Section 7 habitats protected under the Environment Wales (Act) 2016 and OSPAR habitats under the OSPAR Convention
- Section 7 species (PDF, 0.25MB) protected under the Environment Wales (Act) 2016 and OSPAR habitat under the OSPAR Convention (maps for some species can be found on datamap.gov.wales
- Annex I habitats (inside and) outside Special Areas of Conservation
- Bathing waters (see NRW 'Find a bathing water' webGIS)
- Waterbodies designated by the Water Framework Directive (WFD) (see NRW Water Watch Wales webGIS)
- Shellfish Waters.

Other sensitive areas exist and depend on the locality of your project or activity: understanding of the local setting is important at this stage.

4. Mitigation strategies

Your coastal processes assessment should consider mitigation strategies when changes to marine or coastal physical processes caused by your project or activity could negatively affect the marine environment, particularly a sensitive area.

The most important point about mitigation is that it should be embedded in project design from the outset. For example, if your project is to install a new jetty, planning to use a design supported on narrow cylindrical piles (which allows currents and sediment through) would have less long term impact on coastal morphology than a solid, sheet-piled structure.

Careful consideration of your method statement and construction plans may also help you mitigate negative effects: for example, by avoiding construction at times of year when sensitive migratory species are present in your project or activity area.

You can find more examples of mitigation strategies in section 5 and table 4 of Evidence Report 624: Advice on Physical Processes for Small-scale Marine and Coastal Projects (PDF 1.2MB).

Appendix A: Generic topic card

This appendix provides a generic topic card, covering most possible questions from the project or activity specific topic cards; this means that not all questions will be relevant to your project or activity but when relevance is uncertain, should be answered.

A1. Project definition

- Where is the location of your project or activity and project or activity components (Map and grid co-ordinates)?
- What are the working methods for your project or activity (including likely equipment and machinery)?
- If your project or activity requires construction materials, where will these be sourced from and stored?
- Describe the footprint and characteristics of any new infrastructure associated with your project or activity.
- If beach access is required, can plant access working location without impacting existing defence structures, protected habitats or other key or sensitive features of the site?
- Are you moving, removing, or placing sediment as part of your proposal? If so:
    - What is the sediment type and volume that is being moved, removed or placed?
    - Where will any sediment that is removed, be deposited (map and grid co-ordinates)?
    - Where will any sediment that is being placed be sourced from and where will it be placed (map and grid co-ordinates)? Give reasoning for the placement location.
    - Where will any sediment that is being moved, be moved from and where will it be placed (map and grid co-ordinates)? Give reasoning for these locations.
    - Does your method statement cover how the sediment will be moved (type of dredger and placement method etc.)?
    - [For beneficial use] What (if any) methods will be used to promote de-watering if fine grained material is being used?
- When will the project be carried out and what are the timescales of key project components? Include the expected lifespan of any new infrastructure.

A2. Description of existing environment

- Is the setting exposed to wind or wave activity (e.g. open coast) or sheltered (e.g. up-estuary)?
- What is the approximate tidal range (spring and neap)? (Reference: 1)
- What are the average and peak current speeds? (Reference: 1)
- What is the spring tidal excursion distance at the site? (Reference: 1)
- What is the elevation of the seabed and inter-tidal in the area of the project or activity, relative to Mean High Water of Spring Tides? (Reference: 2,3,4,5,6,7)
- What are the characteristics of the seabed and inter-tidal sediments at the site which may be disturbed (including shallow geology)? (Reference: 2,3,5,7,8,9)
- Is the project or activity in a high or low turbidity environment? (Reference: 10)

