

# Technical note

<b>Project:</b>	Newgale WelTAG Study	<b>To:</b>	Rob Morgan
<b>Subject:</b>	WelTAG Water Framework Directive Assessment	<b>From:</b>	Shelley Vince
<b>Date:</b>	10 Jan 2017	<b>cc:</b>	

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N.B. The text within this Technical Note will be inputted into a multi-discipline WelTAG assessment prior to issue to the client and will be subject to revision/review.

## 1. Introduction

This document provides a preliminary review of compliance with the Water Framework Directive (WFD) for four proposed shortlisted options for a new road layout near Newgale in Pembrokeshire. This review forms part of the WelTAG stage 1 appraisal which aims to resolve transportation issues arising from the intermittent failure of the coastal defences at Newgale. It is not possible at this stage to undertake a full Water Framework Directive Compliance Assessment as the options have currently only been developed to a strategy level. This report therefore provides a high level preliminary review of the potential impacts of each of the four shortlisted road options under consideration. The aims of the document are to:

- Provide background information on the proposed scheme and the WFD legislation;
- Provide a baseline understanding of the relevant waterbodies within the context of the WFD;
- Provide a high level assessment of the potential for each of the proposed road options to cause deterioration in the WFD status of any waterbody directly or indirectly affected by the scheme;
- Provide a high level assessment of the potential impacts on waterbody improvement measures and ability to meet WFD objectives.

## 2. The Project

### 2.1. Background

The A487 between Haverfordwest and St. David's is protected from the sea by a shingle embankment offering a very low standard of defence and is therefore vulnerable to flooding. Over the winter months the village of Newgale can become cut off by shingle being moved by storms and covering the road.

Following severe storm events in January and February 2014 where the road was closed due to flooding and obstruction several times, Pembrokeshire Country Council (PCC) commissioned a study which confirmed that the existing embankment provides a 1:1 level of protection over the next 10 years, and without significant works within 20 years, substantial bank failure may occur with increasing frequency, posing a threat not only to the safety and security of local residents but also to the transport infrastructure of the St David's peninsula. To address these issues, in 2015 PCC undertook a draft Welsh Transport Planning and Appraisal Guidance (WelTAG) Planning Stage Report to identify possible new road options.

The purpose of the current work is to build on the WelTAG Planning Stage Report by undertaking a WelTAG Stage 1 appraisal of the options identified in the WelTAG Planning Stage Report.

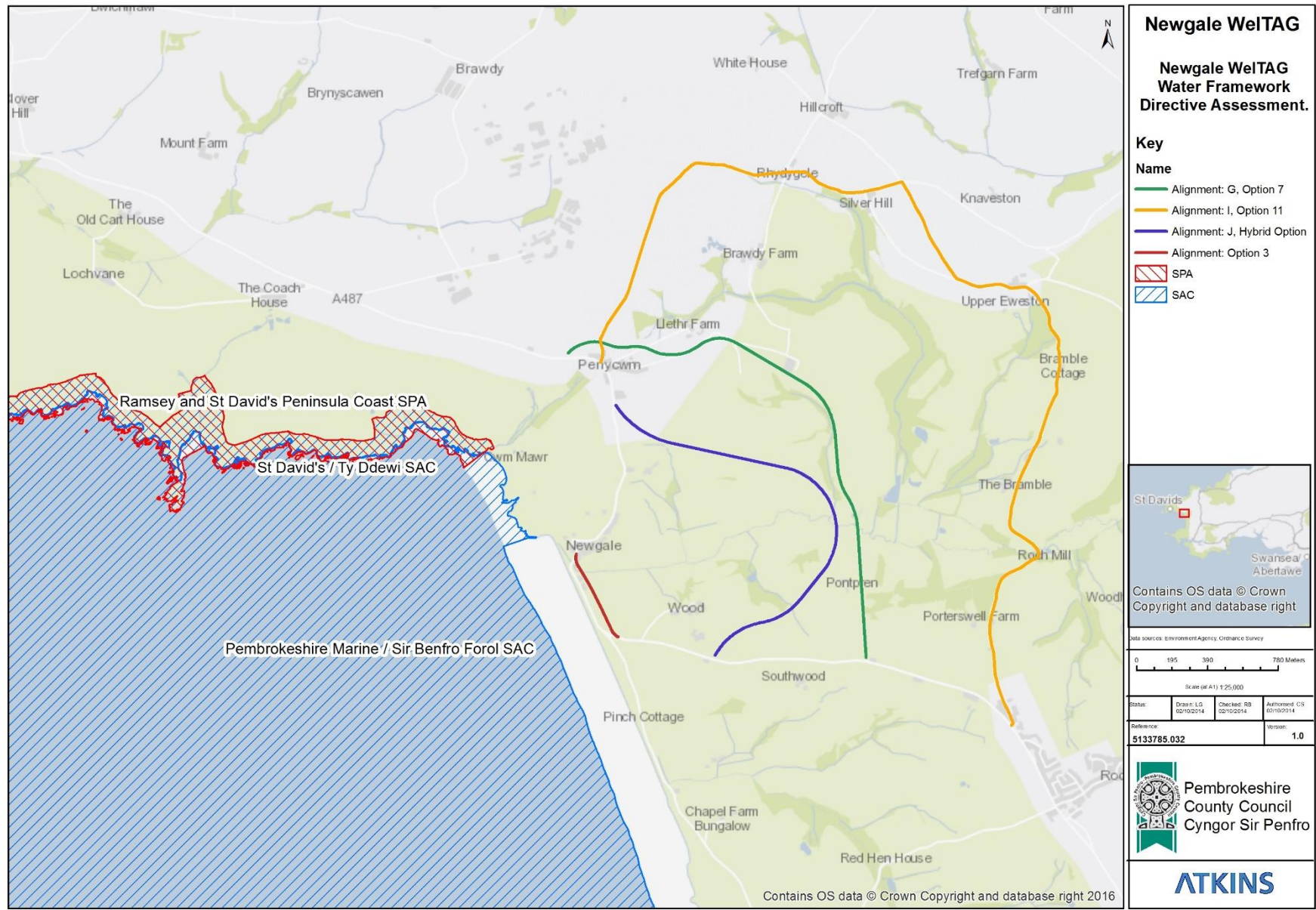
### 2.2. The Scheme Options

The PCC WelTAG Planning Stage Report identified ten options for further assessment. Following an initial Ecology and Landscape appraisal these ten options have been reduced to four. The following options have been retained for further assessment and are the subject of this preliminary WFD assessment:

