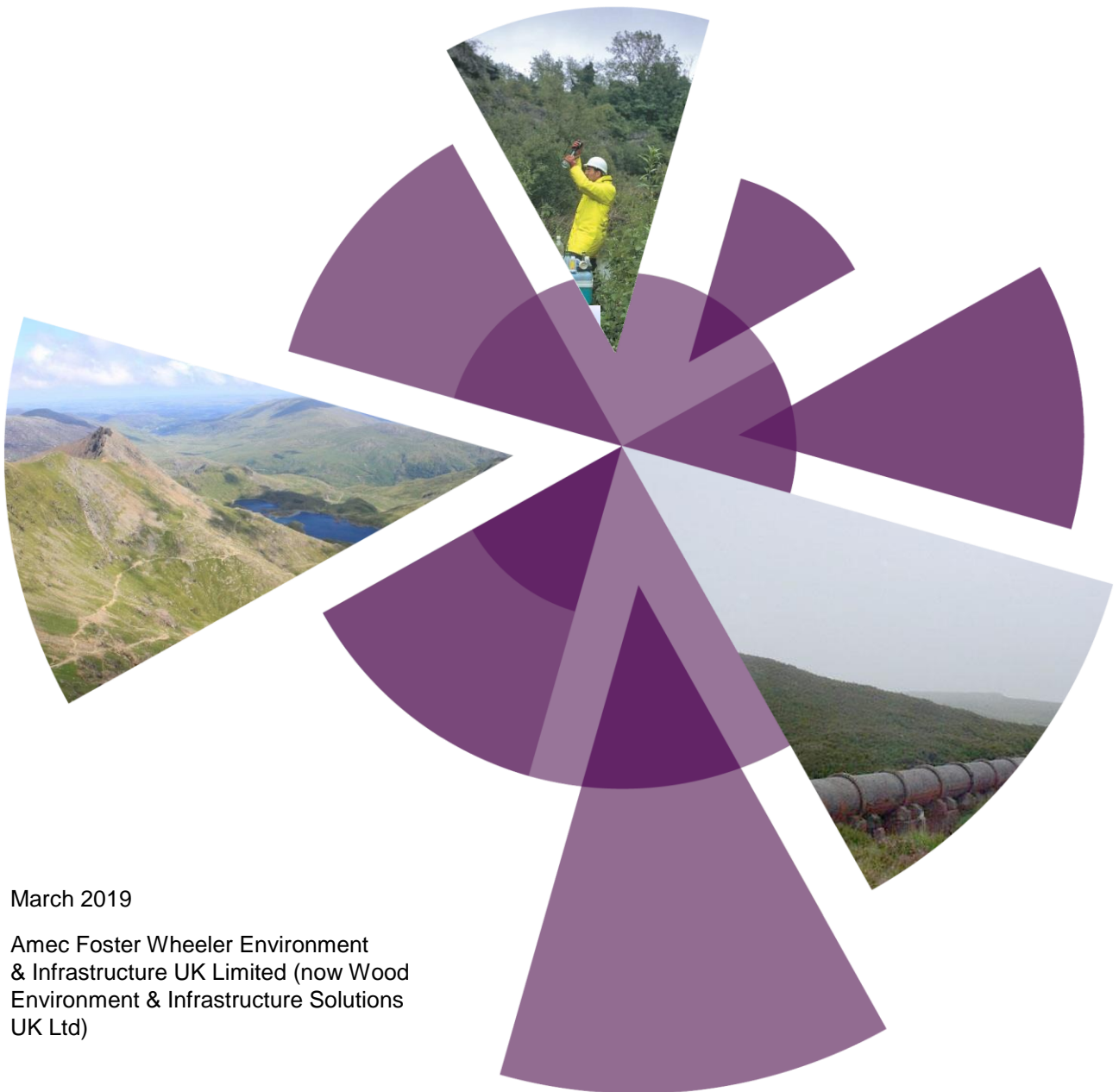


Dŵr Cymru Welsh Water

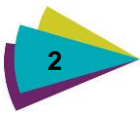
Strategic Environmental Assessment of the Final Water Resources Management Plan 2019

Final Environmental Report



March 2019

Amec Foster Wheeler Environment
& Infrastructure UK Limited (now Wood
Environment & Infrastructure Solutions
UK Ltd)



Report for

Water Services
Dŵr Cymru Welsh Water
Ty Awen
Spoooner Close
Celtic Springs Business Park
Newport
NP10 8FZ

Main contributors

Emma Beagley
Ana Braid
Pete Davis
Katharine Mason
Alex Melling
Sean Nicholson

Issued by

.....
Alex Melling

Approved by

.....
Pete Davis

Amec Foster Wheeler (now Wood)

Gables House
Kenilworth Road
Leamington Spa
Warwickshire CV32 6JX
United Kingdom
Tel +44 (0) 1926 439 000

Doc Ref. 39086R110i1

h:\projects\39086 dcww wrmp19 options assessment\3.
delivery\stage 5 options assessment\sea hra and wfd + env
valuation\environmental report\revised final environmental
report 29.03.19\dcww wrmp sea environmental report
(final)_issued.docx

Copyright and non-disclosure notice

The contents and layout of this report are subject to copyright owned by Amec Foster Wheeler (© Amec Foster Wheeler Environment & Infrastructure UK Limited 2018) save to the extent that copyright has been legally assigned by us to another party or is used by Amec Foster Wheeler under licence. To the extent that we own the copyright in this report, it may not be copied or used without our prior written agreement for any purpose other than the purpose indicated in this report. The methodology (if any) contained in this report is provided to you in confidence and must not be disclosed or copied to third parties without the prior written agreement of Amec Foster Wheeler. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests. Any third party who obtains access to this report by any means will, in any event, be subject to the Third Party Disclaimer set out below.

Third-party disclaimer

Any disclosure of this report to a third party is subject to this disclaimer. The report was prepared by Amec Foster Wheeler at the instruction of, and for use by, our client named on the front of the report. It does not in any way constitute advice to any third party who is able to access it by any means. Amec Foster Wheeler excludes to the fullest extent lawfully permitted all liability whatsoever for any loss or damage howsoever arising from reliance on the contents of this report. We do not however exclude our liability (if any) for personal injury or death resulting from our negligence, for fraud or any other matter in relation to which we cannot legally exclude liability.

Management systems

This document has been produced by Amec Foster Wheeler Environment & Infrastructure UK Limited in full compliance with the management systems, which have been certified to ISO 9001, ISO 14001 and OHSAS 18001 by LRQA.

Document revisions

No.	Details	Date
1	Draft Environmental Report	09.12.17
2	Final Environmental Report	15.12.17
3	Revised Environmental Report	12.09.18
4	Final Environmental Report	29.03.19

Non-Technical Summary

Introduction

Dŵr Cymru Welsh Water (Welsh Water) has published its Final Water Resources Management Plan 2019 (Final WRMP). The Final WRMP demonstrates how Welsh Water will balance the supply of water available and the demand for water from its customers over the period 2020 to 2050. The Draft WRMP was published on 16th March 2018 for a 12 week public consultation. Representations on the Draft WRMP were received from a total of 11 consultees and a Statement of Response was published on 14th September 2018. Following a review of the Statement of Response to the consultation and the changes made in a Revised Draft WRMP, on the 8th March 2019 Welsh Government gave Welsh Water direction to publish its Final WRMP.

This Non-Technical Summary (NTS) provides an overview of the Final Environmental Report produced as part of the Strategic Environmental Assessment (SEA) of the WRMP. The SEA is being carried out on behalf of Welsh Water by Wood Environment & Infrastructure Solutions Limited (Wood), formerly Amec Foster Wheeler Environment and Infrastructure UK Ltd to assess the likely significant economic, social and environmental effects of the WRMP and to identify ways in which adverse effects can be avoided, minimised or mitigated and how any positive effects can be enhanced.

The following sections of this NTS:

- ▶ provide an overview of the WRMP;
- ▶ describe the SEA process together with how it is being applied to WRMP19;
- ▶ describe the approach to undertaking the SEA of the WRMP;
- ▶ summarise the findings of the SEA of the WRMP; and
- ▶ set out the next steps in the SEA of WRMP19.

What is the Water Resources Management Plan?

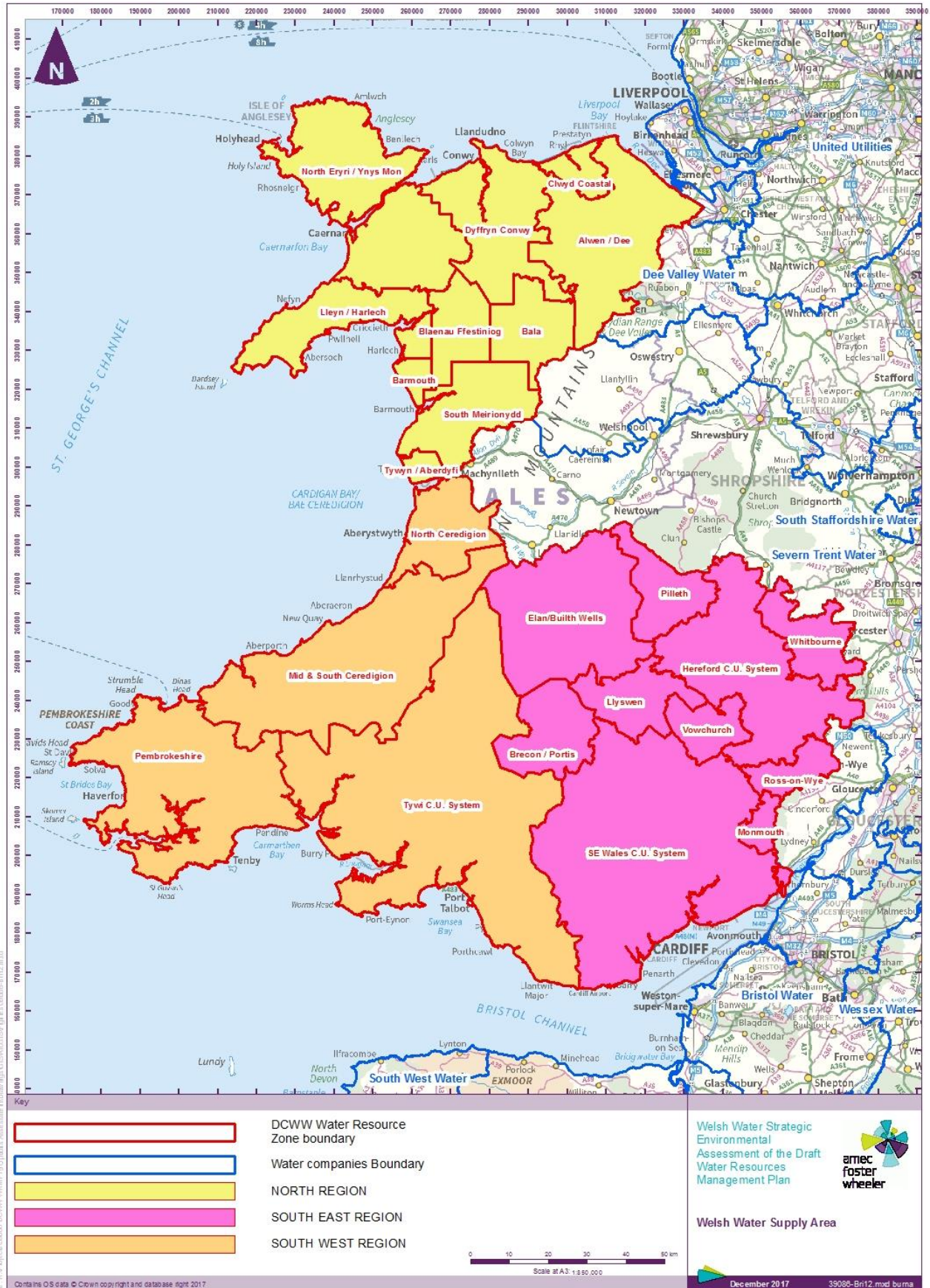
Welsh Water is a statutory water and sewerage undertaker covering most of Wales and parts of England, including the majority of Herefordshire. It is the sixth largest of the ten regulated water and sewerage companies in England and Wales.

Along with all water companies in England and Wales, there is a statutory requirement for Welsh Water to prepare, maintain and publish a water resources management plan (WRMP) that sets out how the balance between water supply and demand will be maintained over a minimum of a 25 year period in a way that is economically, socially and environmentally sustainable. WRMPs are produced on a rolling 5 year basis and Welsh Water is currently preparing its WRMP for the period 2020 to 2050, which is due to be published in 2019. Once published, WRMP19 will replace the current 2014 WRMP.

Water resource planning is undertaken on a water resource zone (WRZ) basis. WRZs are defined in the Water Resource Planning Guideline¹ as “*an area within which the abstraction and distribution of supply to meet demand is largely self-contained (with the exception of agreed bulk transfers)...Within a WRZ all parts of the supply system and demand centres (where water is needed) should be connected so that all customers in the WRZ should experience the same risk of supply failure and the same level of service for demand restrictions*”. Welsh Water has 24 WRZs, as shown in **Figure NTS.1**.

¹ Environment Agency and Natural Resources Wales (2018) Water Resources Planning Guideline: Interim Update. Available at: <https://cdn.naturalresources.wales/media/686174/interim-wrpg-update-july18-final-changes-highlighted.pdf> [Accessed August 2018].