- If the project is coastal, what is the shoreline management policy at your project or activity location (e.g. Advance the line, Hold the line, Managed realignment, No active intervention)? (Reference: 11)
- What are the local sediment transport pathways and how well are they understood within the wider coastal cell in which the works will be undertaken? At a minimum you should specify the direction (and ideally rate) of longshore (coastal project) or seabed (offshore project) sediment transport? (Reference: 11)
- If beach re-profiling is proposed, how has the beach profile naturally varied over time (i.e. months to years)? (Reference: 2,3)
- If sediment movement, removal or placement is planned, what is the net change in beach volume in the location where sediment movement, removal or placement is proposed? (Reference: 2,3)
- If sediment is being deposited away from the main project or activity area:
    - What is the spring tidal excursion distance where material is being deposited? (Reference: 1)
    - Is the disposal location in a high or low turbidity environment? (Reference: 11)
- What is the nature of the seabed and coast (geology and erosion/accretion trends) in the vicinity of the project/activity area and to what extent might it be sensitive to a change in wave energy? (Reference: 2,3,5,7,8,9,11)
- Do any structure(s) that will be removed or altered have any role in determining/ stabilising the morphology of the adjacent coast? (For instance, a large outfall pipe which has been in place for many decades may control the form of the adjacent coast for several tens to hundreds of metres either side of it.) (Reference: 11)

A3. Impact assessment

- To what extent could localised disturbance of the seabed, caused by any aspect of your project, result in elevated levels of suspended sediment concentrations in the coastal receiving waters?
- How long might any sediment plume persist, how far would it reach and at what elevation above background levels?
- What is the potential extent and thickness of bed level change associated with material settling out of suspension from sediment plumes?
- Could any changes in coastal morphology caused by your project or activity influence flood risk, for example, through lowering of protection to storm surge events?
- If your project or activity involves the installation, modification or removal of any infrastructure:
    - How might the passage of waves or currents be modified by the change in infrastructure and could such changes result in the modification of the adjacent inter-tidal areas and shorelines?
    - To what extent might the change in infrastructure alter the movement of sediment, both at the bed and suspended in the water column?
    - To what extent could the change in infrastructure impact coastal morphology, both directly adjacent and downdrift, because of changes to sediment supply?

    - How has the potential for climate change (especially sea level rise and larger, more frequent storms) been taken into consideration in the design of new infrastructure?
    - Is short, medium, or long-term scour or accretion expected to occur in the immediate vicinity of the infrastructure?
    - If the new infrastructure is on the coastline, could it contribute to coastal squeeze and have you conducted a coastal squeeze assessment?
- If your project or activity will make use of any machinery in the inter-tidal or sub-tidal areas (e.g. diggers, jack-up barges):
    - To what extent might construction machinery impact the inter-tidal or seabed, either directly (due to physical disturbance or leg pressure) or indirectly (due to scour or temporary blockage of flow)?
    - How long might any resultant topographical depressions persist for?
- If your project or activity involves the movement, removal or placement of sediment:
    - In the case of sediment recycling, what are the potential impacts on downdrift areas where material is being extracted?
    - Could the re-distribution of material result in an increase in local flood risk?
    - Are pits expected to fill in overtime and if yes, what are the approximate timescales envisaged?
    - What is the likely change to hydrodynamics and the height of waves passing over dredge or deposition areas and any associated implications for coastal erosion?
    - What are the implications for local water circulation resulting from the removal or creation of topographical features on the seabed?
    - What is the likely effect on the seabed of removing material? In particular the nature of the sediment to be left once dredging ceases, and the likely nature and scale of the resulting topography?
    - What, if any, are the anticipated maintenance dredging requirements expected to be for your project or activity?
    - [For beneficial use] What existing issues could be addressed by the addition of dredged material (e.g. salt-marsh loss due to sea level rise, enhanced coastal protection)? Can these be demonstrated using observational evidence?
    - [For beneficial use] Will the deposited material be retained in situ long term? Are any containment devices to be used (e.g. brush fences, geotextile tubes, bunds etc.)?
    - [For beneficial use] If the material is sacrificial, where is it likely to disperse and what is the likely timescale?
    - [For beneficial use] Are there other environmental benefits (e.g. reduction in emissions, fuel saving, increased carbon capture etc.)?