- Option 3b - realigning the road behind two properties on a bridge or viaduct causeway. The new road would traverse over Brandy Brook as a viaduct as a culverted causeway would not be suitable because of the required height (elevation) of the road.
- Option 7 - New road and upgrade to existing road. Partially on existing road and track: 'Pen-y-Cwm – Llethr – (Site of) Brawdy Mill' – new road including crossing of Brandy Brook.
- Option 11 - upgrade the existing diversion route, adjusted to avoid the school and a narrow pinchpoint at that location. Option would require widening of existing road network.
- Option J - New road through existing brooks, hedgebanks, hedgerows and agricultural farmland.

These four road options are shown on Figure 2-1. There is currently limited information available about the methods that would be used to construct each of these options. This preliminary WFD assessment therefore covers a variety of possible construction options. A further more detailed WFD compliance assessment will be required once the preferred option has been identified and more detailed design work undertaken.

Figure 2-1 Newgale road options



## 2.3. Need for the scheme

The village of Newgale in Pembrokeshire is protected from the sea by a large shingle bank. The shingle bank has been overtopped on many occasions in the past, with shingle being washed over the crest onto the main A487 road, resulting in closure of the road and, under more severe conditions, extensive flooding of the low lying valley behind. There has been growing concern over the increasing vulnerability of the shingle ridge and the implications this has at both a strategic level, in terms of the transport network and the future viability of property within the area.

At present, the situation is being managed, as it has over at least the last 20 years, accepting that the shingle ridge will be overtopped on occasion and that when this occurs shingle is lost from the crest of the bank blocking the road. The Council responds to this overwash and failure of the bank by removing shingle from the road and hinterland and rebuilding the crest to a minimum crest height and width matching as near as possible, the original profile. This approach addresses the immediate problem but as the shingle bank is becoming increasingly unstable and vulnerable to failure due to sea level rise a long term more sustainable solution is being sought.

Pembrokeshire County Council identified a range of possible options through the WeITAG process which are now being taken forward for further appraisal to identify the preferred solution.

## 3. Water Framework Directive

### 3.1. Legislative background

The Water Framework Directive 2000<sup>1</sup> requires all natural water bodies to achieve both good chemical status (GCS) and good ecological status (GES). The River Basin Management Plans (RBMPs) outline the actions required to enable water bodies to achieve GES. Artificial water bodies (AWBs) and heavily modified water bodies (HMWBs) may be prevented from reaching GCS and GES due to the modifications necessary to maintain their function. They are, however, required to achieve good ecological potential (GEP) and good chemical potential (GEP), through implementation of a series of mitigation measures outlined in the applicable RBMP.

New activities and schemes within the water environment could adversely impact biological, hydromorphological, physico-chemical and/or chemical quality elements (WFD quality elements), leading to deterioration in waterbody status. They may also render proposed improvement measures ineffective, leading to the waterbody failing to meet its WFD objectives for GES/GEP. Under the WFD, activities must not cause deterioration in waterbody status or prevent a waterbody from meeting GES/GEP by invalidating improvement measures.

The overall ecological status of a waterbody is primarily based on consideration of its biological quality elements and determined by the lowest scoring of these. These biological elements are, however, in turn supported by the physio-chemical and hydromorphological quality elements. Assessment of hydromorphological quality is not explicitly required for a waterbody to achieve moderate ecological status or lower. However, to achieve the overall WFD aim of GES or higher, hydromorphological quality must be considered within the classification assessment.

In addition, to achieve the overall WFD aim of GES, a waterbody must pass a separate chemical status assessment, relating to pass/fail checks on the concentrations of various identified priority/dangerous substances.

A summary of key WFD concepts is set out in the box on the following page.

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<sup>1</sup> Water Framework Directive (Directive 2000/60/EC), implemented in England and Wales by the Water Environment (Water Framework Directive) Regulations (SI 3242/2003).

## WFD Objectives

The Water Framework Directive (WFD) is a European Directive which sets out a strategic planning process for the purpose of managing, protecting and improving the water environment. The main objectives of the WFD are to:

- 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 waters by 2015 (2021 or 2027) where fully justified within an extended deadline under Article 4.4;
- Promote sustainable use of water;
- 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
- Help reduce the effects of floods and droughts.

The Environment Agency is the Government's lead agency for implementing the WFD in England and already monitors, advises and manages many aspects of the water environment through regulating discharges, abstractions and processing environmental permits and licences. The Environment Agency is committed to implementing environmental improvements by reducing the physical impacts of construction activities (within artificial or heavily modified water bodies).

## WFD Classification

The WFD classification for a defined water body is produced by assessment of a wide variety of different 'elements' which includes:

- '*biological elements*' such as fish, invertebrates, phyto-benthos (which include plants, macro-algae, phytoplankton);
- '*supporting elements*' that include chemical measurements such as ammonia, dissolved oxygen, pH, phosphate, copper, zinc and temperature; and
- '*supporting conditions*' (sometimes referred to as hydromorphology) that assess the physical attributes of the water body such as 'quantity and dynamics of flow' and 'morphology'.