Figure NTS.1 Welsh Water's Supply Area and Water Resource Zones



The WRMP process identifies potential shortages in the future availability of water and sets out the possible solutions required to maintain the balance between water supply and future demand. The process initially reviews as many potential solutions as possible (the 'unconstrained list' of options) to identify 'feasible' options for each WRZ where deficits are predicted. These include supply, demand and leakage management options. These 'feasible' options are reviewed to identify 'preferred options' to resolve any supply deficits.

Welsh Water has identified two WRZs with a forecast baseline supply-demand balance deficit over the plan period; Pembrokeshire and Tywyn Aberdyfi. Following an initial screening of unconstrained options, 63 feasible options across both WRZs were identified comprising of 13 feasible supply-side options, 41 demand management options and nine leakage reduction options. These feasible options were assessed in terms of their financial, environmental and social costs and ranked. Informed by this assessment, ongoing discussion with stakeholders, and the outcomes of the SEA, Habitats Regulations Assessment (HRA) and Water Framework Directive (WFD) Assessment, this list was further refined to identify preferred options for WRMP19. The three preferred options identified for WRMP19 are:

- ▶ Option PEM024b: Canaston Bridge – upgrade pumping station (deployable output (DO) gain 0.66 mega litres per day (Ml/d);
- ▶ Option TYA004: New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont water treatment works (WTW) (DO gain 0.44 Ml/d); and
- ▶ Option TYA009a: Pen-y-Bont WTW Bankside Storage (8Ml) (DO gain 0.44).

The Final WRMP also contains the outcome of an assessment of the resilience of the water supply systems to a drought that might occur 1 in every 200 years with measures identified to increase the resilience of the supply in the Vowchurch WRZ.

Further information in respect of the preparation of WRMP19 is set out in Sections 1.3 and 1.4 of the Environmental Report. The Final WRMP is available to view via Welsh Water's website:

<https://www.dwrcymru.com/en/My-Water/Water-Resources/Final-Water-Resources-Management-Plan-2019.aspx>

What is Strategic Environmental Assessment?

Overview

SEA became a statutory requirement following the adoption of Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment. In Wales, this was transposed into legislation on 12th July 2004 as Statutory Instrument 2004 No.1656 - *The Environmental Assessment of Plans and Programmes (Wales) Regulations 2004*. The objective of SEA, as defined in Directive 2001/42/EC, is:

“To provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to contributing to sustainable development.”

Throughout the course of the development of a plan or programme, SEA should seek to identify, describe and evaluate the likely significant effects on the environment of implementing the plan or programme and propose measures to avoid, manage or mitigate any significant adverse effects and to enhance any beneficial effects.

In this context, the purposes of the SEA of the WRMP are to:

- ▶ identify the potentially significant environmental effects of the WRMP;
- ▶ help identify appropriate measures to avoid, reduce or manage adverse effects and to enhance beneficial effects;

- ▶ give the statutory SEA bodies, stakeholders and the wider public the ability to see and comment upon the effects that the WRMP may have on them, their communities and their interests, and encourage them to make responses and suggest improvements to the WRMP; and
- ▶ inform Welsh Water's selection of the preferred options for WRMP19.

The SEA Process To-date

SEA comprises five key stages:

- ▶ **Stage A:** Scoping;
- ▶ **Stage B:** Develop and Refine Alternatives and Assess Effects;
- ▶ **Stage C:** Prepare Environmental Report;
- ▶ **Stage D:** Consult on the Draft Plan and Environmental Report and Prepare the Post Adoption (SEA) Statement; and
- ▶ **Stage E:** Monitor Environmental Effects.

The first stage of SEA (**Stage A**) is the production of a Scoping Report. This reviews plans and programmes that could affect the WRMP or be affected by it, outlines baseline information for the plan area and sets out the proposed framework for assessing potential environmental effects. Welsh Water published the Scoping Report for the WRMP for a consultation period of six weeks ending 21st April 2017.

During **Stage B**, the Draft WRMP was assessed in accordance with the approach set out in the Scoping Report (as amended to reflect the consultation responses received). This comprised an initial high level assessment of all feasible options followed by a more detailed assessment of the preferred options identified in the Draft WRMP and which, in combination, formed part of Welsh Water's proposed planning solution. The findings of the assessment were presented in the Environmental Report (**Stage C**) to accompany the Draft WRMP. The Environmental Report was then revised to include an assessment of the Revised Draft WRMP; this document is the Final Environmental Report and has been published alongside the Final WRMP.

The Draft WRMP and accompanying documents including the Environmental Report were published for consultation (**Stage D**) which concluded on 8th June 2018. Following a review of the Statement of Response to the consultation and the changes made in a Revised Draft WRMP, on the 8th March 2019 Welsh Government gave Welsh Water direction to publish its Final WRMP. Alongside this Final Environmental Report, Welsh Water has also issued a Post Adoption Statement which sets out the results of the consultation and SEA process and the extent to which the findings of the SEA have been accommodated in the Final WRMP. The SEA then requires monitoring of any resulting environmental effects of the WRMP (**Stage E**).

Section 1.6 of the Environmental Report describes the requirement for SEA of WRMPs and the SEA process in further detail, including its relationship with the preparation of Welsh Water's WRMP.

How has the Final WRMP been Assessed?

An assessment framework has been developed to assess the economic, social and environmental effects of the Final WRMP. This framework includes 12 assessment objectives and associated guide questions that reflect the topics contained in Annex I of the SEA Directive and have been informed by:

- ▶ the SEA objectives and guide questions developed as part of the SEA of the 2015 WRMP;
- ▶ a review of relevant plans and programmes and the associated key policy objectives and messages (see **Section 2** and **Appendix B** of the Environmental Report);
- ▶ the baseline information and key sustainability issues contained in **Section 3** of the Environmental Report; and
- ▶ responses received to consultation on the SEA Scoping Report (see **Appendix E**).



By assessing each option against the SEA objectives, it is more apparent where the Final WRMP will contribute to sustainability, where it might have a negative effect and where enhancements could be made. Guide questions focus the assessment on specific aspects of the objective that reflect issues identified from the review of baseline and contextual information relating to the Welsh Water area.

The assessment framework that has been used to assess the Final WRMP is shown in **Table NTS.1** below. The well-being goals of the *Well-being of Future Generations (Wales) Act 2015* are fully reflected in the framework to help ensure alignment with national policy and legislation on sustainability. Additionally, those objectives that are directly related to the objective for SMNR, established in the *Environment (Wales) Act 2016*, are highlighted

Table NTS.1 Assessment Framework for the WRMP

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
Biodiversity	1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity	<i>Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?</i>	A prosperous Wales A resilient Wales A healthier Wales A globally responsible Wales	Yes	Biodiversity, Flora and Fauna
		<i>Will the option protect and enhance non-designated sites and local biodiversity?</i>			
		<i>Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?</i>			
		<i>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</i>			
		<i>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</i>			
		<i>Will the option prevent the spread/introduction of invasive non-native species?</i>			
		<i>Will the option maintain and enhance the green infrastructure network and the biodiversity it supports?</i>			
		<i>Will the option contribute to the restoration of species that are currently not achieving management objectives?</i>			
		<i>Will the option maintain and enhance ecosystem resilience?</i>			
Geology and Soils	2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	<i>Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?</i>	A prosperous Wales A resilient Wales A globally responsible Wales	Yes	Soils, Material Assets
		<i>Will the option utilise previously developed land?</i>			
		<i>Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?</i>			
		<i>Will the option minimise the loss of best and most versatile agricultural land?</i>			
		<i>Will the option minimise conflict with existing land use patterns?</i>			
		<i>Will the option minimise land contamination?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
Water – Quantity	3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.	<i>Will the option minimise the demand for water resources?</i>	A prosperous Wales A resilient Wales A healthier Wales	Yes	Water, Biodiversity, Flora, Fauna
		<i>Will the option result in changes to river flows?</i>			
		<i>Will the option result in changes to groundwater levels?</i>			
		<i>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</i>			
Water – Quality	4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.	<i>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</i>	A prosperous Wales A resilient Wales A healthier Wales	Yes	Water, Biodiversity, Flora, Fauna
		<i>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</i>			
		<i>Will the option support the achievement of protected area objectives?</i>			
		<i>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</i>			
		<i>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</i>			
Water – Flood Risk	5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.	<i>Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?</i>	A prosperous Wales A resilient Wales A healthier Wales A Wales of cohesive communities A globally responsible Wales	Yes	Human health, Climatic Factors
		<i>Will the option have the potential to help alleviate flooding in the catchment area now or in the future?</i>			
		<i>Will the option be at risk of flooding now or in the future?</i>			
		<i>Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?</i>			
		<i>Will the option promote the use of sustainable drainage systems?</i>			
		<i>Will the option promote opportunities for collaborative working with other risk management authorities?</i>			
		<i>Will the option affect the risk of flooding to people and/or property?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<i>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</i>			
Climate Change	6. To limit the causes and potential consequences of climate change and to adapt to future changes.	<i>Will the option reduce or minimise greenhouse gas emissions?</i>	A prosperous Wales A resilient Wales A healthier Wales A Wales of cohesive communities A globally responsible Wales	Yes	Climatic Factors.
		<i>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</i>			
		<i>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</i>			
		<i>Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?</i>			
		<i>Will coastal erosion have consequences on the operation of this option now or in the future, taking account of expected climate change sea level rise?</i>			
Human Environment - Health	7. To ensure the protection and enhancement of human health.	<i>Will the option ensure the continuity of a safe and secure drinking water supply?</i>	A prosperous Wales A globally responsible Wales A resilient Wales A healthier Wales A more equal Wales	Yes	Population, Human Health.
		<i>Will the option impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation?</i>			
		<i>Will the option maintain surface water and bathing water quality within statutory standards?</i>			
		<i>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</i>			
		<i>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</i>			
Human Environment -Social and Economic Well-Being	8. To maintain and enhance the economic and social well-being of the local community.	<i>Will the option ensure sufficient infrastructure is in place for predicted population increases?</i>	A prosperous Wales A globally responsible Wales A resilient Wales	Yes	Population, Human Health, Material Assets.
		<i>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</i>			
		<i>Will the option help to meet the employment needs of local people?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<p><i>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</i></p> <p><i>Will the option improve access to local services and facilities (e.g. sport and recreation)?</i></p> <p><i>Will the option contribute to sustaining and growing the local and regional economy?</i></p> <p><i>Will the option avoid disruption through effects on the transport network?</i></p> <p><i>Will the option be resilient to future changes in resources (both financial and human)?</i></p> <p><i>Will the option improve opportunities for social interaction and community cohesion?</i></p>	<p>A healthier Wales</p> <p>A more equal Wales</p> <p>A Wales of cohesive communities</p> <p>A Wales of vibrant culture and thriving Welsh language</p>		
Material Assets and Resource Use - Water Resources	9. To ensure the sustainable and efficient use of water resources.	<i>Will the option lead to reduced leakage from the supply network?</i>	<p>A prosperous Wales</p> <p>A resilient Wales</p> <p>A globally responsible Wales</p>	Yes	Water, Material Assets.
		<i>Will the option improve efficiency in water consumption?</i>			
Material Assets and Resource Use – Waste and Resource Use	10. To promote the efficient use of resources.	<i>Will the option seek to minimise the demand for raw materials?</i>	<p>A prosperous Wales</p> <p>A resilient Wales</p> <p>A globally responsible Wales</p>	Yes	
		<i>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</i>			
		<i>Will the option encourage the use of sustainable design and materials?</i>			
		<i>Will the option reduce or minimise energy use?</i>			
Cultural Heritage	11. To conserve and enhance the cultural, historic and industrial heritage resource.	<i>Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings</i>	<p>A prosperous Wales</p> <p>A Wales of vibrant culture and thriving Welsh language</p>	Yes	Cultural Heritage
		<i>Will the option avoid or minimise damage to archaeologically important sites?</i>			
		<i>Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?</i>			
		<i>Will the option affect public access to, or enjoyment of, features of cultural heritage?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<i>Will the option protect or enhance Welsh language and culture?</i>			
Landscape	12. To conserve and enhance landscape character.	<i>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</i>	A resilient Wales A Wales of cohesive communities A healthier Wales	Yes	Landscape
		<i>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</i>			
		<i>Will the option affect public access to existing landscape features?</i>			
		<i>Will the option minimise adverse visual impacts?</i>			

The effects of the Final WRMP have been assessed in two stages. The first stage comprised a high level assessment of all feasible options (including supply-side, demand management and leakage reduction options) against the 12 SEA assessment objectives. A more detailed assessment has then been undertaken of the preferred options and the resilience option.

Section 4 of the Environmental Report provides further information in relation to the approach to the assessment of the Final WRMP.

What are the Potential Effects of the Feasible Options?

Overview

In support of the development of the WRMP, the SEA has considered a total of 63 feasible options across both the Pembrokeshire and Tywyn Aberdyfi WRZs comprising of 13 feasible supply-side options, 41 demand management options and nine leakage reduction options.

Each feasible option was assessed against the SEA objectives to identify the likely environmental effects during both construction/implementation and operation. The feasible options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Where quantified information was available for the feasible option from Welsh Water, the assessment was also informed by reference to threshold values set out in definitions of significance (see **Appendix B** to the Environmental Report).

