



Shell Island Maintenance Dredge

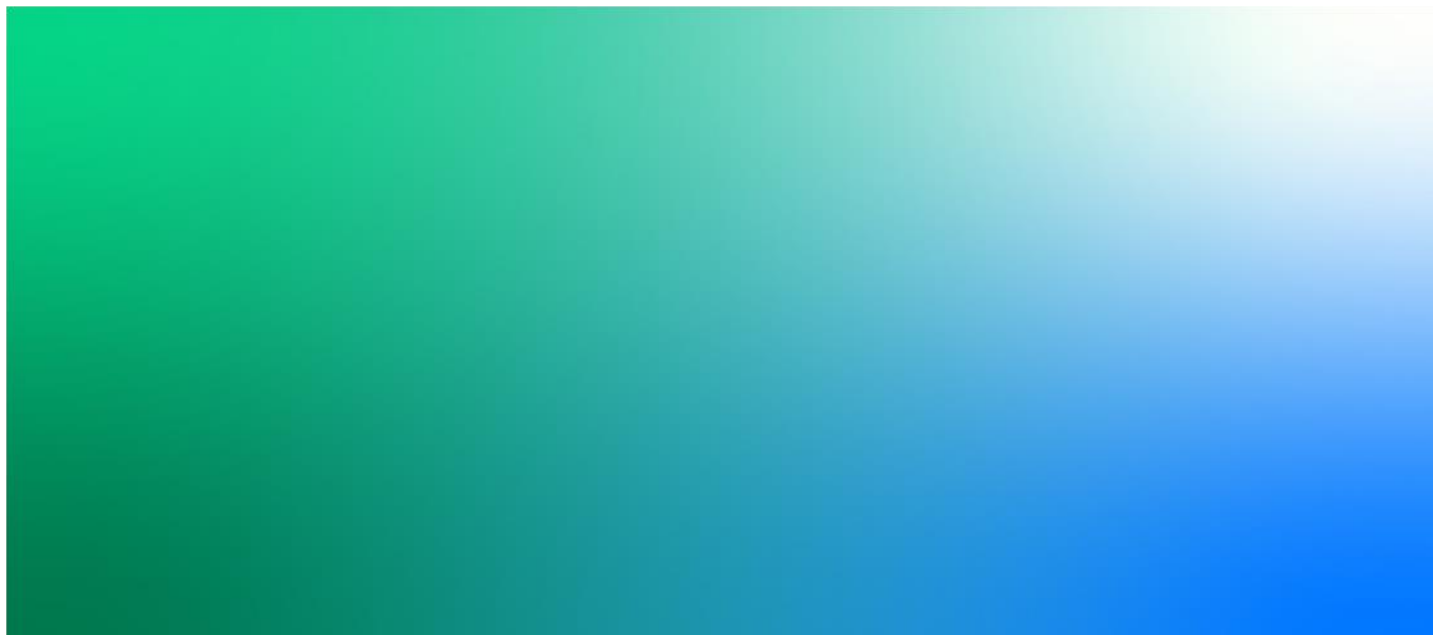
Water Framework Directive Assessment

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Shell Island

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1. Background

The Water Framework Directive (WFD)¹ requires all water bodies to achieve both good chemical status and good ecological status. For each River Basin District, a River Basin Management Plan (RBMP) outlines the actions required to enable natural water bodies to achieve this. Water bodies that are designated in the RBMP as Heavily Modified Water Bodies (HMWB) or Artificial Water Bodies (AWB) may be prevented from reaching good ecological status by the physical modifications for which they are designated or purpose for which they were constructed (e.g. navigation, flood defence, urbanisation). Instead they are required to achieve good ecological potential, through implementation of a series of mitigation measures outlined in the applicable RBMP (and in some cases updated since the publication of the RBMP).

As part of a flood risk management authority's activities there is a requirement to assess the impact of planned works on the associated WFD waterbodies. Defra has published guidance on how to assess the impact of activities in transitional and coastal waters for the WFD, referred to as "Clearing the Waters for All" (Environment Agency 2017). The guidance sets out the following three discrete stages to WFD assessments:

- **Screening:** excludes any activities that do not need to go through the scoping or impact assessment stages;
- **Scoping:** identifies the receptors that are potentially at risk from an activity and need impact assessment; and
- **Impact Assessment:** considers the potential impacts of an activity, identifies ways to avoid or minimise impacts, and indicates if an activity may cause deterioration or jeopardise the water body achieving Good Ecological Status or Potential (GES or GEP).

This report provides a Clearing the Waters (Water Framework Directive) Assessment for Shell Island, also known as Mochras, located on the west of Llanbedr in Gwynedd, Wales.

¹ 2017 SI No. 407 WATER RESOURCES, ENGLAND AND WALES. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

2. Screening

2.1 Scheme Description

Shell Island Lagoon is near the inner estuary entrance of the Afon Artro. The works involve maintenance dredging at Shell Island (Mochras), Llanbedr, Gwynedd, and disposal of the dredging arisings.

Dredging of sandy material will be undertaken over an area of approximately 0.03 km² within the Artro Estuary. The disposal of the sandy sediment to be dredged as beach replenishment to:

- Outside the estuary mouth on the nearshore sandbar (Bar Newydd); and/or
- On the 'Dinghy Beach' if bad weather prevented disposal directly outside the estuary mouth.