The assessment given for each element is also accompanied by a measure of certainty in the result. The status classification on Water Watch Wales provides a baseline condition against which compliance and future improvements can be measured.

## WFD Compliance

There are three key objectives against which the impacts of proposed works on a water body need to be assessed to determine compliance with the overarching objectives of the WFD:

- Objective 1: The scheme will not cause a deterioration in any element of water body classification.
- Objective 2: The scheme will not prevent the WFD status objectives from being reached within the water body or other downstream water bodies.
- Objective 3: The scheme will contribute to the delivery of the relevant WFD objectives.

The first two obligations must be met to avoid infringement of the WFD. The delivery of the third objective is central to the Environment Agency's implementation of the WFD, where it can be supported through its operational activities. If it is considered that the scheme is likely to cause deterioration in water body status or prevent a water body from meeting its ecological objectives then an assessment would be made against the conditions listed in Article 4.7 of the WFD. Article 4.7 can be invoked if; 'new modifications' are of overriding public interest and/or the environmental and social benefits of achieving the WFD objectives are outweighed by the benefits of the new modifications to human health, safety and sustainable development; there are no significantly better environmental options that are technically feasible or not disproportionately costly; and all practicable steps for mitigation have been taken.

*Continued overleaf.....*

## Artificial or Heavily Modified Water Bodies

These water bodies cannot achieve GES due to substantial modification, e.g. for flood risk management or navigation. Instead, they are required to reach GEP. The presence or absence of a set list of mitigation measures is used as a proxy for biological indicators. If all mitigation measures have been taken, the water body is assigned a preliminary tag of 'GEP or better'. Good chemical status is a prerequisite for GEP. 'Moderate or worse' is used if some mitigation measures are yet to be implemented. HMWBs may therefore have an element rated 'poor' but not be considered 'poor' in overall status.

## Hydromorphology

Hydromorphology is a term used in the WFD to describe the processes operating within, and the physical form of, a water body. The term encompasses both hydrological and geomorphological characteristics that, in combination, help support a healthy ecology. Hydromorphology is a supporting condition unless a water body is classified as being of 'high' ecological status. In these cases, hydromorphological elements contribute towards status classification.

## What is a water body? (in relation to this assessment)

The Environment Agency Guidance note 'Water bodies for the Water Framework Directive' (Environment Agency July 2012) explains that the Directive defines a surface water body as a "discrete and significant element" of surface water such as a lake or reservoir or entire (or part) stream, river or canal, estuary or stretch of coastal water (out to 1 mile). They were identified in England and Wales as part of the characterisation process. The guidance further explains that 'the objectives for a river water body apply to every bit of the watercourse within the river body catchment' not just the reported network as shown on the Environment Agencies 'What's in Your Backyard' system.

## 3.2. Purpose of the report and WFD assessment approach

This document provides a preliminary WFD assessment and comprises a summary overview, waterbody screening, preliminary high level quality element assessment, preliminary assessment on waterbody improvement measures and ability to meet WFD objectives. The assessment will take account of hydromorphology, aquatic ecology, water quality and groundwater.

# 4. Waterbody Screening

The proposed works fall within the Western Wales River Basin District within the Cleddau and Pembrokeshire Coastal Rivers Management Catchment.

### River water bodies

All four scheme options cross the Brandy Brook - headwaters to tidal limit river waterbody (GB110061031160) and have the potential to cause alterations that could impact this waterbody. This waterbody is screened in for further assessment.

### Groundwater bodies

The proposed works overlie groundwater body Cleddau and Pembrokeshire (GB41002G200400). The proposed road options overlie Coal Measures which contain sandstone strata, which are potential aquifers. Option 3b could require significant ground works such as excavation and piling to create the viaduct which could interact physically with ground water. It is possible that options 7 and J which include construction of a new road could require cutting into the ground for structural foundations which could interact with ground water. All four road options will cross Brandy Brook and will require the construction of a culvert or bridge. The foundations of this bridge/culvert may interact with groundwater. All four scheme options have been screened into further assessment for the Cleddau and Pembrokeshire waterbody.

### Transitional water bodies

There are no transitional waterbodies in the vicinity of the proposed scheme. All transitional waterbodies have been screened out.

### Coastal water bodies

Brandy Brook feeds into Pembrokeshire South coastal water body (GB611008590003). The operation of the chosen scheme will allow the coastal frontage at Newgale to migrate inland which could have impacts on this

waterbody. Pembrokeshire South water body has been screened in for further assessment for all scheme options.

## 5. Baseline waterbody information

The waterbodies screened into this assessment are detailed in Table 5-1 and the characteristics of these waterbodies are provided in Table 5-2.

**Table 5-1 WFD waterbodies screened into assessment**

Name	ID	Type
Brandy Brook - headwaters to tidal limit	GB110061031160	River
Pembrokeshire South	GB611008590003	Coastal
Cleddau and Pembrokeshire	GB41002G200400	Groundwater

Data sourced from Water Watch Wales website (<http://waterwatchwales.naturalresourceswales.gov.uk/en/>)

**Table 5-2 Waterbody Characteristics**

Characteristics	Brandy Brook 2015 Status	Pembrokeshire South 2015 Status	Cleddau and Pembrokeshire 2015 Status
Waterbody ID	GB110061031160	GB611008590003	GB41002G200400
Hydromorphological designation	Not designated	Not designated	n/a
Current overall waterbody status/potential	Moderate	Good	Poor
Ecological status/potential	Moderate	Good	n/a
Chemical status/potential	Good	Good	Poor
Quantitative status (for groundwaters)	n/a	n/a	Good
Reason for not achieving good status	Phosphate	none	Chemical dependent surface water body status
Future Status Objective	Good by 2021	Good by 2015	Good by 2021
Protected area designation	-	SAC, SPA, Bathing water	Drinking water protected area, SAC