A4. Topic card references

1. UK Renewables Atlas
2. Wales Coastal Monitoring Centre
3. Data map Wales
4. UKHO bathymetry
5. European Marine Observation and Data Network (EMODnet)
6. Imardis data portal
7. Strategic environmental assessment (SEA) data portal
8. BGS GeoIndex Offshore
9. JNCC UKSeaMap
10. CEFAS Suspended Sediment Climatologies around the UK
11. Shoreline Management Plans

Appendix B: Calculating the zone of influence

This is an example calculation of the zone of influence for a hypothetical project.

This hypothetical scenario is designed to show examples of all different types of extent. It does not follow that similar projects in the real world would necessarily be considered small, or obtain a marine licence.

The scenario is that a sailing club based on an estuary wants to improve accessibility by constructing a small jetty and dredging to ensure boats can access the jetty at all stages of tide.The hypothetical estuary is a straight channel with uniform sediment of medium sand, a tidal range of 4m and a maximum tidal current of $1ms^{-1}$ in the subtidal area.

The proposed jetty has a footprint of 16m x 5m and is supported on 10 1m diameter piles.

The dredged area will be adjacent to the jetty and have a footprint of 30m x 8m. The dredged area will be in water depths of between -1.2m to – 0.2m CD (chart datum). The area will be dredged so that the whole area will be -1.2m. A mechanical, back hoe, dredger will be used. The dredged material will be deposited on the opposite bank of the estuary in the intertidal area in a 15m by 16m area. Deposition onto the intertidal will be at low tide and so sediment disturbance related change will only be caused the dredging activity and not by the deposition. Figure B0 describes the scheme.