Summary of Effects

Significant Positive Effects

The majority of the feasible supply-side options in the Pembrokeshire WRZ were assessed as having a positive effect on economic and social well-being (SEA Objective 8) during construction. This reflects the potential for capital investment to generate supply chain benefits and employment opportunities as well as increased spend in the local economy by contractors and construction workers. The anticipated scale of investment associated with a number of the options is such that significant positive effects have been identified in respect of this SEA objective. Investment generated by SMART Metering in the Pembrokeshire WRZ could also be of a scale that may generate significant positive effects on this objective, depending on the number of customers ultimately targeted. The scale of investment related to the leakage reduction options would be greater and, subject to the confirmed extent of works, options involving pipeline renewal/repair could generate a significant positive effect on economic and social well-being.

Three feasible supply-side options were assessed as having a positive effect on economic and social well-being as well as on human health (SEA Objective 7) during the operational phase as they would help to ensure the continuity of a safe and secure drinking water supply which may in-turn support economic and population growth. Several of the leakage reduction options in the Pembrokeshire WRZ were additionally assessed as having a positive effect on health and economic and social well-being during operation given the potential for water savings to also help ensure continuity of water supply and support population and economic growth.

Once operational, the feasible demand management and leakage reduction options would help to reduce overall water use in the Welsh Water supply area and minimise water loss from the network which is expected to have a positive effect on the water quantity (SEA Objective 3) and water resources (SEA Objective 9). The assessment has identified that the potential scale of water savings associated with one leakage reduction option in the Pembrokeshire WRZ could be significant.

Demand and leakage reductions may in-turn reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. For SMART Metering and several leakage reduction options in the Pembrokeshire WRZ, this was identified as having positive effects on climate change (SEA Objective 6) and waste and resource use (SEA Objective 10).

Significant Negative Effects

The assessment found that the feasible supply-side options identified for the WRMP would be likely to have the most significant effects during construction across the SEA objectives. Where significant negative effects on the SEA objectives have been identified, this principally reflects the scale of construction activity and the sensitivity of the receiving environment. In contrast, the feasible demand management and leakage reduction options are, overall, likely to be more limited in range and smaller in magnitude when compared to the supply-side options. This reflects the fact that construction activity would be smaller in scale and, in the case of water efficiency options, undertaken predominantly within properties such that few environmental effects are anticipated.

Several of the supply-side feasible options were assessed as having a significant negative effect on climate change (SEA Objective 6), related to associated greenhouse gas emissions, and waste and resource use (SEA Objective 10), given their anticipated high energy and raw material requirements, during construction with further negative effects on climate change and waste and resource use expected during operation related to the pumping and treatment of water. In addition, all of the demand management and leakage reduction options would result in resource/energy use and carbon emissions and for those options that could involve the replacement/repair of large lengths of pipeline in particular, resource use and emissions could be substantial. In this regard, a total of five leakage reduction options were assessed as having a significant negative effect on these objectives.

A total of five feasible supply-side options were assessed as having potentially significant negative effects on biodiversity (SEA Objective 1) during construction, due to the potential for works to affect internationally and/or nationally designated conservation sites (although it may be possible to avoid or mitigate impacts on these sites and in consequence, some uncertainty remains), whilst one option (Option PEM012) was assessed as having a significant negative effect on this objective during operation. Leakage reduction options involving potentially larger scale pipeline works in the Pembrokeshire WRZ may also have negative effects on biodiversity.

Two supply-side options were assessed as having significant negative effects on cultural heritage (SEA Objective 11), due to the potential for direct impacts on designated heritage assets during construction, and four options were assessed as having significant negative effects on landscape (SEA Objective 12), due to their location within Snowdonia National Park. Additionally, three leakage reduction options may have negative effects on landscape where they involve larger scale works. Those options involving potentially larger scale works in the Pembrokeshire WRZ may also have negative effects on human health (SEA Objective 7) during the construction phase due to impacts on air quality.

Section 5 of the Environmental Report presents the detailed results of the feasible options assessment by option type and WRZ.

What are the Likely Significant Effects of the Final WRMP?

As set out above, three preferred options have been identified by Welsh Water to address the potential future water deficit in the Pembrokeshire and Tywyn Aberdyfi WRZs:

- ▶ **Option PEM024b: Canaston Bridge (deployable output (DO) gain 0.66 MI/d).** This option involves asset upgrades at the Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau and in-turn enable water to be conserved within the Llys y Fran reservoir by matching compensation releases to actual abstraction. It requires a low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d. This may be supplemented with additional raw water storage capacity of 30,000m³.
- ▶ **Option TYA004: New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW) (DO gain 0.44 MI/d).** This option allows Pen y Bont Water Treatment Works (WTW) to receive abstracted water from the Afon Dysynni directly via a new raw water transfer main. Due to topography, the supply would need to be pumped from source. It requires the construction of an intake and pumping station at Pont y Garth and the laying of approximately 6km of pipeline running alongside a road to the WTW at Pen y Bont. This option may also be supplemented with additional raw water storage as described in option TYA009a.

- ▶ **Option TYA009a: Pen-y-Bont WTW Bankside Storage (8MI) (DO gain 0.44).** This option would involve the construction of an 8 MI non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of the Tywyn Aberdyfi system. The reservoir would be filled from the existing Afon Fathew source in winter (under existing licence volumes) and would be used to supply Pen y Bont WTW during periods of poor raw water conditions in other stream sources.

The solutions put forward to resolve the supply demand balance for the Pembrokeshire and Tywyn Aberdyfi zones will also address water supply resilience for these two zones.

In addition, Welsh Water assessed the susceptibility of the **Vowchurch WRZ** to severe droughts and identified that the River Dore and associated gravel aquifer may not provide the required yield to meet customer demands during a 1 in every 200 years drought event.

Given the water supply risks related to poor raw water quality and resilience to drought, Welsh Water plan to lay a new potable water main between the Hereford and Vowchurch zones, capable of meeting the whole Vowchurch demand from Broomy Hill WTW when needed. It requires the installation of approximately 12km of main between Broomy Hill WTW and Kingstone service reservoir (SR) together with an upgrade to Broomy Hill water pumping station (WPS).

The three preferred options and the resilience option have been subject to more detailed assessment through the SEA. A summary of the findings of this assessment is presented in **Table NTS.2** together with the predicted overall cumulative effect of implementing all of the preferred options that comprise the Final WRMP.

Table NTS.2 Assessment of Preferred Options

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
PEM024b	Canaston Bridge – Upgrade Pumping Station	C	-	-	0	0	--	-	0	++	0	-	0	-
		O	0	0	0/+	0	-	+/-	0	0	+	-	0	0
TYA004	New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW)	C	-	-	0	-	--	-	-	-	0	-	0	--
		O	0/?	0	-	0	--	-	0	0	0	-	0	-
TYA009a	Pen-y-Bont WTW Bankside Storage (8MI)	C	-	-	0	0	0	-	-	0	0	-	0	--
		O	0	0	0	0	0	-	0	0	0	-	0	-
Option 2a	Transfer from Hereford WRZ	C	-	0	0	0	0	-	-	+/-	0	-	0	-
		O	+	0	+	+	0	+	+	+	0	0	0	0
Cumulative Effects of the Preferred Options		C	-	-	0	-	--	--	-	++/-	0	--	0	--

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		0	0/?	0	+/-	0	--	+/-	+	+	+	-	0	-

Key

Score	Description	Symbol
Significant Positive Effect	Significant positive effect of the Water Resources Management Plan option on this objective	++
Minor Positive Effect	Positive effect of the Water Resources Management Plan option on this objective	+
Neutral	Overall neutral effect of the Water Resources Management Plan option on this objective	0
Minor Negative Effect	Negative effect of the Water Resources Management Plan option on this objective	-
Significant Negative Effect	Significant negative effect of the Water Resources Management Plan option on this objective	--
No Relationship	There is no clear relationship between the Water Resources Management Plan option and the achievement of the objective or the relationship is negligible.	~
Uncertain	The Water Resources Management Plan option has an uncertain relationship to the objective or the relationship is dependent on the way in which the aspect is managed. In addition, insufficient information may be available to enable an assessment to be made.	?
Mixed Effect	Mixed positive and negative effect of the Water Resources Management Plan option on this objective	+/-



The subsections that follow provide a summary of the likely significant construction and operational effects of the Final WRMP, taking into account the findings of the assessment of the preferred options summarised in **Table NTS.2** above

Construction Effects

Capital investment associated with the Final WRMP would generate supply chain benefits, employment opportunities and increased spend in the local economy by contractors and construction workers. The local economies in Pembrokeshire and Tywyn Aberdyfi are both expected to experience benefits, with significant expenditure associated with Option PEM024b anticipated; however, the plan options are not likely to generate significant in combination effects in this regard due to the distance between the two WRZs and the relatively low spend associated with Options TYA004 and TYA009a. Overall, a significant positive effect has been identified in respect of economic and social well-being (SEA Objective 8), albeit with a mixed minor negative effect expected due to highways disruption and diversions to recreational users on the National Cycle Network associated with the implementation of Option TYA004 and the disruption arising from the construction of the pipeline for Option 2a Pipeline.

No further significant or minor positive effects have been identified during the assessment of the Final WRMP.

Significant negative effects have been identified in respect of flood risk (SEA Objective 5), as construction activity associated with Options PEM024b and TYA004 would take place within Flood Zones 2 and 3. However, project level mitigation, informed by a FCA, would be likely to manage adverse effects in this regard.

The Final WRMP would give rise to the emission of greenhouse gases resulting from embodied carbon (in, for example, construction materials) in addition to plant operation and vehicle movements. Together, the construction of the preferred options would generate a total of at least 1,282 tCO₂e which has been assessed as having a significant negative effect on climate change (SEA Objective 6). Using the scale of carbon emissions as a proxy for resource use, a significant negative effect would also be expected on waste and resources (SEA Objective 10).

Construction associated with the preferred options may cause adverse landscape and visual impacts (SEA Objective 12) which could affect the special qualities of Snowdonia National Park and Pembrokeshire Coast National Park as well as local landscape character and the visual amenity of proximate residential and recreational receptors. For Options TYA004 and TYA009, these effects have been assessed as significant and, additionally, in combination landscape effects may arise if the construction of these options takes place at the same time (due to the close proximity of the schemes to one another). However, it is likely that effects in this regard could be managed at the project level through the implementation of appropriate mitigation such as screening informed by appropriate landscape and visual assessment.

No further significant negative effects have been identified during the assessment of the Final WRMP.

Minor negative effects have been identified in respect of biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quality (SEA Objective 4), human health (SEA Objective 7) and economic and social well-being (SEA Objective 8). This reflects construction-related impacts including disturbance, land take, and vehicle emissions.

Operational Effects

No significant positive effects have been identified during the assessment of the Final WRMP. Implementation of the plan would help to ensure the continuity of potable water supplies and increasing WRZ resilience, supporting population and economic growth. In combination, this would give rise to positive effects on human health (SEA Objective 7) and economic and social well-being (SEA Objective 8). The operation of option PEM024b is also expected to minimise wastage, with a positive effect identified for water resources (SEA Objective 9). Reflecting the combined DO gain associated with the preferred options (1.54 MI/d) effects on these objectives are, however, unlikely to be significant.

Mixed minor positive and negative effects have been identified in respect of water quantity (SEA Objective 3). This reflects the expectation that operation of Option PEM024b would reduce the pressure on

abstraction from the Afon Cleddau during times of low flows but also the potential for abstraction associated with Option TYA004 to have an adverse impact on the hydrological regime of the Afon Dysynni. It should be noted that Options TYA004 and TYA009a will both affect the Afon Dysynni and in-combination effects on SEA Objective 3 are therefore possible. However, the two options would not operate concurrently and the 2015 Meirionnydd Catchment Abstraction Management Strategy (CAMS) states that water is available for abstraction without restrictions within the Afon Dysynni. Operation of Option 2a would lead to a reduction of the abstraction from the Vowchurch boreholes and the improvement in the baseflow in the River Dore is also assessed as having positive effects on water quantity (SEA Objective 3) and water quality (SEA Objective 4).

Mixed minor positive and negative effects have also been identified in respect of climate change (SEA Objective 6). The improved storage position in Llys y Fran reservoir associated with Option PEM024b and Option 2a have the potential to reduce vulnerability to the effects of climate change (drought), generating a positive effect on this objective. However, the release of greenhouse gases associated with all of the preferred options (a total of 741 tCO_{2e}) has been assessed as having an overall minor negative effect on climate change.

A significant negative effect has been identified with respect to flood risk (SEA Objective 5). This is because new above ground infrastructure would be sited in Flood Zones 2 and 3 under Options PEM024b and TYA004. However, project level mitigation, informed by a FCA, would be likely to manage adverse effects in this regard.

Further minor negative effects have been identified in respect of waste and resources (SEA Objective 10) due to combined energy use across the options. Additionally, implementation of the Final WRMP may give rise to minor negative effects on landscape (SEA Objective 12) as Options TYA004 and TYA009a would result in the development of new aboveground infrastructure in Snowdonia National Park (SEA Objective 12) (although as the new infrastructure for these options would be situated approximately 4km apart, significant in combination landscape effects are not anticipated).

The detailed assessment of the preferred options is contained in Appendix D and summarised in Sections 6.2 and 6.3 of the Environmental Report. The cumulative effects of the Final WRMP, both alone and in-combination with other plans and programmes, are assessed in Section 6.4. Section 6.5 considers the contribution that the Final WRMP will make to the well-being goals for Wales contained in the *Well-being of Future Generations (Wales) Act 2015* and the objective for the sustainable management of natural resources established in the *Environment (Wales) Act 2016*. Section 6 concludes by setting out Welsh Water's reasons for selection of the preferred WRMP options and rejection of alternatives (Section 6.7).