Data sourced from Water Watch Wales, WFD data download

### 5.1. Catchment Pressures

The Cleddau and Pembrokeshire coastal rivers management catchment summary<sup>2</sup> identifies that the main challenges for not achieving good status in surface water in the catchment are:

- Mitigation measures assessment
- Physical modifications

<sup>2</sup> Cleddau and Pembrokeshire Coastal Rivers management Catchment Summary, Natural resources Wales, 2016

- Pollution from sewerage and waste water
- Pollution from rural areas
- Unknown (pending investigation)
- Other

NRW investigations suggest that Brandy Brook is likely to be failing to achieve good status due to discharges from waste water treatment works.

## 5.2. National Measures

The programme of measures to achieve Water Framework Directive outcomes in Wales by 2021, include a subset of National Measures<sup>3</sup>. National measures apply to the whole of Wales, or the United Kingdom. In general these set the legislative, policy or strategic approach. Those potentially relevant to the works are listed in Table 5-3 below.

**Table 5-3 National WFD measures relevant to this assessment**

Measure ID	Description
CYM10	Identify opportunities to improve the water environment through existing programmes of work and scheme designs for Flood Risk Management
CYM22	Promote the implementation of SuDS (sustainable drainage systems) in new and existing developments, in both urban and rural areas to gain environmental, water quality, social and flood risk benefits
WW0146	Implementation of SuDS (sustainable drainage systems) Code of Practice. Comply with published advice for operators on sustainable drainage systems

## 5.3. Relevant Local measures

The main programme of measures to achieve Water Framework Directive outcomes for 2021 include Local Measures. Local measures are specific to the river basin district or a part of it. (NRW, 2016). There are no measures specifically assigned to any of the waterbodies screened into this assessment. However, there is a measure required of water companies to investigate how they are contributing to not achieving good status and this is of relevance to the Brandy Brook water body (GB110061031160).

# 6. Preliminary Assessment

This section provides a preliminary assessment of whether the proposed works are compliant with the Water Framework Directive, based on three key tests:

- Test 1: the scheme will not cause a deterioration in any element of water body classification.
- Test 2: the scheme will not prevent the WFD status objectives from being reached within the water body or other downstream water bodies
- Test 3: The scheme will not prevent future improvements from being implemented.

These three tests have been applied to the three screened in water bodies for each of the scheme options under consideration. All of the scheme options will require long term modification to the environment and therefore impacts from both construction and the legacy of the scheme have been assessed.

The impacts from construction will be dependent on the construction practices employed to deliver the scheme. Impact pathways arising from construction methods will depend on a range of factors including the duration of the works, methods of working, requirement for in-river working, and the timing of works. This assessment assumes that significant risks associated with construction will be fully mitigated by suitable control of construction practices such as adherence to the Environment Agency Pollution Prevention

<sup>3</sup> NRW, 2016. Water Watch Wales. [online] Available at: [waterwatchwales.naturalresourceswales.gov.uk/en/](http://waterwatchwales.naturalresourceswales.gov.uk/en/)

Guidance Notes that, although withdrawn from official use as guidance, still represent good practice and contain some of the most useful pollution prevention guidelines available.

The impacts from the legacy of the scheme will be dependent on the design chosen for key elements such as the crossing of Brandy Brook and the engineering of the bridge/viaduct. The detail of this infrastructure has not yet been determined. Impact pathways arising from the legacy of the scheme will depend on factors including the location and scale of modifications to the environment. This assessment assumes that significant risks associated with the legacy of the scheme will be mitigated by adherence to relevant standards including the Highways Standards, which require that drainage systems provide a degree of control over the risk of pollution of the receiving watercourse or flooding elsewhere in the catchment. HD45/09 (Design Manual for Roads and Bridges (DMRB)) requires that discharges from roads must not lead to a deterioration in the classification status of the receiving waters under the Water Framework Directive (WFD) 2000/60/EC. HD 45/09 also requires that roads remain safe and operational in times of flood, result in no net loss of floodplain storage, do not impede water flows or increase flood risk elsewhere. Systems for the control of flooding or pollution are detailed in HA 33/06 (DMRB):

- Spillage control: Oil Separators, Lined Ditches, Penstocks, Baffles, Kerbs and Gullies, Surface Water Channels, Filter Drains;
- Other pollution control: Filter Drains, Unlined Ditches, Oil Separators, Sediment Traps;
- Flow control: Filter Drains, Carrier drains (oversize), Ditches, Combined Kerb and Drainage, Permeable Pavements;
- Vegetated systems: Ponds, Infiltration basins, Wetlands, Grassed channels, Swales, oil interceptors or pollution traps to be incorporated at high risk areas such as the roundabouts.

## 6.1. Test 1 – Deterioration of elements

The results of Test 1, assessment of the likelihood of deterioration of elements, is provided in Table 6-1 for Brandy Brook river waterbody, Table 6-2 for Pembrokeshire South coastal waterbody and Table 6-3 for Cleddau and Pembrokeshire ground waterbody.

The preliminary assessment of Test 1 (deterioration of elements) indicates that all of the scheme options could potentially cause deterioration of the hydromorphological elements of the Brandy Brook waterbody due to works to cross the river. A precautionary assessment of 'potential impacts anticipated' has been given due to the lack of information that is currently available about the construction methodology. Once the preferred option is identified and more detail is known about the design of the scheme, this assessment should be revisited.