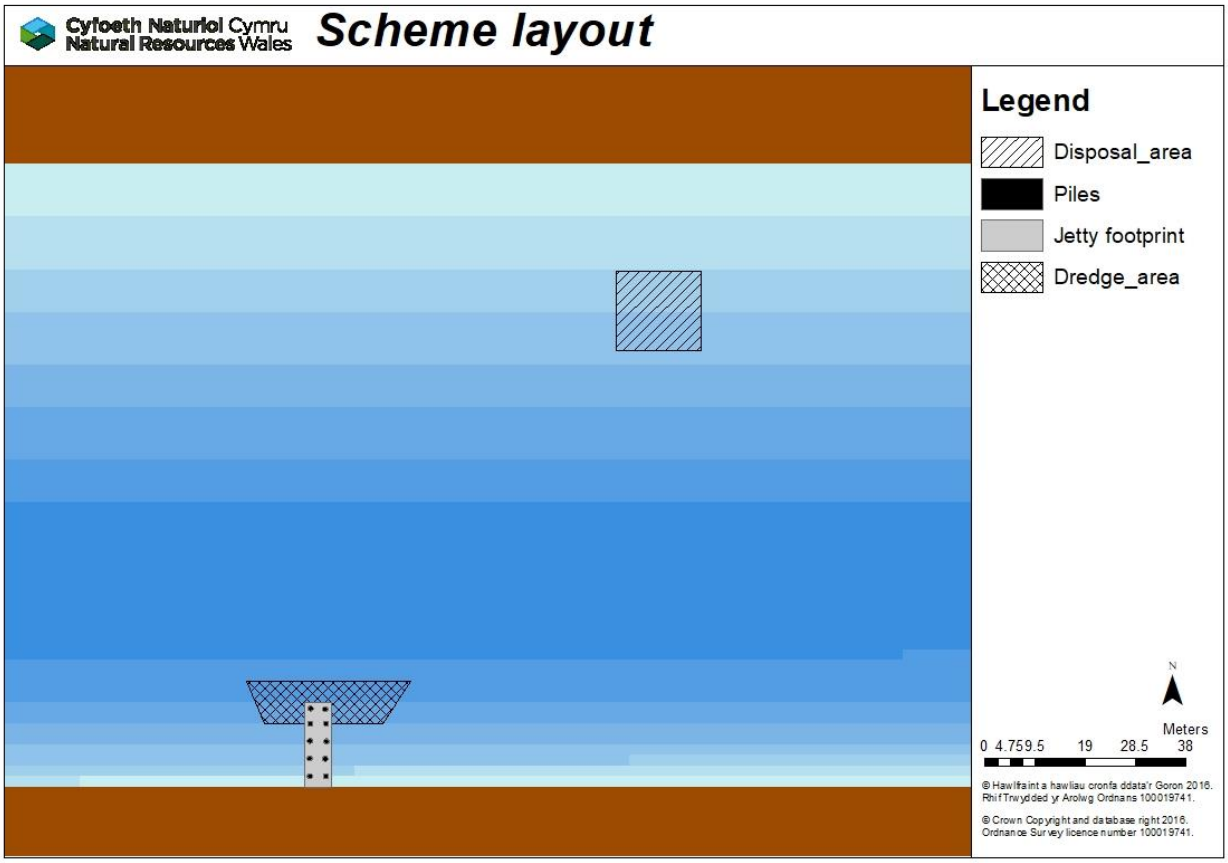


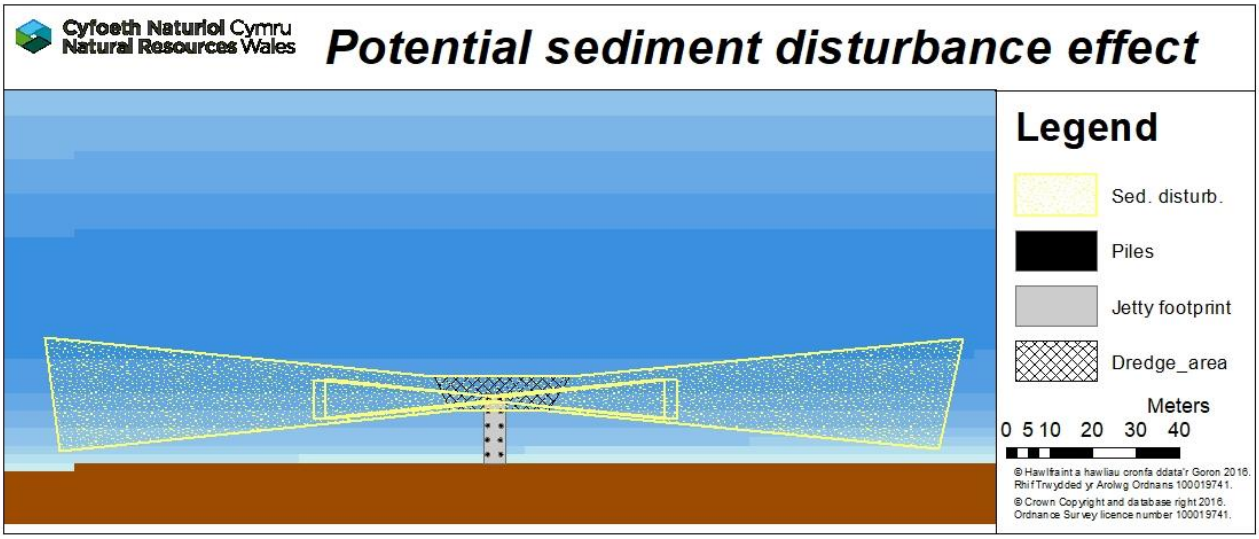
Figure B0: The proposed hypothetical scheme area and components, drawn in a GIS package.

B1. Determining the potential maximum extent of sediment disturbance related changes.