Mitigation and Enhancement

In some cases, there is an opportunity to reduce some of the potential negative effects identified during the assessment of the Final WRMP and to enhance positive effects. The detail of this mitigation needs to be considered during the planning phases of each of the individual component schemes that make up Welsh Water's planning solution.

Potential mitigation measures are included within each of the preferred option assessment matrices in Appendix D of the Environmental Report whilst a summary is contained in Section 6.6.

How will the Effects of the Final WRMP be Monitored?

As the WRMP is implemented, its effects on the environment and people will need to be monitored. Monitoring the significant effects of the WRMP can help to answer questions such as:

- ▶ Were the SEA predictions of effects accurate?
- ▶ Is the WRMP contributing to the achievement of the SEA objectives?
- ▶ Are mitigation measures performing as well as expected?
- ▶ Are there any adverse effects? Are these within acceptable limits, or is remedial action desirable?



Section 7 of the Environmental Report identifies a number of indicators to be used for monitoring the effects of the WRMP's implementation. A final monitoring framework that satisfies the requirements of the SEA Directive is presented in the Post Adoption Statement.



Contents

1.	Introduction	7
1.1	Overview	7
1.2	Purpose of this Revised Environmental Report	7
1.3	Water Resources Management Planning	7
1.5	Welsh Water's Water Resources Management Plan	11
1.6	Strategic Environmental Assessment	14
1.7	Consultation Responses to the Draft WRMP and the Environmental Report	18
1.8	Habitats Regulations Assessment	19
1.9	Water Framework Directive Assessment	20
1.10	The Well-being of Future Generations (Wales) Act 2015	20
1.11	The Environment (Wales) Act 2016	21
1.12	Environmental Report Structure	22
1.13	This Environmental Report	24
2.	Review of Plans and Programmes	25
2.1	Introduction	25
2.2	Overview	25
2.3	Policy Objectives Relevant to the Water Resources Management Plan	28
3.	Baseline Analysis	32
3.1	Introduction	32
3.2	Biodiversity	32
3.3	Geology, Land Use and Soils	40
3.4	Water	43
3.5	Air Quality and Climate	50
3.6	Human Environment	58
3.7	Material Assets and Resource Use	74
3.8	Cultural Heritage	84
3.9	Landscape and Seascape	87
3.10	Summary of Key Sustainability Issues	94
3.11	Limitations of the Data and Assumptions Made	95
4.	Approach to the Assessment	97
4.1	Introduction	97
4.2	Scope of the Assessment	97
4.3	Assessment Framework	98
4.4	Assessment Methodology	104

4.5	Assessment of Secondary, Cumulative and Synergistic Effects	107
4.6	Contribution of the Final WRMP to Wales' Well-being Goals and the Objective for the Sustainable Management of Natural Resources	107
4.7	Difficulties Encountered	108
5.	Assessment of Feasible Options	109
5.1	Introduction	109
5.2	Assessment of Supply-Side Options	109
5.3	Assessment of Demand Management Options	117
5.4	Assessment of Leakage Reduction Options	131
5.5	Summary	139
6.	Assessment of the Final WRMP	141
6.1	Introduction	141
6.2	Pembrokeshire Resource Zone	141
6.3	Tywyn Aberdyfi Resource Zone	144
6.4	Vowchurch Resource Zone	148
6.5	Secondary, Cumulative and Synergistic Effects	151
6.6	Contribution of the Final WRMP to Wales' Well-being Goals and the Objective for SMNR	160
6.7	Mitigation and Enhancement	163
6.8	Conclusions and Reasons for the Selection of the Preferred Options	166
7.	Next Steps and Proposals for Monitoring	168
7.1	Next Steps	168
7.2	How Environmental Effects will be Considered During Plan Implementation	168
7.3	Monitoring the Effects of the Final WRMP	168
<hr/>		
Table 1.1	Responses to the Draft WRMP	18
Table 1.2	The Well-being Goals for Wales	21
Table 1.3	Information Provided in this Report to Meet the Requirements of the SEA Regulations	23
Table 2.1	Plans and Programmes Examined for the SEA of the WRMP	25
Table 2.2	Key Policy Objectives Identified in Other Plans and Programmes relevant to the Assessment of the WRMP	29
Table 3.1	Designations in the Welsh Water Supply Area	33
Table 3.2	Number and Type of Water Bodies in Wales	43
Table 3.3	Overall status of water bodies as a percentage between 2009 and 2015.	47
Table 3.4	People at risk from flooding from Rivers and the sea in Wales	49
Table 3.5	Number of AQMAs in Wales by source	51
Table 3.6	Number of AQMAs per Local Authority	51
Table 3.7	End User Carbon Dioxide Emissions 2015	54
Table 3.8	End User Carbon Dioxide Emissions per Capita 2015 ⁹⁰	54
Table 3.9	Population of Welsh Water Area by County	59
Table 3.10	Population Density per square kilometre of land area by Welsh Authorities	62
Table 3.11	Change in Household Size (2001-2016)	63
Table 3.12	Economic Activity (May 2017 – July 2017)	65
Table 3.13	Workforce jobs by industry – seasonally adjusted (June 2017)	66
Table 3.14	Number of Active Business Enterprises between 2005 and 2015	67
Table 3.15	Projected Population Change 2014 – 2039 by County ¹²⁸	72
Table 3.16	Projected Percentage Change in Household Numbers 2014 – 2039 by County ¹²⁹	72
Table 3.17	Average Daily Water Usage (litres per person)	76
Table 3.18	Number of pipe bursts in company pipe network (per 1,000 km of pipe)	77
Table 3.19	Number of properties in Welsh Water area flooded with sewage ¹³⁷	78
Table 3.20	Welsh Water's Water Efficiency Policy Interventions (2010-2015)	78
Table 3.21	Annual Waste Arisings by Sector in Wales, Kilotonnes per Annum, 2000/01 – 2013/14	81
Table 3.22	Components of the 2045 Welsh Water Demand and the difference between 2016 demand	82

Table 3.23	Welsh Water WRMP deficit zones (taken from WRMP19)	83
Table 3.24	Summary of Key Issues	94
Table 4.1	Basis for Scoping Out Topic Areas from the SEA	97
Table 4.2	Assessment Framework for the WRMP	99
Table 4.3	Feasible Options Assessment Matrix	104
Table 4.4	Qualitative Scoring System	105
Table 4.5	Preferred Options Assessment Matrix	106
Table 5.1	Supply-side Feasible Options: Pembrokeshire Resource Zone	109
Table 5.2	Supply-side Feasible Option Assessment Summary: Pembrokeshire Resource Zone	112
Table 5.3	Supply-side Feasible Options: Tywyn Aberdyfi Resource Zone	115
Table 5.4	Supply-side Feasible Option Assessment Summary: Tywyn Aberdyfi Resource Zone	116
Table 5.5	Demand Management Options (All Zones)	118
Table 5.6	Assessment of Demand Management Feasible Options: Pembrokeshire Resource Zone	120
Table 5.7	Assessment of Demand Management Feasible Options: Tywyn Aberdyfi Resource Zone	125
Table 5.8	Leakage Reduction Options	131
Table 5.9	Assessment of Leakage Reduction Feasible Options: Pembrokeshire Resource Zone	133
Table 5.10	Assessment of Leakage Reduction Feasible Options: Tywyn Aberdyfi Resource Zone	136
Table 6.1	Preferred Option Assessment Summary: Pembrokeshire Resource Zone	142
Table 6.2	Preferred Option Assessment Summary: Tywyn Aberdyfi Resource Zone	145
Table 6.3	Preferred Option Assessment Summary: Vowchurch	149
Table 6.4	Cumulative Effects of Options within the Final WRMP	152
Table 6.5	Current Status of National Policy Statements	156
Table 6.6	Pembrokeshire Drought Actions	158
Table 6.7	Tywyn Aberdyfi Drought Actions	158
Table 6.8	Assessment of the Contribution of the Final WRMP to the Well-being Goals for Wales	161
Table 7.1	Indicators for Monitoring Effects	169

Figure 1.1	The WRMP Process	10
Figure 1.2	Welsh Water's Supply Area and Water Resource Zones	12
Figure 1.3	Linking the SEA and WRMP Development	17
Figure 1.4	Sustainable Management of Natural Resources – Principles	22
Figure 3.1	European Sites in the Welsh Water Supply Area	34
Figure 3.2	Percentage of SAC and SPA Habitats in Favourable and Unfavourable Condition	35
Figure 3.3	Percentage of SAC and SPA Species in favourable and Unfavourable Condition	36
Figure 3.4	National and Local Nature Conservation Designations in the Welsh Water Supply Area	37
Figure 3.5	Split of Land on Agricultural Holdings by Usage (2016)	41
Figure 3.6	Welsh Water WRZs	46
Figure 3.7	Ambient Pollutant Trends in Wales 1990 – 2015 (taken from Welsh Government Air Pollution in Wales 2015)	53
Figure 3.8	Air Quality Projections, Wales	56
Figure 3.9	Age Distribution of Population by Gender and Local Authority	61
Figure 3.10	Percentage of Adult Population who reported their general health status as fair/poor (2014 and 15)	65
Figure 3.11	Index of Multiple Deprivation in Wales (taken from WIMD 2014 Executive Summary)	70
Figure 3.12	Projected Population Change for Wales 2014 - 2039	71
Figure 3.13	Welsh Water long term water demand (taken directly from Welsh Waters WRMP 2014 ¹³²)	75
Figure 3.14	Components of the 2012/13 Welsh Water Demand	76
Figure 3.15	Welsh Water leakage volumes (taken directly from Welsh Waters Helping to manage and sustain our environment)	77
Figure 3.16	Welsh Water's Water Efficiency Interventions 2010 – 2015 (taken directly from the Welsh Water WRMP 2014 ¹⁴²)	79
Figure 3.17	Total Electricity Generated from Renewable Sources in Wales per Year	81
Figure 3.18	Cultural Heritage Features in Welsh Water Supply Area	85
Figure 3.19	Listed Buildings in Welsh Water Supply Area	86
Figure 3.20	Landscape Designations in Wales	89
Figure 3.21	National Landscape Character Areas of Wales	90
Figure 3.22	Landscape of Historic Interest in Wales	91
Figure 3.23	National Marine Character Areas for Wales	92
Figure 3.24	2009 Wales Tranquil Areas Map	93

Appendix A	Review of Plans and Programmes	
Appendix B	Criteria for Assessing Significance	
Appendix C	Feasible Options Assessment Matrices	
Appendix D	Preferred Options Assessment Matrices	
Appendix E	Scoping and Environmental Report Consultation Responses	
Appendix F	Quality Assurance Checklist	

1. Introduction

1.1 Overview

Dŵr Cymru Welsh Water (Welsh Water) has published its Final Water Resources Management Plan 2019 (Final WRMP). The Final WRMP demonstrates how Welsh Water will balance the supply of water available and the demand for water from its customers over the period 2020 to 2050. The Draft WRMP was published on 16th March 2018 for a 12 week public consultation. Representations on the Draft WRMP were received from a total of 11 consultees and a Statement of Response was published on 14th September 2018. Following a review of the Statement of Response to the consultation and the changes made in a Revised Draft WRMP, on the 8th March 2019 Welsh Government gave Welsh Water direction to publish its Final WRMP.

In developing the Final WRMP, Welsh Water has undertaken a comprehensive assessment of future available water supplies and the demand for water, extensive stakeholder engagement and a rigorous process of options identification and appraisal. As part of this plan preparation process, Wood Environment & Infrastructure Solutions Limited (Wood), formerly Amec Foster Wheeler Environment and Infrastructure UK Ltd was commissioned by Welsh Water to undertake a Strategic Environmental Assessment (SEA) of the WRMP.

The SEA has been undertaken in accordance with Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (the SEA Directive) and *The Environmental Assessment of Plans and Programmes Regulations 2004* (the SEA Regulations). It assesses the likely economic, social and environmental effects of the WRMP and identifies ways in which adverse effects can be avoided, minimised or mitigated and how any positive effects can be enhanced. In doing so, the SEA has been used to inform the choice of options for water supply and demand management that comprise the Final WRMP, helping to optimise the contribution of the plan to sustainability.

1.2 Purpose of this Revised Environmental Report

This Environmental Report presents the findings of the SEA of the Final WRMP. The purposes of the SEA of the Final WRMP and this Environmental Report are:

- ▶ to ensure that the likely significant environmental and socio-economic effects of the Final WRMP and any reasonable alternatives are identified, characterised and assessed;
- ▶ to help identify appropriate measures to avoid, reduce or mitigate adverse effects and to enhance beneficial effects associated with the implementation of the Final WRMP wherever possible;
- ▶ to provide a framework for monitoring the potential significant effects arising from the implementation of the Final WRMP;
- ▶ to inform Welsh Water's decisions on the Final WRMP; and
- ▶ to demonstrate that the Final WRMP has been developed in a manner consistent with the requirements of the SEA Directive and SEA Regulations.

1.3 Water Resources Management Planning

Requirements for a Water Resources Management Plan

Welsh Water, along with all water companies in England and Wales, is required to prepare, maintain and publish a WRMP under the *Water Industry Act 1991*, updated by the provisions in section 37A-D of the *Water Act 2003* and the *Water Act 2014* and the *Environment (Wales) Act 2016*. Prior to April 2007, water companies submitted WRMPs to the Environment Agency on a voluntary basis. WRMPs must now be

submitted to the Secretary of State and/or the Welsh Government's Minister for Environment, Planning and Countryside. The relevant minister considers each company Plan and can issue directions for the companies to make amendments if necessary.