It is not considered that any dredging of muddy sediment will need to be undertaken from the inner basin in this most recent dredge and disposal activity, as occurred in the past. A location plan of Shell Island is shown in Figure 2-1 and the dredging and disposal areas are shown in Figure 2-2.



Figure 2-1: Location Plan

2.2 Site Context

Shell Island provides marina facilities for around 100 boats and is a significant source of input into the local economy. Maintenance dredging is required at regular intervals (around every 3 years) to return the water levels to their original depths and allow craft to navigate safely. Dredging of sandy materials will occur in the subtidal areas of the entrance channel (Figure 2-2). Disposal of dredged materials will follow the previously consented methodology of 2013: materials will be carried along existing slipways and deposited on Bar Newydd, Dinghy Beach and potentially Llandanwg Beach for sandy materials.

It is not considered that this most recent dredge will encounter any muddy materials (only sandy materials), but a plan for both types has been retained within the long-term management plan, in case any muddy materials are encountered in future dredge and disposal operations. The long-term management plan has been attached as Appendix 1 in the Appropriate Assessment.

Works are proposed for March 2020 to avoid disturbance to breeding birds and migratory fish.

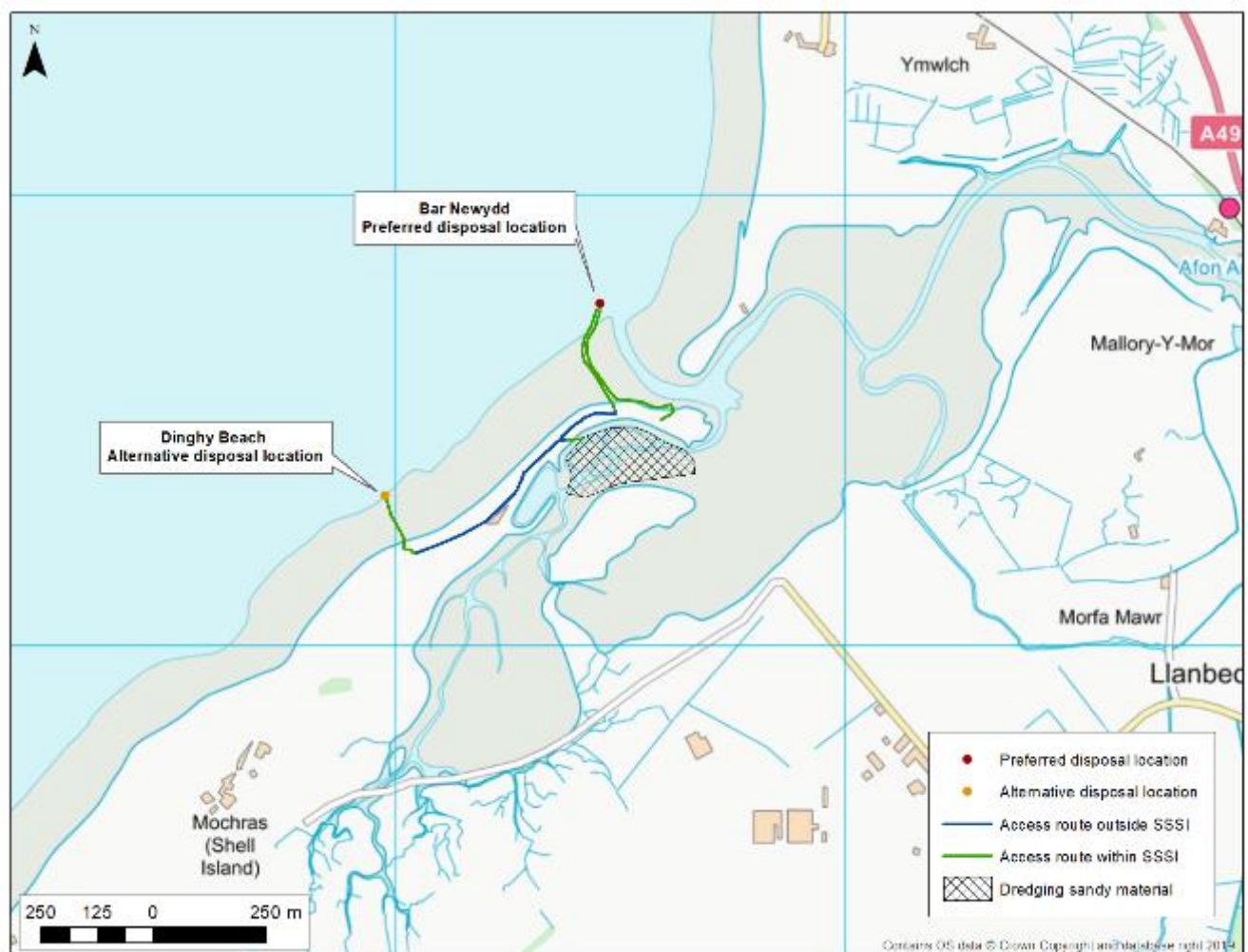


Figure 2-2: Location of dredging and disposal activities

2.3 Potentially Affected Water Bodies

The following water bodies are within the Western Wales River Basin District:

- Tremadog Bay coastal;
- Cardigan Bay coastal;
- Artro Estuary (Transitional (TRaC)).

All of the above are scoped into the assessment.

The groundwater body Meirionnydd (ID GB41002G203200) is scoped out of the assessment due to no likely impact to the aquifer. The river water body Dyffryn Ardudwy - Main Drain (GB521006407200) is also scoped out due to this being upstream of the harbour.