The assessment also indicates that all of the scheme options could cause deterioration in the hydromorphological and biological elements of the South Pembrokeshire coastal waterbody in the long term once the shingle bank fails due to sea level rise. A precautionary assessment of 'potential impacts anticipated' has been provided due to the lack of information about how this process will occur and whether the sea will be allowed to inundate the coast naturally or whether any hard structure would be put in place to protect certain assets. Once the preferred option has been identified and more detail is known about the design of the scheme and the future evolution of the coast, this assessment should be revisited.

The assessment indicates that all of the scheme options could cause deterioration to the Cleddau and Pembrokeshire groundwater body. This assessment assumes that each of these options may require significant cutting or piling into the ground which could impact the ground water body. The construction methodologies for each of these options are not yet known so potential impacts have been anticipated on a precautionary basis. This assessment should be revisited once further information about the construction methodologies is known.

**Table 6-1      Test 1 – Potential for deterioration in elements of Brandy Brook river waterbody**

	Scheme Option			
WFD quality elements	Option 3b - realigning the road on a bridge or viaduct causeway.	Option 7 - New road and upgrade to existing road	Option 11 - upgrade the existing diversion route	Option J - New road
<b>Hydromorphological elements</b> <ul style="list-style-type: none"> <li>Hydrological regime</li> <li>Morphological conditions</li> <li>River continuity</li> <li>Tidal regime</li> </ul>	<p><i>Potential impact anticipated</i></p> <p>Depending on the bridge structure chosen to cross the river, it is possible that there may be changes in morphological conditions and freshwater flow. The significance of these will need to be determined once further information about the design of the scheme is known.</p> <p>Tidal regime is not applicable.</p>	<p><i>Potential impact anticipated</i></p> <p>Depending on the structure chosen to cross the river, it is possible that there may be changes in morphological conditions and freshwater flow. The significance of these will need to be determined once further information about the design of the scheme is known.</p> <p>Tidal regime is not applicable.</p>	<p><i>Potential impact anticipated</i></p> <p>Depending on the structure chosen to cross the river, it is possible that there may be changes in morphological conditions and freshwater flow. The significance of these will need to be determined once further information about the design of the scheme is known.</p> <p>Tidal regime is not applicable.</p>	<p><i>Potential impact anticipated</i></p> <p>Depending on the structure chosen to cross the river, it is possible that there may be changes in morphological conditions and freshwater flow. The significance of these will need to be determined once further information about the design of the scheme is known.</p> <p>Tidal regime is not applicable.</p>
<b>Biological elements</b> <ul style="list-style-type: none"> <li>Phytoplankton</li> <li>Macrophytes and phytobenthos</li> <li>Aquatic flora</li> <li>Benthic invertebrates</li> </ul>	<p><i>No impact anticipated</i></p> <p>The potential for sediment mobilisation through bridge construction could cause degradation of phytoplankton by affecting species composition. This could also lead to phytoplankton blooms. Sediment plumes could also result in reduced light attenuation in the water column, and a degradation of this element through reduced</p>	<p><i>No impact anticipated</i></p> <p>The potential for sediment mobilisation through bridge/culvert construction could cause degradation of phytoplankton by affecting species composition. This could also lead to phytoplankton blooms. Sediment plumes could also result in reduced light attenuation in the water column, and a degradation of this element through reduced</p>	<p><i>No impact anticipated</i></p> <p>The potential for sediment mobilisation through bridge/culvert construction could cause degradation of phytoplankton by affecting species composition. This could also lead to phytoplankton blooms. Sediment plumes could also result in reduced light attenuation in the water column, and a degradation of this element through reduced</p>	<p><i>No impact anticipated</i></p> <p>The potential for sediment mobilisation through bridge/culvert construction could cause degradation of phytoplankton by affecting species composition. This could also lead to phytoplankton blooms. Sediment plumes could also result in reduced light attenuation in the water column, and a degradation of this element through reduced</p>