The plan must set out how a water company intends to maintain the balance between supply and demand for water over a minimum of a 25 year period. This is complemented by a water company drought plan, which sets out the short-term operational steps a company will take as a drought progresses.

The *Water Industry Act 1991* establishes procedural requirements for the process that water companies must follow to develop and publish their plans. Companies must set out a baseline forecast of demand for water for a minimum of 25 years, assuming current demand policies. This must be compared against a baseline forecast of available water supply, including current resources and future planned supply schemes/policies. Companies should integrate the impact of climate change on supply and demand when calculating the forecast supply-demand balance under dry year conditions, to identify whether there is a water surplus or deficit each year. Where there is a deficit, companies must develop water management options to address this, considering the costs and benefits of a range of options to justify a preferred set of options (the 'strategy') to be implemented.

Water companies must revise their WRMPs in any event, no later than 5 years after the previous plan was last published. Welsh Water published its Final WRMP for the period 2020 to 2050 in March 2019, replacing WRMP14.

Water Resources Management Planning Stages

The Welsh Government has produced guidance on WRMPs (April 2016) *Guiding Principles for Developing Water Resources Management Plans for 2020*.² The Guidance applies to water undertakers whose area is wholly or mainly in Wales, which included Welsh Water. In addition, the Environment Agency and Natural Resources Wales (NRW) have published the *Water Resources Planning Guideline*³ to provide a framework for the development and presentation of water company plans.

Reflecting the Welsh Government guidance, key stages in the development of WRMPs are summarised below (and are also illustrated in **Figure 1.1**):

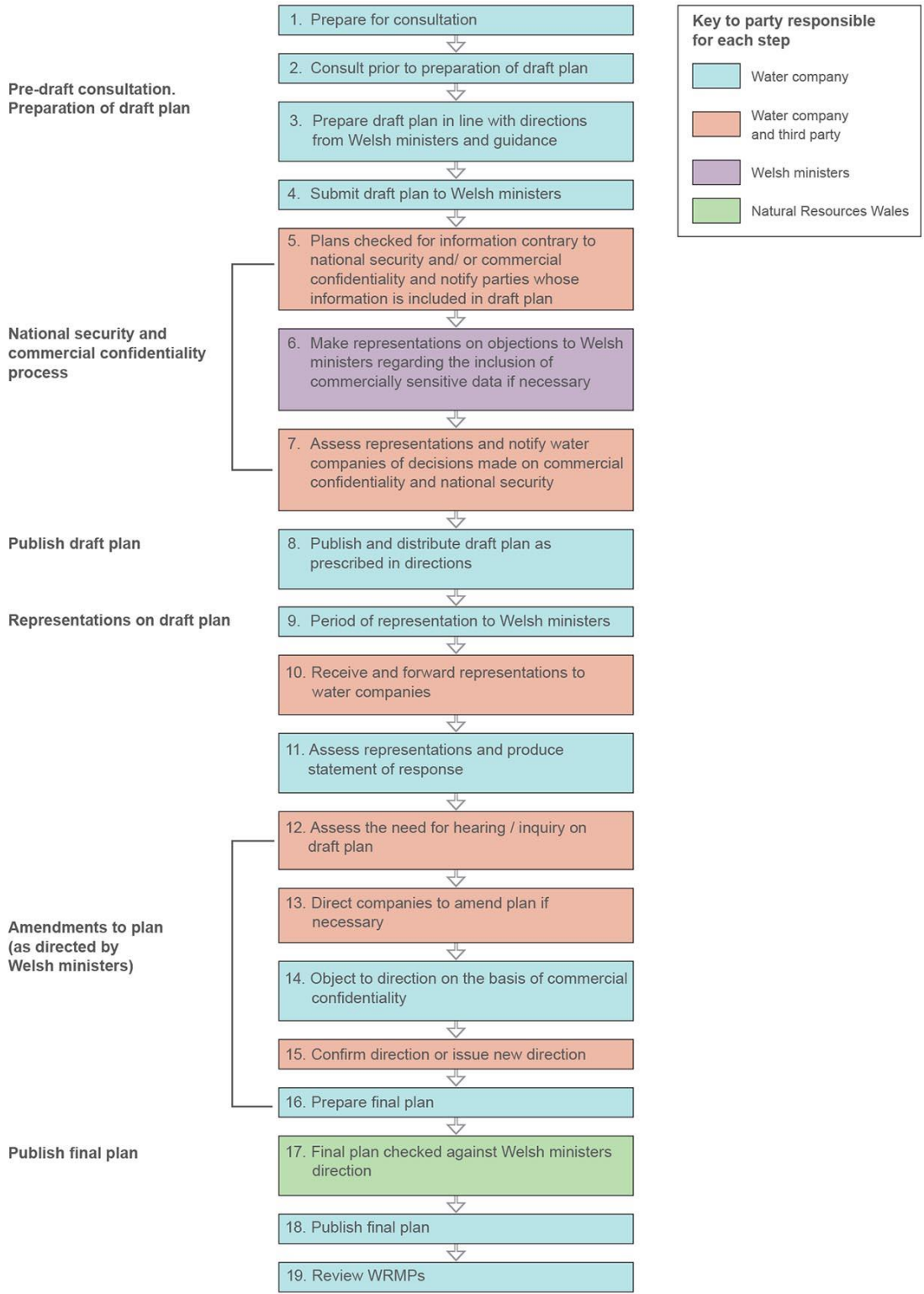
- ▶ **Step 1 Prepare for consultation:** At this stage, the existing WRMP should be reviewed and any improvements considered. Previous recommendations from NRW, statutory consultees, directions from Government and recent water company experience should be utilised. The WRMP should be reviewed in the context of Drought Plans to make sure they are consistent;
- ▶ **Step 2 Consult prior to preparation of draft plans:** The document identifies the need to consult with a range of stakeholders prior to preparing the draft plan. These include NRW, Ofwat, Welsh Ministers, customers and the Environment Agency as well as the Secretary of State if the plan affects areas of England);
- ▶ **Step 3 Prepare draft plan:** The guidance states that water companies should follow the relevant regulations and directions on the form of the plan and what the plan should address and the requirements specified under section 39B of the Water Industry Act 1991;
- ▶ **Step 4: Submit draft plan:** The plan is submitted to Welsh Ministers and all information submitted should be publicly available, unless a company makes a case to Welsh Ministers for it to be considered commercially confidential. NRW will be requested to review the plan on behalf of Welsh Ministers as the Government's technical advisor on managing water resources and Ofwat will be requested to review it in its role as independent economic regulator;
- ▶ **Step 5: Plan checked for sensitive information:** The Welsh Ministers will notify any named third parties whose information may be commercially confidential that their sensitive information is included in the plan and that the plan has to be published;

² The Welsh Government (2016) *Guiding Principles for Developing Water Resources Management Plans WRMPs for 2020*.

³ Environment Agency and Natural Resources Wales (2017) *Water Resources Planning Guideline: Interim Update* [available at: <https://naturalresources.wales/media/681612/interim-wrpg-update-final-april-2017.pdf>]

- ▶ **Step 6: Representations on objections:** Objections to publishing draft plans containing any information that is commercially sensitive are made at this stage;
- ▶ **Step 7: Assess representations:** The Welsh Ministers make a decision on whether or not information should be left out of the plan on grounds of commercial confidentiality and inform the water company accordingly. Information can also be excluded on grounds of national security;
- ▶ **Step 8: Publish and distribute draft plan:** Once a direction has been received from the Welsh Ministers, the draft plan is published and made available. The challenges and proposed solutions included in the plan need to be communicated to customers;
- ▶ **Step 9: Period of representations:** A 12 week minimum consultation period on the draft plan is required with representations submitted to the Welsh Ministers;
- ▶ **Step 10: Forward representations:** The Welsh Ministers will send copies of representations to Welsh Water and also send copies to NRW as its technical advisor;
- ▶ **Step 11: Assess representations and produce statement of responses:** The water company will review representations and produce a statement of response outlining any changes the company has made and an explanation of where it has not made changes. If a revised draft plan is produced, any changes should be clearly set out in the statement of response. The statement of response will be published and the Welsh Government will consult NRW on the response. NRW will also consult Natural England in relation to any areas of the statement of response that affect England;
- ▶ **Step 12: Assess the need for hearing/inquiry on draft plan:** A hearing or an inquiry may be needed where there are substantial unresolved conflicts of opinions; where a water company has not provided enough evidence to justify a particular course of action or where a substantial change to the plan has been made that did not form part of the consultation;
- ▶ **Step 13: Direct companies to amend plans if necessary:** Welsh Ministers will advise of any changes that need to be made to the plan as a result of representations received, statement of response or the outcome of any hearings or inquiries;
- ▶ **Step 14: Object to direction on basis of commercial confidentiality:** If necessary, a water company may object by notice to the Welsh Ministers on any commercial confidentiality issues arising from the direction;
- ▶ **Step 15: Confirm direction or issue new direction:** Welsh Ministers consider the notice and whether to confirm the current direction, or cancel it and issue a new one;
- ▶ **Step 16: Prepare final plan:** The water company amends its plans taking into account any directions from the Welsh Ministers and sends final plans to the Welsh Ministers and NRW;
- ▶ **Step 17: Final plan checked against Welsh Ministers' direction:** Welsh Ministers and NRW will check the plan to make sure that it complies with the direction and that no new information that is a risk to national security has been included;
- ▶ **Step 18: Publish final plan:** The water company publishes the final plan, along with other required information and explains its implications to customers and stakeholders;
- ▶ **Step 19 Review WRMP:** The review of WRMPs should commence if either circumstances change significantly or if directed by the Welsh Ministers. A company must revise and resubmit its WRMP no later than five years after it published its latest plan. A water company must also review its plan annually, and report any changes to Welsh Ministers. The Welsh Government recommends that a company should publish its annual reviews on its website so customers and interested groups can see the progress being made.

Figure 1.1 The WRMP Process



1.5 Welsh Water's Water Resources Management Plan

Overview

Welsh Water is responsible for providing over 3 million people with drinking water and for taking away and properly disposing of the associated wastewater. It also has over 100,000 business customers, and in total delivers more than 800 million litres of drinking water every day. Welsh Water supplies come primarily from surface water resources such as rivers and reservoirs (95 per cent of total resources). Groundwater sources constitute the remaining water resources, reflecting the geology of Wales which is unsuitable for supporting large scale groundwater supplies.

WRMP19 details how Welsh Water will maintain the balance between demand for water from its customers and the resources available to it over the 30 year period from 2020 to 2050. This is termed the 'Supply Demand Balance'. Water resource planning is undertaken on a water resource zone (WRZ) basis, these are defined in the Water Resource Planning Guideline⁴ as "*an area within which the abstraction and distribution of supply to meet demand is largely self-contained (with the exception of agreed bulk transfers) ... Within a WRZ all parts of the supply system and demand centres (where water is needed) should be connected so that all customers in the WRZ should experience the same risk of supply failure and the same level of service for demand restrictions*". Welsh Water has 24 WRZ (see **Figure 1.2**). Where the Supply Demand Balance identifies WRZs in deficit over the lifetime of the plan, the WRMP will present both supply-side and demand management options for each WRZ.

The process of options identification includes a review of as many potential solutions as possible (the 'unconstrained list' of options) to identify 'feasible' (constrained) water management options (including supply-side, demand management and leakage reduction options) for each WRZ where deficits are predicted. These 'feasible' options are then reviewed in relation to financial, environmental and social costing to identify 'preferred options' to resolve any supply deficits.