Sediment disturbance related change could be caused by the dredging activity as sediment could escape from the dredge bucket. Maximum water depth at high tide would be ~5m and the maximum current speed would be 1ms^{-1}. Using Table 3 in Evidence report 624, the distance sand would travel in the direction of the current can be estimated as 90m, with the lateral spreading estimated as 9m from the rule given in Figure 3 of the Evidence report. The piling activity could also disturb sediment. However, it is assumed that the piling would only disturb sediment for the two subtidal locations, because intertidal piling could be done at low tide. It is estimated that piling could displace sediment 2m into the water column and therefore could result in sediment plumes of 40m distance and 4m lateral expansion.

These extents are shown in Figure B1. Here, the extents are carefully drawn in a GIS system, but manual drawing to scale on a hard copy map is suitable if a GIS package is not available. In this case, the areas potentially affected by the dredging overlaps the areas affected by the piling.

Figure B1: A map showing the area of potential sediment disturbance related change from the dredging and the piling activity



B2. Determining the potential maximum extent of bed level changes

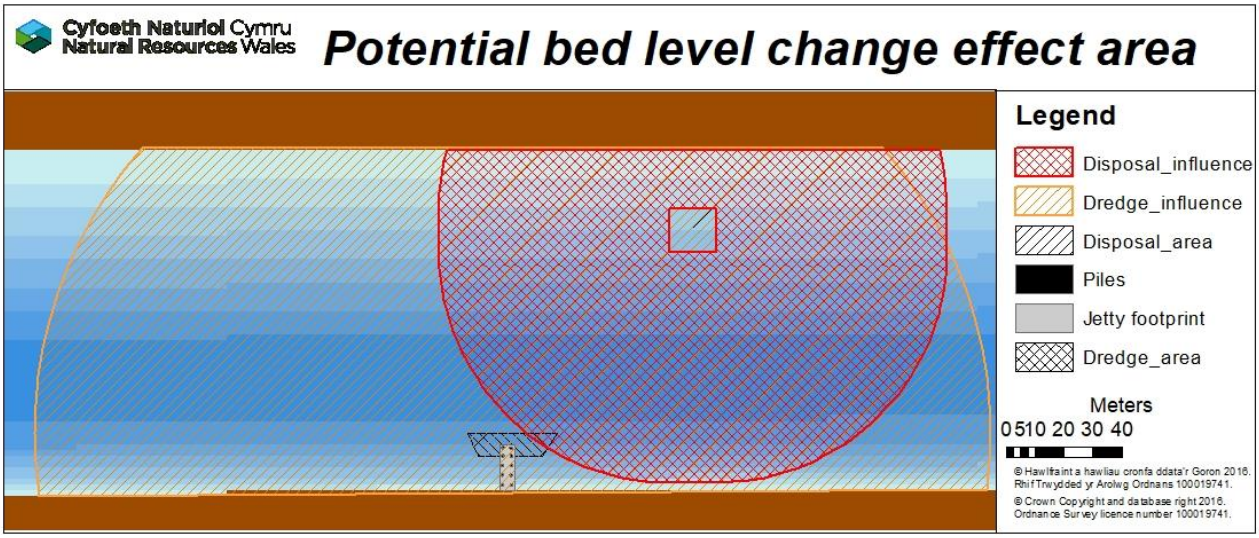
Both the dredge and deposition areas could cause bed level related change. A threshold of change of 5% of the water depth is given in Evidence report 624 (PDF 1.2MB) as the level over which impacts might be observed. Once changes to bed level exceed 5%, Evidence report 624 (PDF 1.2MB) suggests that an effect could occur up to a distance away from the area of bed level change of 5x the maximum dimension of the area of bed level change.

For the dredge area, the bed level change is up to 1m, and in this area, the water depth is 4m, so the percentage change is 25%. This exceeds the 5% threshold and therefore changes could occur up to 150m (5 x 30m) from the dredge area.

For the deposition area, average bed level increase is expected to be 0.5m, which in the intertidal means the change will also exceed the 5% threshold. Therefore change is possible up to 80m (5 x 16m) from the disposal area.