	<p>abundance and altered composition.</p> <p>The potential for sediment mobilisation through bridge construction could cause degradation of macroalgae by affecting species composition. Sediment plumes could also result in reduced light attenuation, and may smother the sub-littoral macroalgae community, resulting in a degradation of this element.</p> <p>Any negative impacts on phytoplankton and macroalgae could disrupt food-chain dynamics, and have knock on effects for benthic macroinvertebrates. Sediment and pollutant mobilisation also has the potential to clog gill filaments and impact on benthic invertebrate community composition and abundance. Water quality generally may be adversely affected by pollution caused by spills or leakages, imported materials or waste generated as a result of the construction activities, with knock-on impacts for all biological quality elements.</p> <p>Providing that suitable measures are implemented to control construction methods, all of the above impact pathways should be</p>	<p>abundance and altered composition.</p> <p>The potential for sediment mobilisation through bridge/culvert construction could cause degradation of macroalgae by affecting species composition. Sediment plumes could also result in reduced light attenuation, and may smother the sub-littoral macroalgae community, resulting in a degradation of this element.</p> <p>Any negative impacts on phytoplankton and macroalgae could disrupt food-chain dynamics, and have knock on effects for benthic macroinvertebrates. Sediment and pollutant mobilisation also has the potential to clog gill filaments and impact on benthic invertebrate community composition and abundance. Water quality generally may be adversely affected by pollution caused by spills or leakages, imported materials or waste generated as a result of the construction activities, with knock-on impacts for all biological quality elements.</p> <p>Providing that suitable measures are implemented to control construction methods,</p>	<p>abundance and altered composition.</p> <p>The potential for sediment mobilisation through bridge/culvert construction could cause degradation of macroalgae by affecting species composition. Sediment plumes could also result in reduced light attenuation, and may smother the sub-littoral macroalgae community, resulting in a degradation of this element.</p> <p>Any negative impacts on phytoplankton and macroalgae could disrupt food-chain dynamics, and have knock on effects for benthic macroinvertebrates. Sediment and pollutant mobilisation also has the potential to clog gill filaments and impact on benthic invertebrate community composition and abundance. Water quality generally may be adversely affected by pollution caused by spills or leakages, imported materials or waste generated as a result of the construction activities, with knock-on impacts for all biological quality elements.</p> <p>Providing that suitable measures are implemented to control construction methods,</p>	<p>abundance and altered composition.</p> <p>The potential for sediment mobilisation through bridge/culvert construction could cause degradation of macroalgae by affecting species composition. Sediment plumes could also result in reduced light attenuation, and may smother the sub-littoral macroalgae community, resulting in a degradation of this element.</p> <p>Any negative impacts on phytoplankton and macroalgae could disrupt food-chain dynamics, and have knock on effects for benthic macroinvertebrates. Sediment and pollutant mobilisation also has the potential to clog gill filaments and impact on benthic invertebrate community composition and abundance. Water quality generally may be adversely affected by pollution caused by spills or leakages, imported materials or waste generated as a result of the construction activities, with knock-on impacts for all biological quality elements.</p> <p>Providing that suitable measures are implemented to control construction methods,</p>
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	<p>manageable, with no significant impacts for biological quality elements.</p> <p>It is understood that over time as sea level rises and moves landwards the environment would be allowed to evolve naturally and it is therefore anticipated that there would not be any long term impacts on biological elements of the waterbody. If it is intended to install any hard engineering structures along this watercourse, this assessment will need to be revisited.</p>	<p>all of the above impact pathways should be manageable, with no significant impacts for biological quality elements.</p> <p>It is understood that over time as sea level rises and moves landwards the environment would be allowed to evolve naturally and it is therefore anticipated that there would not be any long term impacts on biological elements of the waterbody. If it is intended to install any hard engineering structures along this watercourse, this assessment will need to be revisited.</p>	<p>all of the above impact pathways should be manageable, with no significant impacts for biological quality elements.</p> <p>It is understood that over time as sea level rises and moves landwards the environment would be allowed to evolve naturally and it is therefore anticipated that there would not be any long term impacts on biological elements of the waterbody. If it is intended to install any hard engineering structures along this watercourse, this assessment will need to be revisited.</p>	<p>all of the above impact pathways should be manageable, with no significant impacts for biological quality elements.</p> <p>It is understood that over time as sea level rises and moves landwards the environment would be allowed to evolve naturally and it is therefore anticipated that there would not be any long term impacts on biological elements of the waterbody. If it is intended to install any hard engineering structures along this watercourse, this assessment will need to be revisited.</p>
<p><b>Critical sensitive habitats/species</b></p> <ul style="list-style-type: none"> <li>Protected sites</li> <li>Priority habitats and species</li> </ul>	<p>Brandy Brook waterbody is not within any critical/sensitive habitats or species.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Brandy Brook waterbody is not within any critical/sensitive habitats or species.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Brandy Brook waterbody is not within any critical/sensitive habitats or species.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Brandy Brook waterbody is not within any critical/sensitive habitats or species.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>
<p><b>Physico-chemical elements</b></p> <ul style="list-style-type: none"> <li>Salinity</li> <li>Nutrient concentrations</li> <li>Oxygen balance</li> <li>Temperature</li> <li>Transparency</li> </ul>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of substrate (and potentially organic pollutants) associated with the construction of a bridge, this is likely to be</p>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of substrate (and potentially organic pollutants) associated with the construction of a bridge or culvert, this is likely</p>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of substrate (and potentially organic pollutants) associated with the construction of a bridge or culvert, this is likely</p>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of substrate (and potentially organic pollutants) associated with the construction of a bridge or culvert, this is likely</p>

<ul style="list-style-type: none"><li>• Pollution by all priority substances identified as being discharged into the water body</li><li>• Pollution by other substances identified as being discharged in significant quantities into the water body</li></ul>	negligible with appropriate control of construction measures.	to be negligible with appropriate control of construction measures.	to be negligible with appropriate control of construction measures.	to be negligible with appropriate control of construction measures.
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**Table 6-2 Test 1 – Potential for deterioration in elements of Pembrokeshire South coastal waterbody**

	Scheme Option			
WFD quality elements	Option 3b - realigning the road on a bridge or viaduct causeway.	Option 7 - New road and upgrade to existing road	Option 11 - upgrade the existing diversion route	Option J - New road
<b>Hydromorphological elements</b> <ul style="list-style-type: none"> <li>Hydrological regime</li> <li>Morphological conditions</li> <li>River continuity</li> <li>Tidal regime</li> </ul>	<p><i>Potential impact anticipated</i></p> <p>There will be no construction works undertaken in this waterbody and as such there are no impacts to hydromorphological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will cause the sea to move landward and could have impacts on the hydrological regime and tidal regime. At this stage it is not possible to identify the extent of these issues and whether they would cause a significant impact to the hydromorphological elements of the waterbody. Further assessment is required.</p>	<p><i>Potential impact anticipated</i></p> <p>There will be no construction works undertaken in this waterbody and as such there are no impacts to hydromorphological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will cause the sea to move landward and could have impacts on the hydrological regime and tidal regime. At this stage it is not possible to identify the extent of these issues and whether they would cause a significant impact to the hydromorphological elements of the waterbody. Further assessment is required.</p>	<p><i>Potential impact anticipated</i></p> <p>There will be no construction works undertaken in this waterbody and as such there are no impacts to hydromorphological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will cause the sea to move landward and could have impacts on the hydrological regime and tidal regime. At this stage it is not possible to identify the extent of these issues and whether they would cause a significant impact to the hydromorphological elements of the waterbody. Further assessment is required.</p>	<p><i>Potential impact anticipated</i></p> <p>There will be no construction works undertaken in this waterbody and as such there are no impacts to hydromorphological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will cause the sea to move landward and could have impacts on the hydrological regime and tidal regime. At this stage it is not possible to identify the extent of these issues and whether they would cause a significant impact to the hydromorphological elements of the waterbody. Further assessment is required.</p>
<b>Biological elements</b> <ul style="list-style-type: none"> <li>Phytoplankton</li> <li>Macrophytes and phytobenthos</li> <li>Aquatic flora</li> <li>Benthic invertebrates</li> </ul>	<p><i>Potential impact anticipated</i></p> <p>There will be no road construction works undertaken in this waterbody. Any impacts from sediment disturbance or pollutants from the works near, in</p>	<p><i>Potential impact anticipated</i></p> <p>There will be no road construction works undertaken in this waterbody. Any impacts from sediment disturbance or pollutants from the works near,</p>	<p><i>Potential impact anticipated</i></p> <p>There will be no road construction works undertaken in this waterbody. Any impacts from sediment disturbance or pollutants from the works near,</p>	<p><i>Potential impact anticipated</i></p> <p>There will be no road construction works undertaken in this waterbody. Any impacts from sediment disturbance or pollutants from the works near,</p>