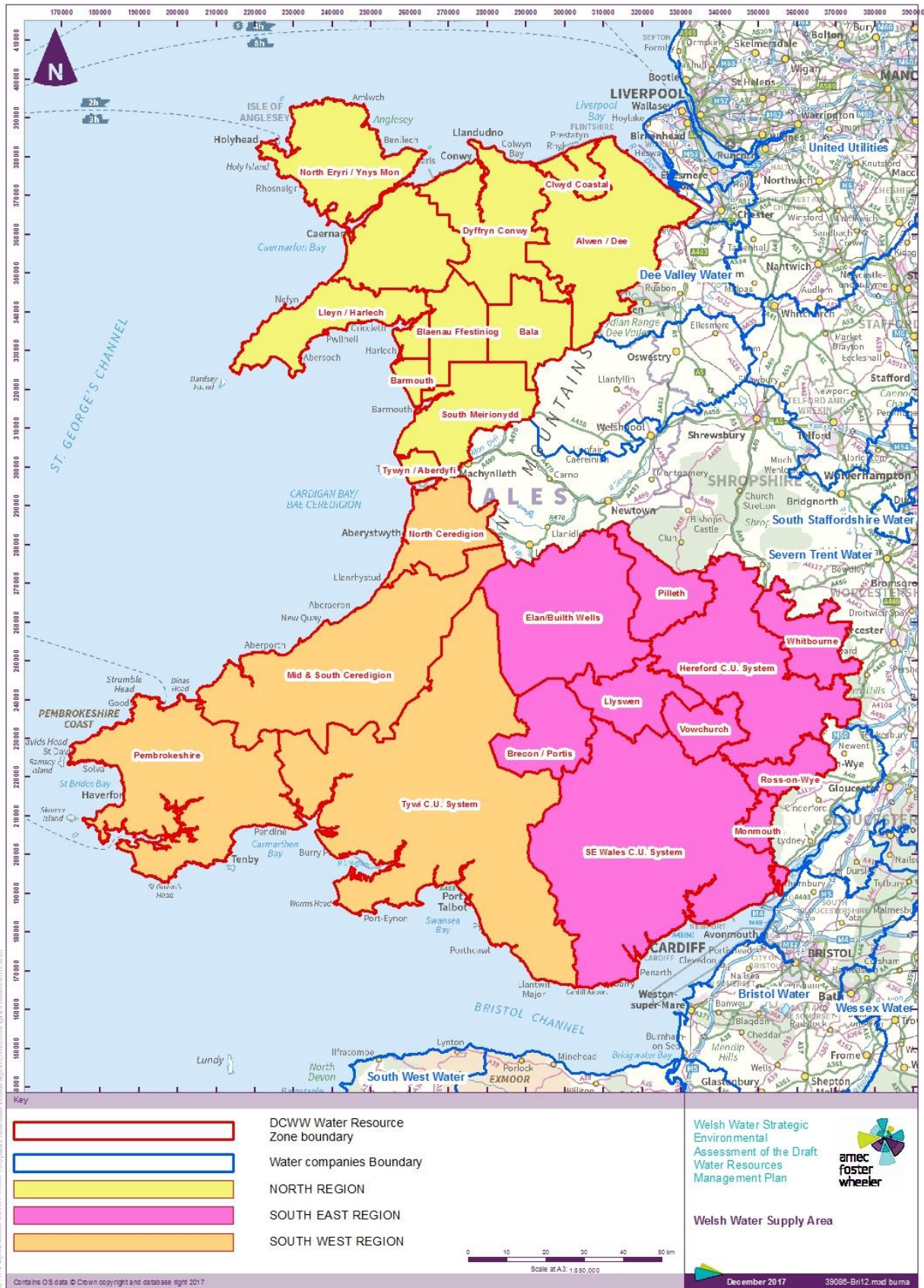
The types of feasible options considered in preparing the WRMP can be broadly categorised as follows:

- ▶ supply-side measures (e.g. increasing capacity at an existing groundwater source);
- ▶ demand management (e.g. water metering or household visits to install water efficiency measures); and
- ▶ leakage reduction and network metering measures (e.g. repairing pipes).

The proposed planning solution for managing supply and demand was presented in the Draft WRMP for formal consultation. The preferred options in the plan have been retained in the Final WRMP and are presented with a justification of their inclusion and timing for implementation below.

⁴ Environment Agency and Natural Resources Wales (2018) Water Resources Planning Guideline: Interim Update. Available at: <https://cdn.naturalresources.wales/media/686174/interim-wrpg-update-july18-final-changes-highlighted.pdf> [Accessed August 2018].

Figure 1.2 Welsh Water's Supply Area and Water Resource Zones



Final Water Resources Management Plan 2019

The Final WRMP identifies two WRZs with a forecast baseline supply-demand balance deficit over the plan period: Pembrokeshire and Tywyn Aberdyfi. The nature of these zones' vulnerabilities are summarised below:

- ▶ **Pembrokeshire:** a regulated river flow/reservoir resource base provides much of Pembrokeshire's public water supply. Surface water resources are also required to support industrial customers' demands. However, the baseline supply-demand balance is particularly vulnerable to a reduction in resource base that the Review of Consents is expected to enforce from 2018-19, together with the forecast effects of climate change. The Pembrokeshire WRZ is forecast to fall into deficit in both the annual average and critical period scenarios before the end of the planning period. The deficit is driven by low storage in Llys y Fran and reaches a maximum of 14 MI/d in 2049/50 under the annual average scenario and a maximum of 12 MI/d under the critical period scenario.
- ▶ **Tywyn Aberdyfi:** a very small zone which is dependent on two small river abstractions and has no water transfer facilities. During drought events, it is unlikely they will be able to provide sufficient water to meet customer's demand, a situation that will be exacerbated by the effects of climate change. The Tywyn Aberdyfi WRZ is forecast to have a small supply demand deficit from the start of the planning period in 2020, reaching a maximum shortfall of 1.52 MI/d by the end of the period in 2050 under the annual average scenario and a maximum shortfall of 2.79 MI/d under the critical period scenario. The small demand restricts the type of supply or demand options that could be technically and economically feasible.

Following an initial screening of unconstrained options, 63 feasible options across both the Pembrokeshire and Tywyn Aberdyfi WRZs were identified comprising of 13 feasible supply-side options, 41 demand management options and nine leakage reduction options. These feasible options were assessed in terms of their financial, environmental and social costs and ranked. Informed by this assessment, ongoing discussion with stakeholders, and the outcomes of the SEA, Habitats Regulations Assessment (HRA) and Water Framework Directive (WFD) Assessment, this list was further refined to identify preferred options for WRMP19.

The three preferred options identified for WRMP19 are, for the Pembrokeshire resource zone:

- ▶ **Option PEM024b: Canaston Bridge - upgrade pumping station (deployable output (DO) gain 0.66 MI/d):** This scheme involves asset upgrades at the Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau and in-turn enable water to be conserved within the Llys y Fran reservoir by matching compensation releases to actual abstraction. It requires a low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d. This may be supplemented with additional raw water storage capacity of 30,000m³.

For the Tywyn Aberdyfi resource zone:

- ▶ **Option TYA004: New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont water treatment works (WTW) (DO gain 0.44 MI/d):** This scheme allows Pen y Bont Water Treatment Works (WTW) to receive abstracted water from the Afon Dysynni directly via a new raw water transfer main. Due to topography, the supply would need to be pumped from source. It requires the construction of an intake and pumping station at Pont y Garth and the laying of approximately 6km of pipeline running alongside a road to the WTW at Pen y Bont. This option may also be supplemented with additional raw water storage as described in option TYA009a.
- ▶ **Option TYA009a: Pen-y-Bont WTW Bankside Storage (8MI) (DO gain 0.44 MI/d):** This scheme would involve the construction of an 8 MI non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of the Tywyn Aberdyfi system. The reservoir would be filled from the existing Afon Fathew source in winter (under existing licence volumes) and would be used to supply Pen y Bont WTW during periods of poor raw water conditions in other stream sources..

The solutions put forward to resolve the supply demand balance for the Pembrokeshire and Tywyn Aberdyfi zones will also address water supply resilience for these two zones.

In addition, Welsh Water assessed the susceptibility of the **Vowchurch WRZ** to severe droughts and identified that the River Dore and associated gravel aquifer may not provide the required yield to meet customer demands during a 1 in every 200 years drought event.

Given the water supply risks related to poor raw water quality and resilience to drought, Welsh Water plan to lay a new potable water main between the Hereford and Vowchurch zones, capable of meeting the whole Vowchurch demand from Broomy Hill WTW when needed. It requires the installation of approximately 12km of main between Broomy Hill WTW and Kingstone service reservoir (SR) together with an upgrade to Broomy Hill water pumping station (WPS).

The feasible and preferred options and resilience options are described in more detail in **Sections 5 and 6** of this report respectively. The options identification and appraisal process is described further in the Final WRMP.

The Final WRMP is available to view via Welsh Water's website: <https://www.dwrcymru.com/en/My-Water/Water-Resources/Final-Water-Resources-Management-Plan-2019.aspx>

1.6 Strategic Environmental Assessment

Overview

SEA became a statutory requirement following the adoption of Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment. In Wales, this was transposed into legislation on 12th July 2004 as Statutory Instrument 2004 No.1656 - *The Environmental Assessment of Plans and Programmes (Wales) Regulations 2004*.

The objective of the SEA Directive is:

“to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view of contributing towards sustainable development”.

Throughout the course of the development of the plan, policy or programme, the aim of SEA is to identify the potential impact of options proposed in the plan in terms of their environmental, economic and social effects. If any adverse effects are identified, these options can then be avoided or proposals modified to manage or mitigate adverse effects.

Applying SEA to Water Resources Management Plans

The SEA Directive requires “*an environmental assessment ... of certain plans and programmes which are likely to have significant effects on the environment*” (Article 1). Plans and programmes are defined as those:

- ▶ *“which are subject to preparation and/or adoption by an authority at national, regional or local level or which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government; and*
- ▶ *which are required by legislative, regulatory or administrative provisions”* (Article 2(a)).

Guidance produced by the European Commission (EC)⁵ indicates that in preparing long-term plans for ensuring water resources, privatised utilities companies can be considered an authority because they are providing services that would be carried out by public authorities in a non-privatised regime. The preparation of a WRMP is a statutory requirement and therefore meets the requirements of Article 2(a) of the Directive.

⁵ EC (2003) *Implementation of Directive 2001/42 on the Assessment of the Effects of Certain Plans and Programmes on the Environment*.

Plans and programmes that may have significant effects on the environment are identified as those:

- ▶ “which are prepared for... water management... and which set the framework for future development consent of projects listed in Annexes I and II to Directive 85/337/EEC [the Environmental Impact Assessment Directive]; or
- ▶ which, in view of the likely effect on sites, have been determined to require an assessment pursuant to Article 6 or 7 of Directive 92/43/EEC [the Habitats Directive]” (Article 3, paragraph 2(a)).

Broadly, this includes plans that may include development of infrastructure to source, store, or transfer water, or may affect sites that have European designations (Special Areas of Conservation (SACs), Special Protection Areas (SPAs), and Ramsar sites and candidate sites).

Government⁶, industry⁷ and regulator⁸ guidance set out that there is a requirement for water companies, as responsible authorities, to determine whether their WRMPs fall within the scope of the SEA Regulations and whether an SEA must be undertaken. The Welsh Government’s guidance⁹ on WRMPs (April 2016) identifies the need to carry out a SEA and HRA of plans.

Stages of Strategic Environmental Assessment

SEA comprises five key stages:

- ▶ **Stage A:** Scoping;
- ▶ **Stage B:** Develop and Refine Alternatives and Assess Effects;
- ▶ **Stage C:** Prepare Environmental Report;
- ▶ **Stage D:** Consult on the Draft Plan and Environmental Report and Prepare the Post Adoption (SEA) Statement; and
- ▶ **Stage E:** Monitor Environmental Effects.

The processes and interrelationships between the key stages of SEA and development of WRMPs are shown in **Figure 1.3**.

The first stage of SEA (**Stage A**) is the production of a Scoping Report. This reviews plans and programmes that could affect the WRMP or be affected by it, outlines baseline information for the plan area and sets out the proposed framework for assessing potential environmental effects.

Welsh Water published the SEA Scoping Report for WRMP19 for a consultation period of six weeks ending 21st April 2017. Three responses were received to the consultation from NRW, Welsh Government and Cadw which resulted in amendments to the baseline information and assessment framework that has been used to assess the WRMP (a schedule of consultation responses to the Scoping Report is contained at **Appendix E**).

The WRMP has been subject to assessment using the amended assessment framework (**Stage B**). The SEA has assessed the effects in two stages, complementary to the development of the plan itself. The first stage comprised a high level assessment of all feasible water management options. A more detailed assessment was then undertaken of the preferred options identified in the Draft WRMP that, in combination, formed part of Welsh Water’s proposed planning solution. The findings of the assessment were presented in the Environmental Report (**Stage C**) to accompany the Draft WRMP. The Environmental Report was then revised to include an assessment of the Revised Draft WRMP; this document is the Final Environmental Report and has been published alongside the Final WRMP.

⁶ ODPM *et al* (2005) *A Practical Guide to the Strategic Environmental Assessment Directive*.

⁷ UKWIR (2012) *Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7)*.

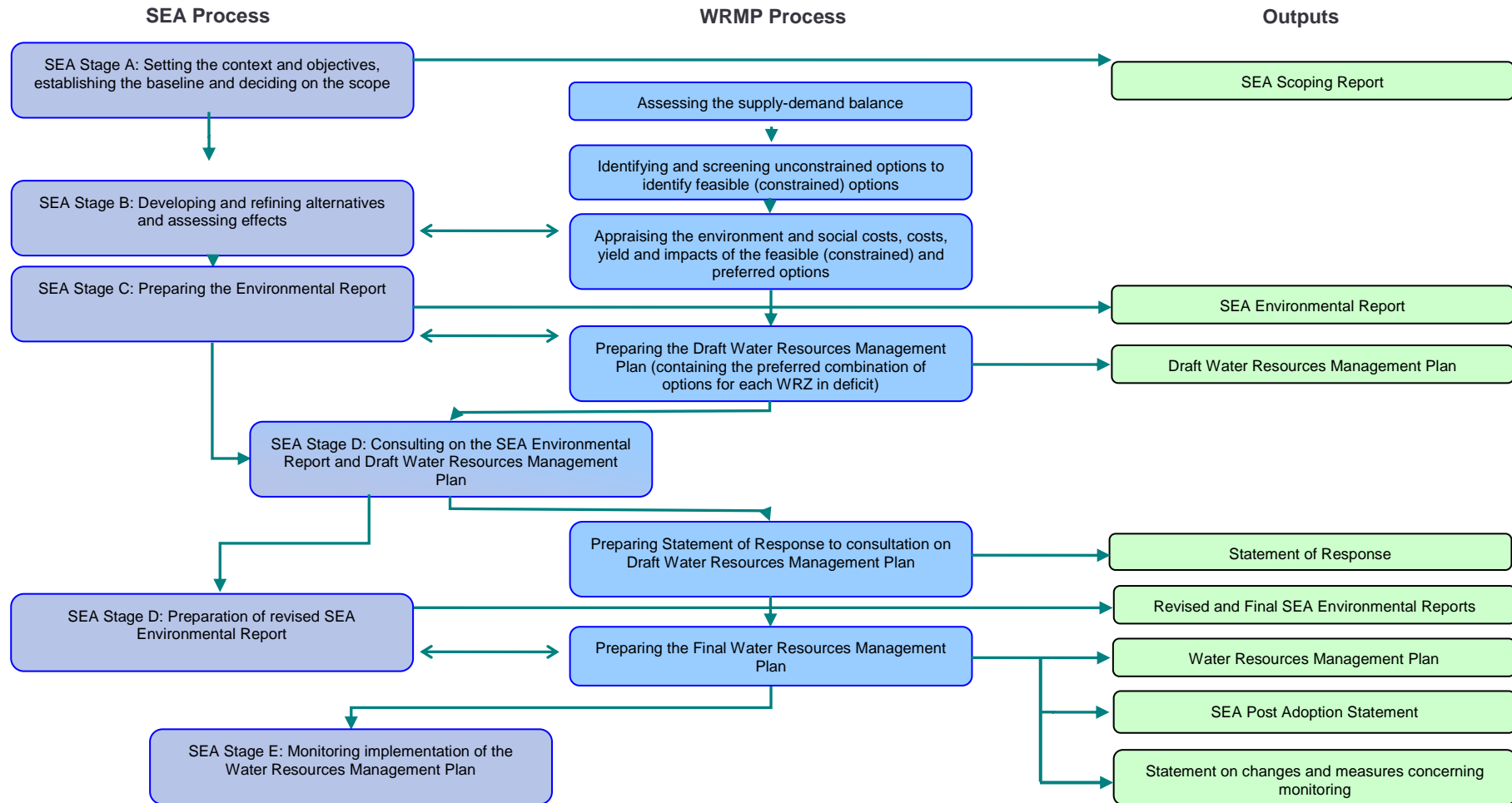
⁸ Environment Agency and Natural Resources Wales (2017) *Water Resources Planning Guideline: Interim Update*.