These areas of change are can be drawn in GIS by applying a buffer of the correct distance around the dredge and disposal areas. The buffer regions are subsequently cropped to not include the on-land (brown) areas (Figure B2). In the absence of access to a GIS, it is suggested that scanned Ordnance Survey maps or nautical charts with careful manual scale drawing would be appropriate.

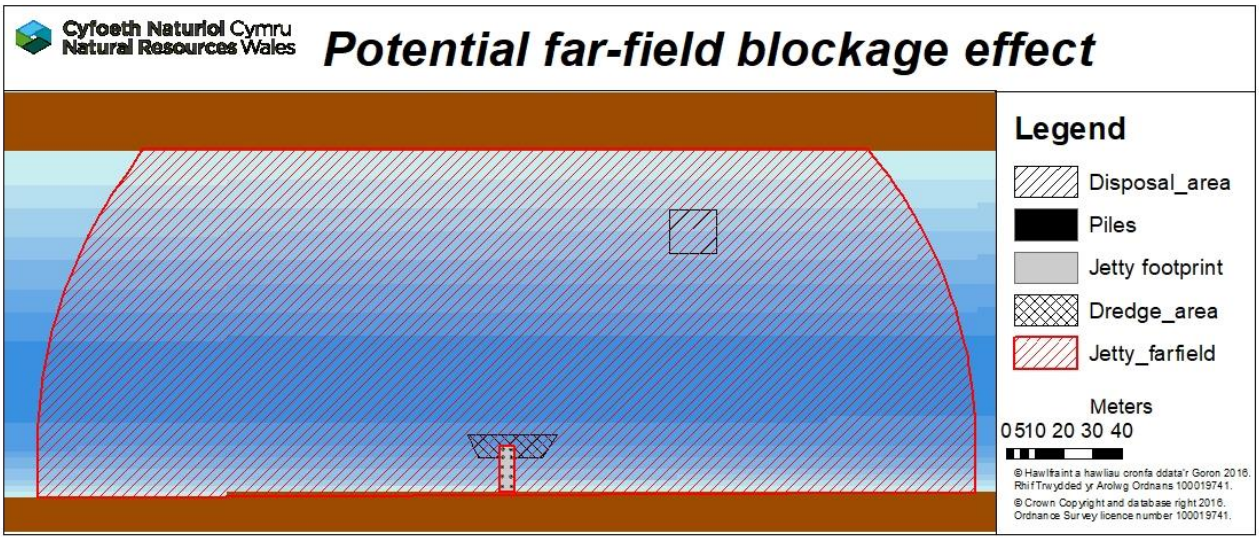
Figure B2: A map showing the areas potentially affected by the effect of bed level change on waves, hydrodynamics and sediment transport (orange for the dredge area, red for the disposal area)



B3. Determing the potential maximum extent of blockage related changes: far field effects

Evidence report 624 (PDF 1.2MB) states that field effects can be estimated to occur up to a distance of 10x the maximum dimension of the structure. In this case, the jetty footprint has a maximum dimension of 16m and so the far field effects could occur up to 160m from the jetty (Figure B3). The same drawing method is used as for bed level change; a buffer of 160m around the jetty is calculated in GIS and the the buffer is cropped around the land areas (brown on map).