2.4 Water Body Existing Status

The following data have been extracted from the NRW website cycle 2 rivers and water bodies² to summarise key parameters of water body status for each of the relevant water bodies within this assessment. All the data are from the interim 2018 information. Summaries of each water body are shown in Table 2-1 to Table 2-3. All relevant water bodies are illustrated in Figure 2-3.

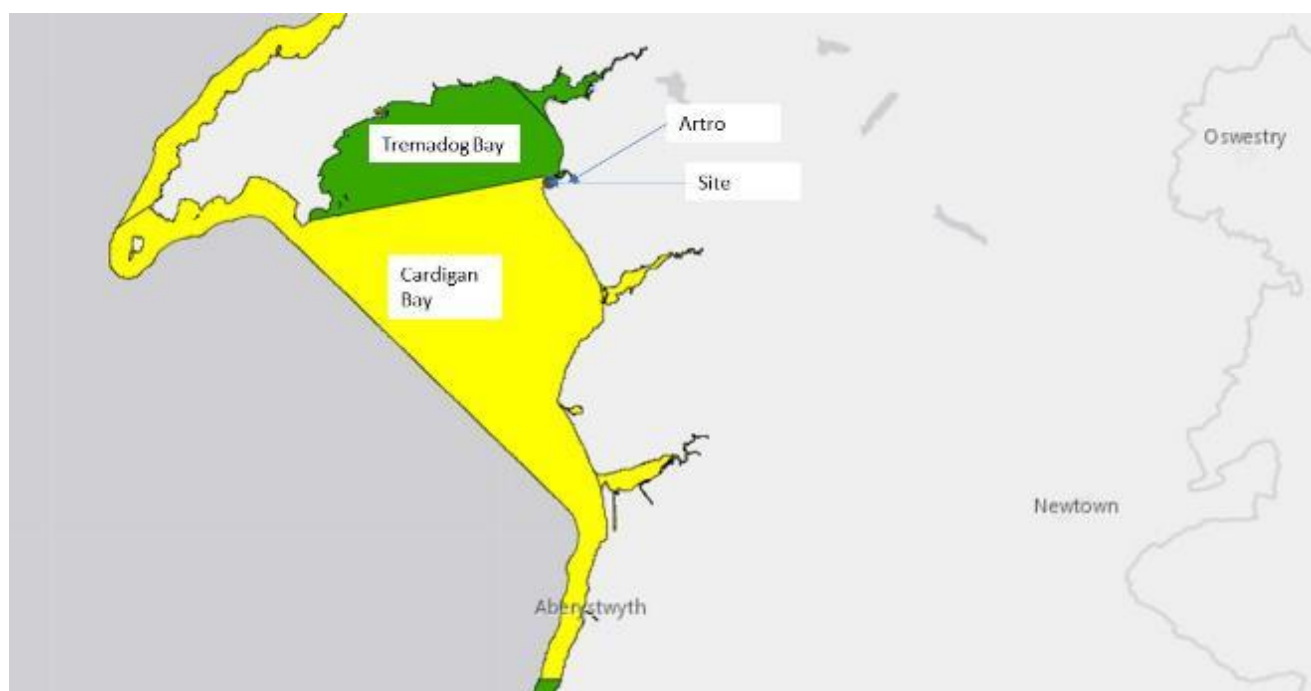


Figure 2-3: Relevant water bodies screened in. Source: NRW data.

² NRW website cycle 2 rivers and water bodies:
<https://nrw.maps.arcgis.com/apps/webappviewer/index.html?id=4ef6ea25c5984c939636714dbfce25f3>

Table 2-1: Water body WFD parameters for Tremadog Bay

Water body ID	GB651009350000
Water category	Coastal - Western Wales TRaC
Water body name	Tremadog Bay
Current overall status	Good
Protected area designation	Morfa Harlech a Morfa Dyffryn SAC;
Hydromorphological status	No HMWB
Area (km²)	239.42
Current ecological status	Good
Chemical quality elements	Good
Higher sensitivity habitats	Polychaete Reefs
Lower sensitivity habitats	Gravel and cobbles (intertidal and subtidal coarse sediments); intertidal soft sediments; subtidal soft sediments; rocky shore (intertidal rock); subtidal rocky reef

Table 2-2: Water body WFD parameters for Cardigan Bay North

Water body ID	GB621009600000
Water category	Coastal - Western Wales TRaC
Water body name	Cardigan Bay North
Current overall status	Moderate
Protected area designation	Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau SAC
Hydromorphological status	No HMWB
Area (km²)	712.19
Current ecological status	Good
Chemical quality elements	Fail
Higher sensitivity habitats	Polychaete Reefs; subtidal kelp beds
Lower sensitivity habitats	Gravel and cobbles (intertidal and subtidal coarse sediments); intertidal soft sediments; subtidal soft sediments; rocky shore (intertidal rock); subtidal rocky reef

Table 2-3: Water body WFD parameters for Artro Estuary

Water body ID	GGB521006407200
Water category	Transitional Western Wales TRaC
Water body name	Artro Estuary
Current overall status	Good
Protected area designation	Meirionnydd Oakwoods and Bat Sites SAC
Hydromorphological status	Not high
Area (km²)	0.72
Current ecological status (and status objective)	Good
Chemical quality elements	Good
Higher sensitivity habitats	-
Lower sensitivity habitats	Gravel and cobbles (intertidal and subtidal coarse sediments); intertidal soft sediments