⁹ Welsh Government (2016), *The Welsh Government Guiding Principles for Developing Water Resources Management Plans (WRMP’s) for 2020*

The Draft WRMP and accompanying documents including the Environmental Report were published for consultation (**Stage D**) which concluded on 8th June 2018. Following a review of the Statement of Response to the consultation and the changes made in a Revised Draft WRMP, on the 8th March 2019 Welsh Government gave Welsh Water direction to publish its Final WRMP. Alongside this Final Environmental Report, Welsh Water has also issued a Post Adoption Statement which sets out the results of the consultation and SEA process and the extent to which the findings of the SEA have been accommodated in the Final WRMP.

During the period of the WRMP, Welsh Water will monitor the implementation and environmental effects of the plan (**Stage E**).

Figure 1.3 Linking the SEA and WRMP Development



1.7 Consultation Responses to the Draft WRMP and the Environmental Report

Consultation on the Draft WRMP

The Draft WRMP was issued for public consultation for 12 weeks from 16th March to 8th June 2018.

In total, 11 responses were received by Welsh Water. The organisation and the sections of the Draft WRMP that they requested changes is summarised in **Table 1.1**.

Table 1.1 Responses to the Draft WRMP

Consultee	Section and Subject of change
Ofwat	Chapter 2 and 5 : Resilience Chapter 4: Demand Forecast Chapter 6: Trading and transfer clarification Chapter 6: Customer Engagement Chapter 7: Water leakage reduction plans
Natural Resources Wales	Chapter 7: 15% leakage reduction in baseline demand Chapter 6: Pre-consultation feedback Chapter 3: Greenhouse gases
Environment Agency	Chapter 6: Trading and transfer clarification Chapter 7: Achieving 15% leakage reduction Chapter 7: Vowchurch resilience Chapter 4: Demand Forecast - consumption model
Consumer Council for Water	Chapter 6: Water efficiency plans Chapter 7: Water leakage reduction plans Chapter 7: Vowchurch and SEWCUS resilience
Canal and Rivers Trust	No change required
RSPB	Chapter 2 and 5 : Resilience Chapter 3: WFD Chapter 6: Trading and transfer clarification Chapter 6: Water efficiency plans Chapter 7: Water leakage reduction plans
Conwy Borough Council	Chapter 6: Water efficiency plans
Pembrokeshire Coast National Park	Chapter 4: Demand Forecast
Waterwise	Chapter 6: Water efficiency plans
Business Customer	Chapter 7: Water leakage

Consultee	Section and Subject of change
GARD	Chapter 6: Trading and transfer clarification

For more information, please refer to the Statement of Response.

Consultation on the Environmental Report

The Environmental Report documented the findings of the assessment of feasible options, the preferred options and alternatives, outlining where any likely significant effects were identified and proposing, where appropriate, mitigation measures. This too was subject to consultation alongside the Draft WRMP for 12 weeks from 16th March to 8th June 2018.

The Environmental Report indicated that Welsh Water welcomed, in particular, views on:

- ▶ Whether the Environmental Report had correctly identified the likely significant effects of the Draft WRMP?
- ▶ Whether conclusions of the Environmental Report and the recommendations concerning the mitigation and enhancement of significant effects were agreed with?
- ▶ Whether the proposed arrangements for monitoring the significant effects of the implementation of the WRMP were agreed with?

Responses were received from two organisations, NRW and the EA. Details of the comments and how they have been addressed are set out in **Appendix E** as well as in the Post Adoption Statement.

1.8 Habitats Regulations Assessment

The Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations') requires that competent authorities assess the potential impacts of plans and programmes on the Natura 2000 network of European protected sites¹⁰ to determine whether there will be any 'likely significant effects' on any European site as a result of the plan's implementation (either on its own or 'in combination' with other plans or projects); and, if so, whether these effects will result in any adverse effects on the site's integrity. The process by which the impacts of a plan or programme are assessed against the conservation objectives of a European site is known as Habitats Regulations Assessment (HRA)¹¹. WRMPs are not explicitly included within this legislation, although the *Guiding Principles for Developing Water Resources Management Plans for 2020* states that this requirement should extend to plans such as WRMPs. The Habitats Regulations require every Competent Authority, in the exercise of any of its functions, to have regard to the requirements of the Habitats Directive. Water companies have a statutory duty to prepare WRMPs and are therefore the Competent Authority for HRA of WRMPs.

In accordance with the Habitats Regulations, what is commonly referred to as a HRA screening exercise has been undertaken to identify whether Welsh Water's WRMP will have any likely significant effects on any European sites (either alone or 'in combination' with other projects or plans). Where the possibility of

¹⁰ A European Site is any classified Special Protected Area (SPA) and any Special Area of Conservation (SAC) from the point where the Commission and the Government agree the site as a Site of Community Importance. SPAs and SACs have been created under the EC Birds Directive and Habitats Directive. In the UK they form part of a larger European network called Natura 2000. HRA is also required, as a matter of Government policy, for potential SPAs (pSPAs), possible SACs (pSACs) and listed Ramsar Sites for the purpose of considering development proposals affecting them (National Planning Policy Framework paragraph 118). As such, pSPAs, pSACs and Ramsar Sites must also be considered by any HRA. Within this report "European site" is used as a generic term for all of the above designated sites.

¹¹ 'Appropriate Assessment' has been historically used as an umbrella term to describe the process of assessment as a whole. The whole process is now more accurately termed 'Habitats Regulations Assessment' (HRA), and 'Appropriate Assessment' is used to indicate the specific stage of HRA.

significant effects could not be excluded, a more detailed Appropriate Assessment was carried out to determine whether these effects would adversely affect the site's integrity.

The HRA is undertaken and reported separately from the SEA. However, the conclusions of the HRA have helped to inform this assessment process, particularly in respect of the potential effects of the WRMP options on biodiversity

1.9 Water Framework Directive Assessment

Welsh Water has undertaken a separate Water Framework Directive (WFD) Assessment of the WRMP that seeks to ensure that the WRMP is compliant with the objectives of the WFD. All construction and operational aspects of options in the WRMP have been considered in the WFD Assessment in order to determine whether there will be serious damage to, or deterioration of the status of, waterbodies under the WFD.

Similar to the HRA, the WFD Assessment is reported separately from the SEA but has informed the SEA Environmental Report as part of the assessment of feasible and preferred options, particularly in respect of the potential effects on water quantity, water quality and also biodiversity.

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

The *Well-being of Future Generations (Wales) Act 2015*¹² places a duty on Welsh public bodies to carry out sustainable development. Welsh Water is not a public body; however, the Act as noted in section 6(3) can apply to other parties '*who exercise functions of a public nature*'. Whilst this interpretation is evolving, it is noted that for the purposes of SEA, as outlined in the EC guidance¹³, Welsh Water, as a "*privatised utilities company can be considered an authority because they are providing services that would be carried out by public authorities in a non-privatised regime*".

In this Act, sustainable development is defined as "*the process of improving the economic, social, environmental and cultural well-being of Wales by taking action, in accordance with the sustainable development principle, aimed at achieving the well-being goals*". In this context, the sustainable development principle means that public bodies "*must act in a manner which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs*". In order to act in this manner, the Act sets out that a public body must take into account:

- ▶ "*the importance of balancing short term needs with the need to safeguard the ability to meet long term needs, especially where things done to meet short term needs may have detrimental long term effect;*
- ▶ *the need to take an integrated approach, by considering how—*
 - ▶ *(i)the body's well-being objectives may impact upon each of the well-being goals;*
 - ▶ *(ii)the body's well-being objectives impact upon each other or upon other public bodies' objectives, in particular where steps taken by the body may contribute to meeting one objective but may be detrimental to meeting another;*
- ▶ *the importance of involving other persons with an interest in achieving the well-being goals and of ensuring those persons reflect the diversity of the population of—*
 - ▶ *(i)Wales (where the body exercises functions in relation to the whole of Wales), or*
 - ▶ *(ii)the part of Wales in relation to which the body exercises functions;*

¹² Available from <http://www.legislation.gov.uk/anaw/2015/2/contents/enacted> [Accessed September 2017].

¹³ EC (2003) *Implementation of Directive 2001/42 on the Assessment of the Effects of Certain Plans and Programmes on the Environment*.

- ▶ *how acting in collaboration with any other person (or how different parts of the body acting together) could assist the body to meet its well-being objectives, or assist another body to meet its objectives;*
- ▶ *how deploying resources to prevent problems occurring or getting worse may contribute to meeting the body's well-being objectives, or another body's objectives."*

The seven well-being goals established in the Act are set out in **Table 1.2**.

Table 1.2 The Well-being Goals for Wales

Goal	Description of the Goal
A prosperous Wales	An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work.
A resilient Wales	A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).
A healthier Wales	A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.
A more equal Wales	A society that enables people to fulfil their potential no matter what their background or circumstances (including their socio economic background and circumstances).
A Wales of cohesive communities	Attractive, viable, safe and well-connected communities.
A Wales of vibrant culture and thriving Welsh language	A society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.
A globally responsible Wales	A nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.

The well-being goals have been fully reflected in the SEA assessment framework to help ensure alignment with national policy and legislation on sustainability. The well-being goals relevant to each SEA objective are set out in the assessment framework (see **Table 4.2**), which was used to assess the feasible and preferred options. A separate summary of the assessment against the well-being goals is presented in **Section 6.5** of this report. The well-being goals have therefore informed this Environmental Report and helped to ensure that sustainable development in Wales has been adequately considered in the WRMP.

1.11 The Environment (Wales) Act 2016

The *Environment (Wales) Act 2016*¹⁴ introduced a new legislative approach for the sustainable management of natural resources (SMNR). It seeks to maintain and enhance the resilience of Wales' ecosystems and the services and benefits they provide and, in so doing, meet the needs of the present generation without compromising the ability of future generations to meet their needs. Section 3(1) of the *Environment (Wales) Act 2016* defines SMNR as:

- ▶ *"using natural resources in a way and at a rate that promotes achievement of the SMNR objective;*

¹⁴ Available from <http://www.legislation.gov.uk/anaw/2016/3/contents/enacted> [Accessed September 2017].

- ▶ *taking other action that promotes achievement of that objective; and*
- ▶ *not taking action that hinders achievement of that objective.”*

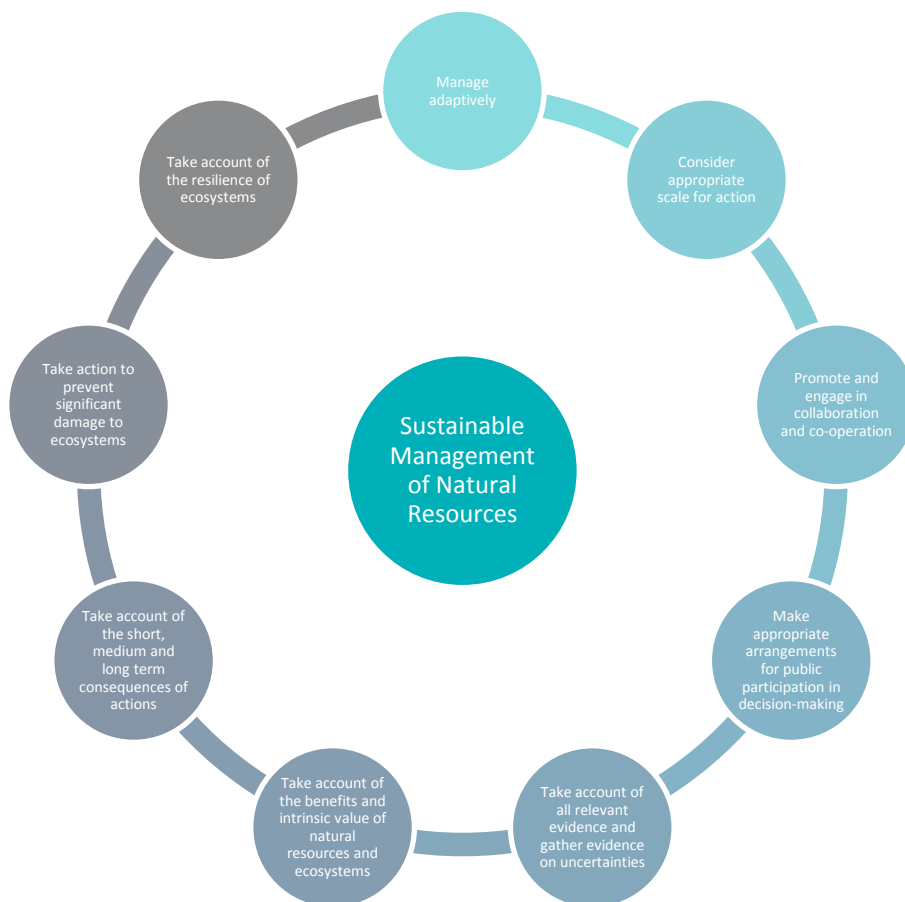
The objective for SMNR referred to above is “*to maintain and enhance the resilience of ecosystems and the benefits they provide and, in so doing—*

(a) meet the needs of present generations of people without compromising the ability of future generations to meet their needs, and

(b) contribute to the achievement of the well-being goals in section 4 of the Well-being of Future Generations (Wales) Act 2015”.