	<p>or over Brandy Brook that could have knock on implications for biological elements are anticipated to be negligible by the time that they reach the Pembrokeshire South waterbody. As such there are no impacts to biological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and will result in the natural succession of species as the environment becomes more saline. If this process is allowed to happen unrestricted there should be negligible impacts on biological elements; however if hard structures are put in place to prevent the natural movement of water and succession of species there may be impacts to the biological elements of the waterbody. This requires further assessment once further detail about the preferred option are known.</p>	<p>in or over Brandy Brook that could have knock on implications for biological elements are anticipated to be negligible by the time that they reach the Pembrokeshire South waterbody. As such there are no impacts to biological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and will result in the natural succession of species as the environment becomes more saline. If this process is allowed to happen unrestricted there should be negligible impacts on biological elements; however if hard structures are put in place to prevent the natural movement of water and succession of species there may be impacts to the biological elements of the waterbody. This requires further assessment once further detail about the preferred option are known.</p>	<p>in or over Brandy Brook that could have knock on implications for biological elements are anticipated to be negligible by the time that they reach the Pembrokeshire South waterbody. As such there are no impacts to biological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and will result in the natural succession of species as the environment becomes more saline. If this process is allowed to happen unrestricted there should be negligible impacts on biological elements; however if hard structures are put in place to prevent the natural movement of water and succession of species there may be impacts to the biological elements of the waterbody. This requires further assessment once further detail about the preferred option are known.</p>	<p>in or over Brandy Brook that could have knock on implications for biological elements are anticipated to be negligible by the time that they reach the Pembrokeshire South waterbody. As such there are no impacts to biological elements anticipated from the construction works.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and will result in the natural succession of species as the environment becomes more saline. If this process is allowed to happen unrestricted there should be negligible impacts on biological elements; however if hard structures are put in place to prevent the natural movement of water and succession of species there may be impacts to the biological elements of the waterbody. This requires further assessment once further detail about the preferred option are known.</p>
<p><b>Critical sensitive habitats/species</b></p> <ul style="list-style-type: none"> <li>Protected sites</li> <li>Priority habitats and species</li> </ul>	<p>The proposed works are not within any protected sites, however the coastline adjacent to the works which is within the Pembrokeshire South waterbody is designated as Pembrokeshire</p>	<p>The proposed works are not within any protected sites, however the coastline adjacent to the works which is within the Pembrokeshire South waterbody is designated as Pembrokeshire Marine SAC.</p>	<p>The proposed works are not within any protected sites, however the coastline adjacent to the works which is within the Pembrokeshire South waterbody is designated as Pembrokeshire Marine SAC.</p>	<p>The proposed works are not within any protected sites, however the coastline adjacent to the works which is within the Pembrokeshire South waterbody is designated as Pembrokeshire Marine SAC.</p>

	<p>Marine SAC. Newgale beach is also a designated bathing water.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Newgale beach is also a designated bathing water.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Newgale beach is also a designated bathing water.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Newgale beach is also a designated bathing water.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>
<p><b>Physico-chemical elements</b></p> <ul style="list-style-type: none"> <li>Salinity</li> <li>Nutrient concentrations</li> <li>Oxygen balance</li> <li>Temperature</li> <li>Transparency</li> <li>Pollution by all priority substances identified as being discharged into the water body</li> <li>Pollution by other substances identified as being discharged in significant quantities into the water body</li> </ul>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of silt or pollutants down river from the works near, in or over Brandy Brook, however this is likely to be negligible with appropriate control of construction measures.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and could encounter land with potentially high nutrient concentrations or pollutants. Any impacts on physiochemical elements due to sea level rise are is likely to be negligible in the context of wider physicochemical conditions.</p>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of silt or pollutants down river from the works near, in or over Brandy Brook, however this is likely to be negligible with appropriate control of construction measures.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and could encounter land with potentially high nutrient concentrations or pollutants. Any impacts on physiochemical elements due to sea level rise are is likely to be negligible in the context of wider physicochemical conditions.</p>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of silt or pollutants down river from the works near, in or over Brandy Brook, however this is likely to be negligible with appropriate control of construction measures.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and could encounter land with potentially high nutrient concentrations or pollutants. Any impacts on physiochemical elements due to sea level rise are is likely to be negligible in the context of wider physicochemical conditions.</p>	<p><i>No impact anticipated</i></p> <p>There may be temporary impacts from the mobilisation of silt or pollutants down river from the works near, in or over Brandy Brook, however this is likely to be negligible with appropriate control of construction measures.</p> <p>In the long term the construction of the scheme will allow the existing shingle bank at Newgale to fail due to sea level rise. This will allow the sea to move landward and could encounter land with potentially high nutrient concentrations or pollutants. Any impacts on physiochemical elements due to sea level rise are is likely to be negligible in the context of wider physicochemical conditions.</p>