2.5 Protected Areas

The WFD requires that activities are also in compliance with other relevant legislation, as considered below. The Clearing the Waters for All guidance recommends that the following are looked at as part of the assessment:

2.5.1 Nature Conservation Designations

Article 3 of the Habitats Directive (92/43/EEC as amended) requires the establishment of a European network of important high-quality conservation sites known as Special Areas of Conservation (SAC) that will contribute to conserving habitats and species identified in Annexes I and II of the Directive. The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). In accordance with Article 4 of the Birds Directive (2009/147/EC), Special Protection Areas (SPA) are strictly protected sites classified for rare and vulnerable birds (Annex I of the Directive), and for regularly occurring migratory species. Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources; in England, Ramsar sites are afforded the same status as SPAs and SACs when undertaking impact appraisal.

The Natural England MAGIC website³ was used to find out the nature conservation designations within 2 km of the site. These include:

- Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau SAC;
- Morfa Harlech a Morfa Dyffryn SAC;

³ Natural England MAGIC website: <https://magic.defra.gov.uk/MagicMap.aspx>

- Meirionnydd Oakwoods and Bat Sites SAC; and
- The Northern Cardigan Bay (Gogledd Bae Ceredigion) Special Protection Area (SPA) is also immediately adjacent to the dredge disposal site.

2.5.2 Bathing Water Directive

The Bathing Water Directive aims to protect bathing water standards in coastal waters. It also sets out microbiological and physico-chemical standards and the process used to monitor water quality at identified bathing waters.

The following are within 2 km of the site:

- Llandanwg (NGR: SH5669028180) in Tremadog Bay;
- Harlech Bathing Water (NGR: SH5676031480) in Cardigan Bay; and
- Dyffryn ((Llanendwyn) (NGR: SH5671022580) in Cardigan Bay.

2.5.3 Urban Waste Water Treatment Directive

The UWWTD (91/271/EEC) aims to protect the environment from the adverse effects of the collection, treatment and discharge of urban waste water. It sets treatment levels on the basis of sizes of sewage discharges and the sensitivity of waters receiving the discharges. In general, the UWWTD requires that collected waste water is treated to at least secondary treatment standards for significant discharges. Secondary treatment is a biological treatment process where bacteria are used to break down the biodegradable matter (already much reduced by primary treatment) in waste water. Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

There are no sites within proximity of the study area.

2.5.4 Shellfish Waters Directive

The Shellfish Waters Directive (2006/113/EC) was repealed in December 2013 and subsumed within the WFD. However, the latest standards for the implementation of the WFD in England and Wales suggest 'Protected areas under WFD include shellfish waters and we are proposing to direct the Agencies to continue to endeavour to observe the microbial standard in shellfish waters, to contribute to a high quality shellfish product directly edible by humans' (Department for Environment, Food and Rural Affairs (Defra), 2014). However, while the guideline bacteriological standard of the former directive has been retained, it is understood that the water column standards have been dispensed with as these are considered to be adequately covered by other aspects of the WFD (Environment Agency and Water UK, 2013).

The most relevant of the directive's former water quality standards would be that a discharge affecting Shellfish Waters must not cause the suspended solid content of the water to exceed by more than 30% the content of waters not affected.

There are no Shellfish Waters within 2 km of the site.

3. Scoping

The Defra Clearing the Waters for All guidance provides a scoping template to record findings and consider potential risks for several key receptors, specifically:

- Hydromorphology;
- Biology;
 - Habitats;
 - Fish;
- Water quality;
- Protected areas; and
- Invasive non-native species (INNS).

3.1 Hydromorphology

Table 3-1 provides a summary of the hydromorphology risk issues within a 3 km buffer. There is a risk to the hydromorphology associated with the proposed works, so this receptor has been scoped into the impact assessment.

Table 3-1: Hydromorphology scoping summary

Hydromorphology Considerations	Hydromorphology risk issue (s)		
	Cardigan Bay	Tremadog Bay	Artro Estuary
Consider if your activity could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status?	No. None at High status	No. None at High status	No. None at High status
Consider if your activity could significantly impact the hydromorphology of any water body?	No. Dredging is not occurring within this water body but dredge arisings being deposited on the backshore adjacent to Cardigan Bay	No	Dredge plume could impact on hydromorphology; operation will remove sediment on seabed which could impact substrate quality and quantity
Consider if your activity is in a water body that is heavily modified for the same use as your activity?	No. Not designated heavily modified	No. Not designated heavily modified	No. Not designated heavily modified

3.2 Biology

3.2.1 Habitats

Table 3-2 presents a summary of biology (habitat) considerations and associated risk issues for the proposed works. As at least one biology (habitats) consideration indicates that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment.

Using the MAGIC website as an indicator of the location of high and low sensitivity habitats, there are many lower and higher sensitivity habitat areas along the shoreline adjacent to the estuary mouth and adjacent to the beach at Shell Island, within Cardigan Bay and Tremadog Bay. These habitats include Polychaete Reefs and subtidal kelp beds offshore of Shell Island and Gravel and Cobbles (intertidal and subtidal coarse sediments); intertidal soft sediments; subtidal soft sediments; rocky shore (intertidal rock); and subtidal rocky reef habitats. Coverage and extent vary along the shoreline. Figure 3-1 illustrates the location and extent of each.