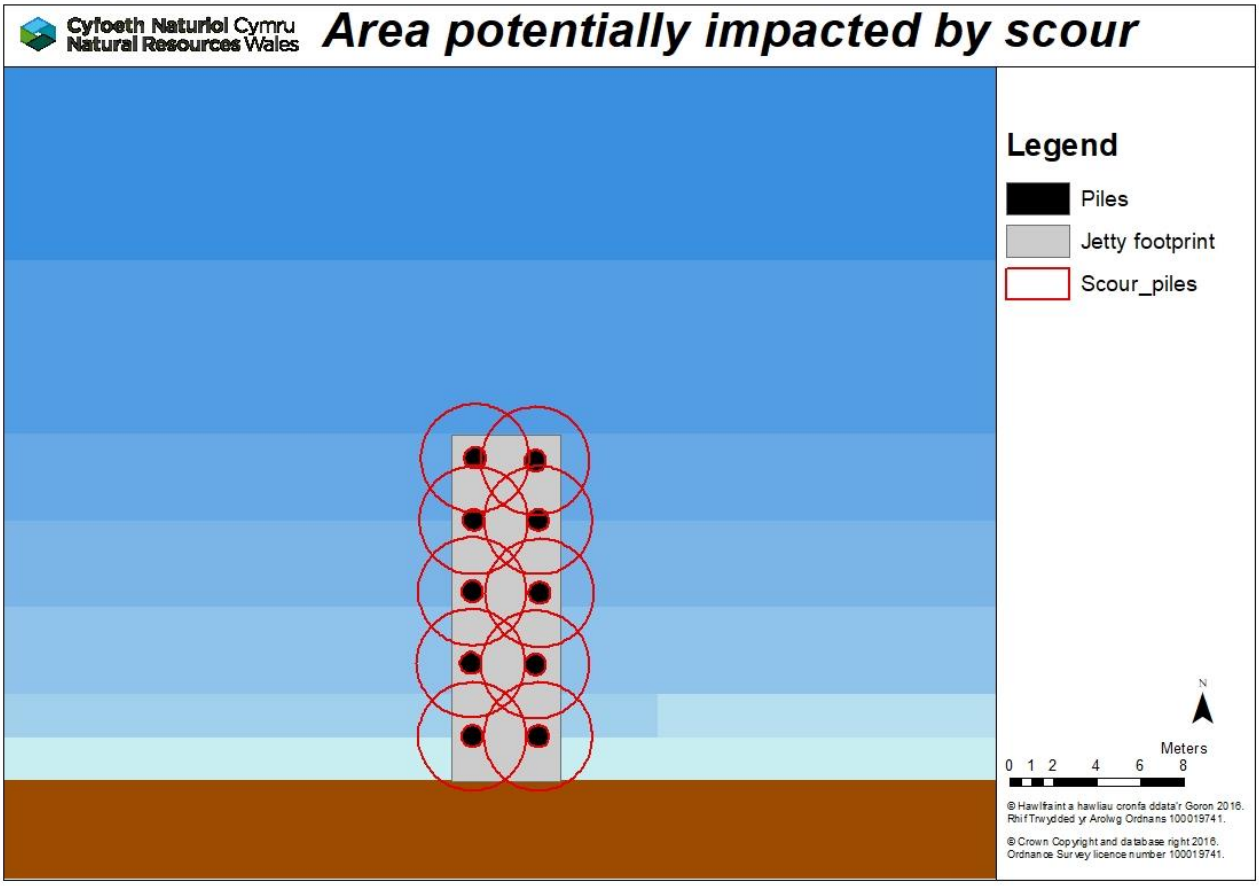
Figure B3: The area potentially affected by far field blockage effects (red hatches area)



B4. Determing the potential maximum extent of blockage related changes: local scour

The extent of the scour around the pilings can be estimated by using Figure 6 in Evidence report 624 (PDF 1.2MB). The pilings are 1m in diameter, so using the data points for sand and gravel we can estimate the maximum scour as 2m from the piling. Again, to draw this in GIS, the buffer tool is used to map the areas 2m away from the piling (Figure B4). You can note that in this example potential scour areas between piles overlap.

Figure B4: The area potentially affected by scour (red outlines)



B5. Calculating the zone of influence

The zone of influence is then calculated by taking the maximum extent when all separate areas are overlapped (Figure B5). Not all areas contribute to the maximum extent: for example, scour is a nearfield process and the other potential changes overlap the scour area.

In a real situation, the next step would be to assess if the zone of influence overlapped any sensitive areas. Since this is a hypothetical example to demonstrate the concept of a zone of influence, this is not conducted.

Figure B5: The total zone of influence (green boundary), made up of the amalgamation of individual areas of change