**Table 6-3      Test 1 – Potential for deterioration in elements of Cleddau and Pembrokeshire ground waterbody**

	Scheme Option			
WFD quality elements	Option 3b - realigning the road on a bridge or viaduct causeway.	Option 7 - New road and upgrade to existing road	Option 11 - upgrade the existing diversion route	Option J - New road
<b>Quantitative elements</b>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater in the Coal Measures for instance through piling or cutting below the water table.</p> <p>Further assessment is required once more detail is known about the scheme. If works could impact the water table, the impact on the groundwater body, and flows within any linked surface water features, should be considered further, within a detailed assessment. If works into the water table are not required it is anticipated that impacts to the groundwater body would be negligible.</p>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater in the Coal Measures for instance through piling or cutting below the water table.</p> <p>Further assessment is required once more detail is known about the scheme. If works could impact the water table, the impact on the groundwater body, and flows within any linked surface water features, should be considered further, within a detailed assessment. If works into the water table are not required it is anticipated that impacts to the groundwater body would be negligible.</p>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater in the Coal Measures for instance through piling or cutting below the water table.</p> <p>Further assessment is required once more detail is known about the scheme. If works could impact the water table, the impact on the groundwater body, and flows within any linked surface water features, should be considered further, within a detailed assessment. If works into the water table are not required it is anticipated that impacts to the groundwater body would be negligible.</p>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater in the Coal Measures for instance through piling or cutting below the water table.</p> <p>Further assessment is required once more detail is known about the scheme. If works could impact the water table, the impact on the groundwater body, and flows within any linked surface water features, should be considered further, within a detailed assessment. If works into the water table are not required it is anticipated that impacts to the groundwater body would be negligible.</p>
<b>Chemical elements</b>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater and is therefore a potential source of pollution to groundwater.</p>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater and is therefore a potential source of pollution to groundwater.</p>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater and is therefore a potential source of pollution to groundwater.</p>	<p><i>Potential impact anticipated</i></p> <p>The scheme has potential to interact physically with groundwater and is therefore a potential source of pollution to groundwater.</p>

	It is anticipated that the water quality of drainage from surface water and groundwater would be fully considered when designing the scheme.	It is anticipated that the water quality of drainage from surface water and groundwater would be fully considered when designing the scheme.	It is anticipated that the water quality of drainage from surface water and groundwater would be fully considered when designing the scheme.	It is anticipated that the water quality of drainage from surface water and groundwater would be fully considered when designing the scheme.
<b>Critical sensitive habitats/species</b> <ul style="list-style-type: none"> <li>Protected sites</li> <li>Priority habitats and species</li> </ul>	<p>Cleddau and Pembrokeshire ground waterbody is within a drinking water protected area and SAC.</p> <p>Impacts to the drinking water protected area will require further assessment once more is known about the scheme.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Cleddau and Pembrokeshire ground waterbody is within a drinking water protected area and SAC.</p> <p>Impacts to the drinking water protected area will require further assessment once more is known about the scheme.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Cleddau and Pembrokeshire ground waterbody is within a drinking water protected area and SAC.</p> <p>Impacts to the drinking water protected area will require further assessment once more is known about the scheme.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>	<p>Cleddau and Pembrokeshire ground waterbody is within a drinking water protected area and SAC.</p> <p>Impacts to the drinking water protected area will require further assessment once more is known about the scheme.</p> <p>A high level Habitats Regulations review has been undertaken of the scheme options which has concluded that a Habitats Regulations Assessment would be required if this scheme option were to be taken forward.</p>

## **6.2. Test 2 – Status Objectives**

Brandy Brook is currently at moderate status and is not achieving good status due to phosphate. The NRW catchment management plan identifies that the waterbody is likely to be failing to achieve good status due to discharges from waste water treatment works and requires water companies to investigate how they are contributing to not achieving good status. The proposed road realignment works are not anticipated to contribute to levels of phosphate in the waterbody but the long term impact of increased flooding and sea level rise could impact phosphate levels if this is contained within the soils that are inundated. The impact of the scheme on the elements identified through Test 1 as 'potential impact anticipated' require further assessment before it can be determined if the project will prevent the waterbody from achieving good status by 2021.

Pembrokeshire South coastal waterbody is currently at good status and therefore has no drivers required to achieve the objective for the waterbody. The objective for this waterbody is therefore simply to maintain good ecological status. The impact of the scheme on the elements identified through Test 1 as 'potential impact anticipated' require further assessment before it can be determined if the project will prevent the waterbody from retaining 'good' status.

Cleddau and Pembrokeshire groundwater body is currently at poor status. The impact of the scheme on the elements identified through Test 1 as 'potential impact anticipated' require further assessment before it can be determined if the project will prevent the waterbody from achieving good status by 2021.

## **6.3. Test 3 – Future Improvements**

There are no anticipated impacts from the proposed scheme on future improvement measures.

## **6.4. Conclusion**

Based on the limited information that is currently available about the various scheme options, the potential for deterioration of several elements has been identified in all three waterbodies. This assessment is however conservative due to the lack of information that is currently available. A more detailed WFD compliance assessment should be undertaken once the preferred option has been identified and the design and methodologies for the construction work defined, to determine if the scheme will cause deterioration in any elements or prevent achievement of good status.