Table 3-2: Biology scoping summary

Biology consideration	Biology Risk Issue(s)		
	Cardigan Bay	Tremadog Bay	Astro Estuary
Is the footprint of the activity 0.5 km ² or larger?	No – not in this water body	No – not in this water body	No. The area to be dredged is about 0.03 km ² and will be confined to the confined to Artro Estuary.
Is the footprint of the activity 1% or more of the water body's area?	No	No	Yes. The total dredge footprint is about 4% of the water body's area.
Is the footprint of the activity within 500 m of any higher sensitivity habitat?	Not within 500 m for the dredging operation. However, there are Polychaete Reefs; subtidal kelp beds offshore of where the disposal site is.	No	No
Is the footprint of the activity 1% or more of any lower sensitivity habitat?	No. There are gravel and cobbles (intertidal and subtidal coarse sediments); intertidal soft sediments; subtidal soft sediments; and rocky shore (intertidal rock) close by the disposal activity	No	No. There are gravel and cobbles (intertidal and subtidal coarse sediments); intertidal soft sediments and rocky shore (intertidal rock) at the vicinity where dredging activities will occur.

High and Low Sensitivity Habitat

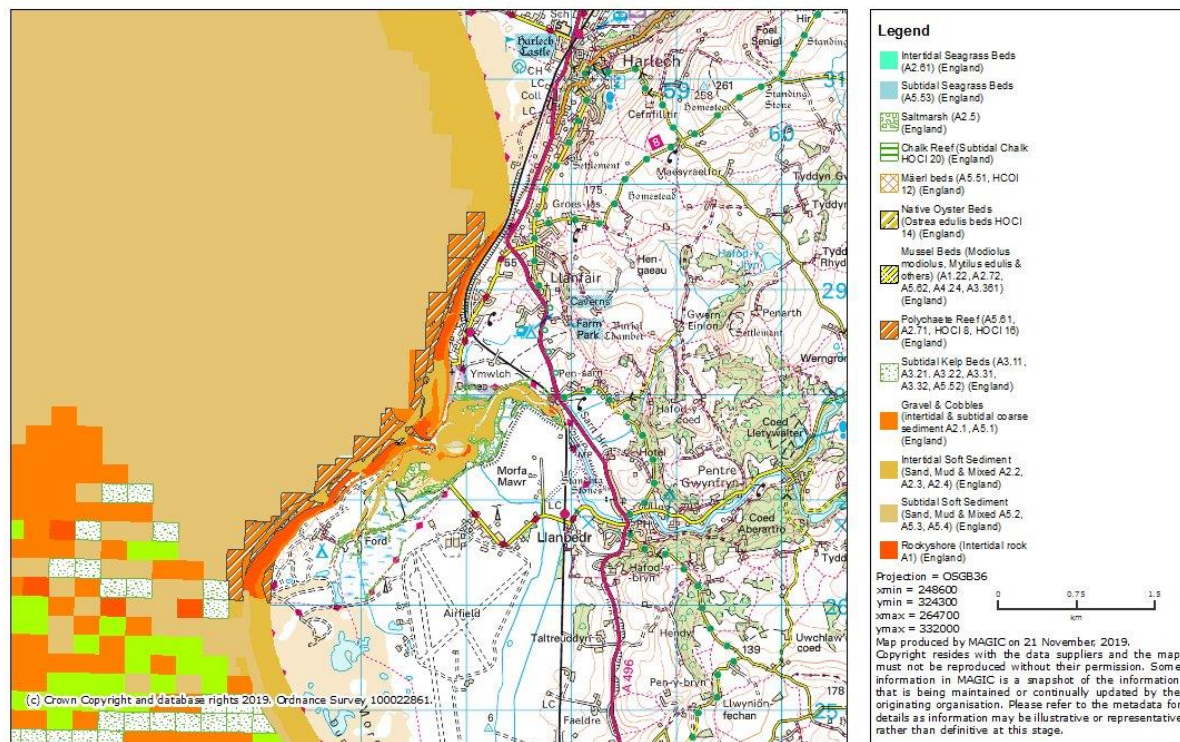


Figure 3-1: Extent of higher and lower sensitivity habitats. Source: Magic DEFRA.

3.2.2 Fish

Activities occurring within an estuary or inshore environment could impact on normal fish behaviour such as movement, migration or spawning. Table 3-3 presents a summary of biology (fish) considerations and associated risk issues for the proposed works. As at least one biology (fish) consideration indicates that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment.

Table 3-3: Biology (fish) scoping summary

Biological (Fish) Considerations	Biological (Fish) Risk Issue(s)		
	Cardigan Bay	Tremadog Bay	Artro Estuary
Consider if your activity is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary?	Yes. Temporary disturbance to fish, temporary loss of feeding habitats, increased suspended sediments.	Yes. Temporary disturbance to fish, temporary loss of feeding habitats, increased suspended sediments.	Yes. Temporary disturbance to fish, temporary loss of feeding habitats, increased suspended sediments.
Consider if your activity could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)?	No	No	Yes
Consider if your activity could cause entrainment or impingement of fish?	No	No	No
Is the footprint of the activity 1% or more of any lower sensitivity habitat?	No	No	No

3.3 Water Quality

Consideration should be made regarding whether phytoplankton status and harmful algae could be affected by the proposed works, as well as identifying the potential risks of using, releasing or disturbing chemicals. Table 3-4 presents a summary of water quality considerations and associated risk issues of the proposed works. As at least one water quality consideration indicates that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment.

Table 3-4: Water quality scoping summary

Biological (Water Quality) Considerations	Biological (Water Quality) Risk Issue(s)		
	Cardigan Bay	Tremadog Bay	Artro Estuary
Consider if your activity could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)?	No. Activity not in this water body.	No. Activity not in this water body.	Yes. Although activities extend over about 10 days, effects on water quality are anticipated.
Consider if your activity is in a water body with a phytoplankton status of moderate, poor or bad?	Phytoplankton at high status.	No data are available for phytoplankton in this water body. Activity not occurring within this water body	Phytoplankton not assessed.
Consider if your activity is in a water body with a history of harmful algae?	No	No	No
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if the chemicals are on the Environmental Quality Standards Directive (EQSD) list?	No	No	No
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if it disturbs sediment with contaminants above Cefas Action Level 1?	No	No	No
If your activity has a mixing zone (like a discharge pipeline or outfall) consider if the chemicals released are on the Environmental Quality Standards Directive (EQSD) list?	No	No	No

Four samples were collected for testing of contaminants in December 2019. These results are all below the Cefas action level 1, and therefore do not exceed the recommended levels for contaminants. The results are shown in the following table (Table 3-5) against the action level.

Table 3-5: Sediment samples and contaminant levels

Lab sample number	2019/246113	2019/246114	2019/246115	2019/246116	CEFAS action level 1
Parameters	Sample 1	Sample 2	Sample 3	Sample 4	-
Total solids (%)	81.4	93.9	85.0	81.8	-
Arsenic (mg/kg)	9.07	8.42	7.30	7.65	20
Cadmium (mg/kg)	<0.014	<0.014	<0.014	<0.014	0.4
Chromium (mg/kg)	6.78	6.68	5.97	6.32	40
Copper (mg/kg)	1.85	1.16	1.13	1.18	40
Mercury (mg/kg)	0.0197	0.0114	<0.01	<0.01	0.3
Nickel (mg/kg)	5.50	4.97	4.61	4.78	20
Lead (mg/kg)	7.40	6.06	7.78	6.01	50
Zinc (mg/kg)	24.2	20.6	19.0	19.3	130
DBT (mg/kg)	<0.002	<0.002	<0.002	<0.002	0.1
TBT (mg/kg)	<0.002	<0.002	<0.002	<0.002	0.1
Total hydrocarbon content (mg/kg)	6.04	0.489	<0.1	0.337	-

3.4 Protected Areas

Consideration should be made regarding whether WFD protected areas are at risk from a proposed activity. Table 3-6 presents a summary of protected area considerations and associated risk issues of the proposed works. As the protected areas considerations indicate that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment.

Table 3-6: Protected areas

Protected Area Considerations	Protected Area Risk Issue(s)		
	Cardigan Bay	Tremadog Bay	Artro Estuary
Consider if your activity is within 2 km of any WFD protected area?	Yes – WFD protected areas (Bathing Waters) are outside of harbour entrance at Harlech Bathing Water (NGR: SH5676031480) in Cardigan Bay. Dyffryn (Llanendwyn) (NGR: SH5671022580) in Cardigan Bay.	Bathing Water at Llandanwg. Impact scoped out as no impact by/to coliform release and distribution. There are no Eutrophic coastal sensitive areas.	No. No WFD protected areas in this water body.
	Yes - Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau SAC Morfa Harlech a Morfa Dyffryn SAC Northern Cardigan Bay (Gogledd Bae Ceredigion) Special Protection Area (SPA) is also immediately adjacent to the dredge disposal site.	Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau SAC Morfa Harlech a Morfa Dyffryn SAC Northern Cardigan Bay (Gogledd Bae Ceredigion) Special Protection Area (SPA) is also immediately adjacent to the dredge disposal site.	Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau SAC Morfa Harlech a Morfa Dyffryn SAC Northern Cardigan Bay (Gogledd Bae Ceredigion) Special Protection Area (SPA) is also immediately adjacent to the dredge disposal site.

Feeding (winter) birds are not a primary or secondary feature for SAC selection, however, the adjacent Special Protection Area (SPA) is noted for its overwintering red-throated divers. As the works will be of a short term and temporary nature, they are unlikely to disturb these species.

The dredging lies within the Pen Llyn a'r Sarnau SAC and Site of Special Scientific Interest (SSSI).

3.5 Invasive Non-Native Species (INNS)

Consideration should be made regarding whether there is a risk the activity could introduce or spread INNS. Risks of introducing or spreading INNS include materials or equipment that have come from, had use in or travelled through other water bodies, as well as activities that help spread existing INNS, either within the immediate water body or other water bodies. Table 3-7 presents a summary of INNS considerations and associated risk issues of the proposed works.

Table 3-7: INNS considerations

INNS Considerations	INNS Area Risk Issue(s)		
	Cardigan Bay	Tremadog Bay	Arthro Estuary
Consider if your activity is within 2 km of any WFD protected area?	No	No	Potential for introduction (on plant / equipment) or spread of INNS by accidental water pollution. It can be scoped out by use of good practice

3.6 Summary

The results of the scoping exercise are given in Table 3-8.

Table 3-8: Scoping summary

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Dredge plume could impact on hydromorphology; operation will remove sediment on seabed which could impact substrate quality and quantity. However, dredging has occurred before at this site.
Biology: habitats	Yes	Lower sensitivity habitats within the harbour, and a mix of high and low sensitivity habitats offshore in the open coast, adjacent to the disposal site. The areas of sensitivity outside of the harbour entrance can be scoped out. Inside the harbour, the habitat is scoped in. However, dredging operations have occurred at this site before.
Biology: fish	Yes	Potential temporary disturbance to fish, temporary loss of feeding habitats, increased suspended sediments, and potential smothering of habitat and spawning areas.
Water quality	Yes	Suspended sediment concentrations. Activities extend over about 10 days and effects on water quality are anticipated but likely to be temporary and localised.
Protected areas (including Bathing Waters and UWWTD)	Yes	Impact to Bathing Waters scoped out as no impact by/to coliform release and distribution. There are no Eutrophic coastal sensitive areas. Impact to SAC scoped in.
Invasive non-native species	No	Potential for spread but can be scoped out if using best practice.

4. Assessment

This section uses the JNCC database to assess the impacts to each of the receptors caused by various pressures. Table 4-1 describes potential impacts for dredging operation.

Table 4-1: WFD Assessment for dredging operation

Quality Element	Impact for dredging operation	Proposed Mitigation
Biological elements		
Phytoplankton	Temporary smothering of habitats from deposition of suspended sediment concentrations from dredge plume during operation, leading to potential disturbance of habitats. Unlikely to cause deterioration to water body status.	None required.
Other aquatic flora (e.g. macroalgae, angiosperms, sea grass, sea weed salt marsh)	Temporary smothering of habitats from deposition of suspended sediment concentrations from dredge plume during operation, leading to potential disturbance of habitats.	None possible for habitat loss as operation is required to return levels to previous navigable depths. However, leaving intervals between deposition of sandy material at disposal sites will minimise the build-up of materials on existing habitats. Disposed material will likely be the same as the in-situ material. Work is proposed only to occur at low tide. Dredge area is likely to be recolonised very rapidly, within 3-4 months, and represents less than 1% of the total area of available feeding habitat for birds and fish.
Benthic invertebrate fauna	Removal of substrate during operation could potentially lead to loss of species present within footprint. Unlikely to cause deterioration to water body status.	
Fish fauna	Fish can be disturbed by the noise during operation. The magnitude of the pressure will depend on the nature and scale/intensity of the activity, plus other factors such as location, species present and age, weather conditions, degree of habituation to disturbance source. The noise and turbidity arising from dredging operations may pose a barrier to species migration when occurring on or in proximity of specific migratory routes. This is unlikely, and any disturbance is unlikely to be sufficient to cause deterioration in water body status.	Works conducted outside migration period, materials disposed so as to be dispersed in natural littoral drift system as quickly as possible. Works conducted so as to ensure negligible losses to feeding habitats.
Hydromorphological elements supporting the biological elements		
Morphological conditions	Removal of substrate during operation will lead to temporary change in morphological conditions within the dredge area.	None specified. Use of good practice to prevent environmental deterioration. Sediment mobility is relatively high within the estuary so will undergo recovery over time. Dredge to be undertaken within

Quality Element	Impact for dredging operation	Proposed Mitigation
		specified footprint as part of the licence application.
Depth variation	Removal of substrate during operation will lead to temporary change in depth within the dredge area. This is not enough to cause deterioration in water body status.	None specified. Sediment mobility is relatively high within the estuary so will undergo recovery over time. Dredge to be undertaken within specified footprint as part of the licence application.
Quantity, structure and substrate of the bed	Sediment removal as part of operation alters the quantity, structure and sediment range on the seabed within the dredge footprint. Dredging may cause local deposition of sediment in the area surrounding the dredge site as well as eventual deposition of fines from the sediment plume. This is not enough to cause deterioration in water body status.	None specified.
Structure of the intertidal zone	Potential loss of fine sediment from sediment budget. Potential to impact on mud flats and marginal intertidal habitat due to sediment loss but insufficient to affect water body status.	None specified.
Tidal regime	No discernible change. The works are inside the harbour entrance and in the lee of Shell Island. Any change in tidal regime would be localised and temporary and not enough to cause deterioration to water body status.	None specified.
Freshwater flow	No change. Works unlikely to affect fresh water flow.	None specified.
Wave exposure	No discernible change. The works are inside the harbour entrance and in the lee of Shell Island. Any change in wave exposure is likely to be because of another reason and not dredging. Any change would be localised and temporary and not enough to cause deterioration to water body status.	None specified.
Chemical and physico-chemical elements supporting the biological elements		
Transparency	Dredging may cause local deposition of sediment in the area surrounding the dredge site as a result of a dredge plume. This is likely to be temporary and localised and unlikely to affect transparency.	None specified.
Thermal conditions	No change.	None specified.

Quality Element	Impact for dredging operation	Proposed Mitigation
Oxygenation conditions	No change.	None specified.
Salinity	No change.	None specified.
Nutrient conditions	No change.	None specified.
Specific pollutants	The primary chemicals of environmental concern in vessel oil and fuel are polycyclic aromatic hydrocarbons (PAHs). Organic based contaminants such as PAHs can be effectively 'locked into' the seabed sediments in ports and harbours. These stable compounds do not decompose readily; subsequent re-mobilisation (e.g. by dredging) can release these contaminants into the water column. The likelihood and severity of any impact depends upon the type and degree of sediment contamination and level of re-mobilisation of the sediment. There is unlikely to be a deterioration in water body status as a result of operation given the low levels of PAHs found in the sediment samples analysed.	None specified. Use of good practice to prevent environmental deterioration. Sediment samples were analysed as part of the marine licence application.
Pollution by all priority substances identified as being discharged into the body of water	These can be spilled into the sea through Synthetic compounds e.g. polychlorinated biphenyls (PCBs) can be effectively 'locked into' the seabed sediments in ports and harbours. These stable compounds do not decompose readily. Subsequent re-mobilisation of the sediments (e.g. by dredging) can release these contaminants into the water column. The likelihood and severity of any impact depends upon the type and degree of sediment contamination and level of re-mobilisation of the sediment. There is unlikely to be a deterioration in water body status as a result of operation.	None specified. Use of good practice to prevent environmental deterioration.
Pollution by other substances identified as being discharged in significant quantities into the body of water	There is unlikely to be a deterioration in water body status as a result of operation.	No mitigation required.

Table 4-2 describes potential impacts for disposal of dredging arisings.

Table 4-2: WFD Assessment for disposal of dredging arisings

Quality Element	Impact	Proposed Mitigation
Biological elements		
Phytoplankton	No change. Deposition on beach/within backshore environment. Therefore, there should be no change to water body status.	None specified.
Other aquatic flora (e.g. macroalgae, angiosperms, sea grass, sea weed salt marsh)	During disposal, there could be disturbance/burial of species/habitat. There could be disturbance to fauna during spoil relocation from fine sediments being released during tipping, and also from the location of spoil itself but this will be localised and temporary. Potential improvement to species as the beach and associated coastal zone develops and becomes increasingly vegetated.	None specified. Use of good practice to prevent environmental deterioration.
Benthic invertebrate fauna	Overall no change. There could be disturbance to fauna during spoil relocation from fine sediments being released during tipping, and also from the location of spoil itself but this will be localised and temporary.	None specified. Use of good practice to prevent environmental deterioration.
Fish fauna	No change. There could be disturbance to fish during spoil relocation, depending on location and proximity but this will be localised and temporary.	None specified. Use of good practice to prevent environmental deterioration.
Hydromorphological elements supporting the biological elements		
Morphological conditions	No change. Deposition of spoil on beach/backshore. Deposition of material will improve morphological conditions because there will be more sediment, which will undergo natural sediment processes. Overall there should be no change to water body.	None specified. Use of good practice to prevent environmental deterioration.
Depth variation	No change. Works to beach/backshore so no change to water body depth.	None specified.
Quantity, structure and substrate of the bed	Disposed material will likely be the same as the in-situ material. Deposition of material will improve morphological conditions as it will undergo natural sediment processes and therefore improve the quantity and structure of	None specified. Use of good practice to prevent environmental deterioration.

Quality Element	Impact	Proposed Mitigation
	the substrate. Overall there should be no change to water body.	
Structure of the intertidal zone	Deposition of material will improve morphological conditions as it will undergo natural sediment processes and therefore improve the quantity and structure of the substrate. Overall there should be no change to water body.	None specified. Use of good practice to prevent environmental deterioration.
Tidal regime	Unlikely to be any change.	None specified.
Freshwater flow	Unlikely to be any change.	None specified.
Wave exposure	Deposition of material will improve morphological conditions as more sediment will be available, and therefore the effect of exposure to waves will lessen as the beach/backshore will be less vulnerable to wave erosion and storm overtopping, should this occur. Overall there should be no change to water body.	None specified. Use of good practice to prevent environmental deterioration.
Chemical and physico-chemical elements supporting the biological elements		
Transparency	Unlikely to be any change.	None specified.
Thermal conditions	Unlikely to be any change.	None specified.
Oxygenation conditions	Unlikely to be any change.	None specified.
Salinity	Unlikely to be any change.	None specified.
Nutrient conditions	Unlikely to be any change.	None specified.
Specific pollutants	Unlikely to be any change.	None specified.
Pollution by all priority substances identified as being discharged into the body of water	Unlikely to be any change.	None specified.
Pollution by other substances identified as being discharged in significant quantities into the body of water	Unlikely to be any change.	None specified.

5. Conclusion

This Water Framework Directive assessment has looked at the specific pressures of the scheme on three WFD water bodies: Cardigan Bay, Tremadog Bay, and the Arthro Estuary.

The specific pressures have included hydromorphology, biology (including habitats and fish), water quality, protected areas and non-native invasive species. The closest sensitive habitats are in Cardigan Bay and within the Arthro Estuary. These comprise Polychaete Reefs and subtidal kelp beds offshore of where the disposal site is located. In the Arthro Estuary, the sensitive habitats comprise gravel and cobbles (intertidal and subtidal coarse sediments); intertidal soft sediments; subtidal soft sediments; rocky shore (intertidal rock); subtidal rocky reef. These habitats both in Cardigan Bay and in the Arthro Estuary are relatively prolific along this shoreline but considered to be at no risk from the implementation of the scheme. There are no risks to Bathing Waters or UWWTD.

Given that maintenance dredging has occurred previously, and the operation is limited to an already modified section of the estuary, the assessment illustrates that overall that the scheme supports the WFD requirements for no deterioration to a water body.

6. References

Defra (2014). Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/307788/river-basin-planning-standards.pdf Accessed on 17 December 2019.

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