To achieve the objective of SMNR, the Act introduces a number of principles. These principles, which are to be applied equally, are highlighted in **Figure 1.4**.

Figure 1.4 Sustainable Management of Natural Resources – Principles



Section 6 of the Act places a duty on public authorities (including Welsh Water) to “*seek to maintain and enhance biodiversity*” so far as it is consistent with the proper exercise of those functions. In so doing, public authorities must also seek to “*promote the resilience of ecosystems*”.

The SEA objectives that are directly related to the SMNR objective are highlighted in the SEA assessment framework (see **Table 4.2**). The assessment of feasible and preferred options and the identification of potential mitigation/enhancement measures as part of this Environmental Report also support the biodiversity duties under the Act.

1.12 Environmental Report Structure

This Environmental Report is structured as follows:

- ▶ **Non-Technical Summary** - Provides a summary of the Environmental Report, including information on both the Final WRMP and the key findings of the assessment;
- ▶ **Section 1: Introduction** - Includes an overview of the Final WRMP, SEA and the Environmental Report contents;
- ▶ **Section 2: Review of Plans and Programmes** - Provides an overview of the review of those plans and programmes relevant to the WRMP which is contained at **Appendix A**;
- ▶ **Section 3: Baseline Analysis** - Presents the baseline analysis of social, economic and environmental characteristics and identifies the key sustainability issues relevant to the WRMP and SEA;
- ▶ **Section 4: Approach to the Assessment** - Outlines the approach to the SEA of the Final including the assessment framework and the technical difficulties encountered in completing the assessment including assumptions and uncertainties;
- ▶ **Section 5: Assessment of Feasible Options** - Presents the findings of the assessment of the feasible options identified for the WRMP (detailed assessment matrices are contained at **Appendix C**);
- ▶ **Section 6: Assessment of the Final WRMP**– Presents the findings of the assessment of the Final WRMP in terms of the preferred options identified for WRMP19 (detailed assessment matrices for preferred options are contained at **Appendix D**) including cumulative effects.
- ▶ **Section 7: Next Steps and Proposals for Monitoring** - Details the next steps in the SEA process including how the environmental effects of the WRMP will be considered and monitored.

Compliance with the SEA Regulations

A Quality Assurance Checklist at **Appendix F** details how the requirements of the SEA Directive and its transposing regulations have been addressed in this Environmental Report. **Table 1.3** indicates the location in this report of the relevant information required under the SEA regulations.

Table 1.3 Information Provided in this Report to Meet the Requirements of the SEA Regulations

SEA Requirement	Section of this Report where Relevant Information is Presented
An outline of the contents and main objectives of the plan or programme, and of its relationship with other relevant plans and programmes.	1.5, 2.3 and Appendix A
The relevant aspects of the current state of the environment and how it will change without implementation of the plan or programme.	3.2 – 3.9
The environmental characteristics of areas likely to be significantly affected.	3.2 – 3.9
Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds and the Habitats Directive.	3.2 – 3.10 (also see HRA report)
The environmental protection objectives, established at International, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation.	2.3 and Appendix A
The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects, on issues such as biodiversity, population, human health, flora, soil, water,	Feasible options: 5.2 - 5.5 and Appendix C Preferred options and resilience option:

SEA Requirement	Section of this Report where Relevant Information is Presented
air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the inter-relationship between these issues.	6.2 - 6.4 and Appendix D
The measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme.	6.5 and Appendix D
An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information.	4.2 – 4.7 and 6.7
A description of the measures envisaged concerning monitoring.	7.3
A non-technical summary of the information provided.	Non-technical summary

1.13 This Environmental Report

SEA regulation 13 states:

“(1) Every draft plan or programme for which an environmental report has been prepared in accordance with regulation 12 and its accompanying environmental report (“the relevant documents”) shall be made available for the purposes of consultation”.

In compliance with this regulation, the Draft WRMP was accompanied by an Environmental Report.

As this Environmental Report relates to the Final WRMP which has now been published, it is not being issued for consultation. However, it is being published to demonstrate that the likely significant effects on the environment of the Final WRMP have been identified, described and assessed.

2. Review of Plans and Programmes

2.1 Introduction

The SEA Regulations require a report containing “an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes” (Schedule 2(1)) as well as “The environmental protection objectives, established at international (European) Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation” (Schedule 2(5)).

One of the first steps in undertaking the SEA of the WRMP is therefore to identify and review other relevant plans and programmes which could influence the plan. These may be plans and programmes at an international/European, national, regional or sub-regional level, commensurate with the scope of the WRMP. The review aims to identify the relationships between the WRMP and these other documents i.e. how the WRMP could be affected by the other plans’ and programmes’ aims, objectives and/or targets, or how it could contribute to the achievement of their environmental and sustainability objectives. It is also a valuable source of information to support the completion of the social, economic and environmental baseline analysis and to determine the key issues for the WRMP and SEA (see **Section 3**).

The completed review of plans and programmes is used to provide the policy context for the subsequent assessment process and helps to inform the development of objectives that comprise the assessment framework (see **Section 4**).

2.2 Overview

The SEA Scoping Report included a review of plans and programmes, consistent with the requirements of the SEA Directive. Consultation responses to the Scoping Report identified additional plans and programmes for consideration in the review which have been subsequently included in this Environmental Report. Over 100 international/European, national, regional/sub-regional and local level plans and programmes have been reviewed. These are listed in **Table 2.1**, with the results of the review provided in **Appendix A**.

Table 2.1 Plans and Programmes Examined for the SEA of the WRMP

Plan / Programme
International / European Plans and Programmes
The Bonn Convention (or CMS) (1975) Bern Convention (1979) Ramsar Convention (1971) UNESCO World Heritage Convention (1972) Kyoto Protocol (1997) Aarhus Convention (1998) The Convention for the Protection of the Architectural Heritage of Europe (Granada Convention 1987) The European Convention on the Protection of Archaeological Heritage (Valetta Convention 1992) World Commission on Environment and Development (1987): Our Common Future (The Brundtland Report) United Nations Convention on Biodiversity (the Rio Convention, 1992) The World Summit on Sustainable Development (WSSD), Johannesburg, September 2002 - Commitments arising from Johannesburg Summit (2002) European Landscape Convention 2000 (became binding March 2007) The Paris Agreement (2015)
European Union (EU) Directives, Strategies & Policy Packages
European Commission (EC) (2006) Thematic Strategy for Soil Protection EU Directives on Environmental Impact Assessment (Codified Directive 2011/92/EU and Revised Directive 2014/52/EU)

Plan / Programme

EC (2011) A Resource- Efficient Europe- Flagship Initiative Under the Europe 2020 Strategy, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (COM 2011/21)

EC (2011) A Roadmap for Moving to a Competitive Low Carbon Economy in 2050

EC (2013) Strategy on Adaptation to Climate Change

EC (2014) A Policy Framework for Climate and Energy in the Period from 2020 to 2030

EC (2015) 'Closing the loop - An EU Action Plan for the Circular Economy' policy package

EU (1991) Directive 91/271/EEC for Urban Waste-water Treatment

EU (1991) Nitrates Directive (91/676/EEC)

EU (1992) Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) & Subsequent Amendments

EU (1998) Drinking Water Directive (98/83/EC)

EU (1999) Directive on the Landfill of Waste (99/31/EC)

EU (2000) Water Framework Directive (2000/60/EC)

EU (2001) Directive on the Assessment of the Effects of Certain Plans and Programmes on the Environment (SEA Directive) (2001/42/EC)

EU (2001) National Emissions Ceiling Directive 2001/81/EC

EU (2002) Environmental Noise Directive (Directive 2002/49/EC)

EU (2002) Directive 2002/91/EC on the Energy Performance of Buildings

EU (2004) Environmental Liability Directive (2004/35/EC)

EU (2005) Thematic Strategy on Air Pollution

EU (2006) Bathing Waters Directive 2006/7/EC

EU (2006) Mining Waste Directive 2006/21/EC

EU (2006) Animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals (2006/88/EC)

EU (2006) Directive 2006/118EC on the protection of groundwater against pollution and deterioration

EU (2006) Renewed EU Sustainable Development Strategy

EU (2007) Floods Directive 2007/60/EC

EU (2007) The Eel Directive 2007/1100/EC

EU (2008) Air Quality Directive (2008/50/EC) and previous directives (96/62/EC; 99/30/EC; 2000/69/EC & 2002/3/EC)

EU (2008) Marine Strategy Framework Directive 2008/56/EC

EU (2008) Directive on Waste (Directive 75/442/EEC, 2006/12/EC 2008/98/EC as amended)

EU (2008) Environmental Quality Standards Directive 2008/105/EC

EU (2009) Directive on the Conservation of Wild Birds (09/147/EC)

EU (2009) Renewable Energy Directive (2009/28/EC)

EU (2009) Birds Directive (2009/147/EC)

EU (2010) Energy 2020 - A Strategy for Competitive, Sustainable and Secure Energy

EU (2010) Europe 2020 : A strategy for smart, sustainable and inclusive growth

EU (2010) The Industrial Emissions Directive (2010/75/EU)

EU (2011) EU Biodiversity Strategy to 2020 – towards implementation

EU (2012) Energy Efficiency Directive (2012/27/EU)

EU (2013) Seventh Environmental Action Programme

EU (2015) Invasive Alien Species Regulation (1143/2014/EU)

National Plans and Programmes

Department for Communities and Local Government (DCLG) (2012) National Planning Policy Framework

DCLG (2014) National Planning Policy for Waste

Department of Energy and Climate Change (DECC) (2010) CRC Energy Efficiency Scheme

DECC (2011) National Policy Statements for Energy Infrastructure

Department for Environment, Food and Rural Affairs (Defra) (2000) Waterways for Tomorrow

Defra (2005) Making Space for Water: Taking forward a new Government strategy for flood and coastal erosion risk management in England (first Government response to 2004 consultation)

Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

Defra (2010) Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network

Defra (2010) Air Pollution: Action in a Changing Climate

Defra (2011) Shoreline Management Plan Guidance

Defra (2011) Mainstreaming Sustainable Development

Defra (2011) Natural Environment White Paper: The Natural Choice: Securing the Value of Nature

Defra (2011) Biodiversity 2020: A strategy for England's wildlife and ecosystem services

Defra (2012) National Policy Statement for Waste Water

Defra (2012) UK post 2010 Biodiversity Framework

Defra (2013) The National Adaptation Programme – Making the Country Resilient to a Changing Climate

Defra (2016) Creating a Great Place for Living – Enabling Resilience in the Water Sector Defra, Scottish Government, Welsh Government (2015) The Great Britain Invasive Non-native Species Strategy

Department for Transport (2011) National Policy Statement for Ports

Environment Agency (2008) Better Sea Trout and Salmon Fisheries: Our Strategy for 2008-2021

Environment Agency (2011) National Flood and Coastal Erosion Risk Management Strategy for England

Environment Agency (2013) Areas of Water Stress: Final Classification

Environment Agency (2016) Creating a Better Place: Our Ambition to 2020

Environment Agency (undated) Restoring Sustainable Abstraction Programme

Environment Agency (various) Drought Plans

Environment Agency and Natural Resources Wales (2017) Water Resources Planning Guideline: Interim Update

Plan / Programme

HM Government (1975) Salmon and Freshwater Fisheries Act
 HM Government (1975) Reservoirs Act
 HM Government (1979) Ancient Monuments and Archaeological Areas Act
 HM Government (1981) Wildlife and Countryside Act
 HM Government (1990) Planning (Listed Buildings and Conservation Areas) Act
 HM Government (1991) Water Resources Act
 HM Government (1994) UK Biodiversity Action Plan
 HM Government (2000) Countryside Rights of Way Act
 HM Government (2003) Water Act
 HM Government (2005) UK Sustainable Development Strategy
 HM Government (2006) Natural Environment and Rural Communities Act
 HM Government (2006) Climate Change and Sustainable Energy Act
 HM Government (2007) Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended 2010)
 HM Government (2008) Climate Change Act
 HM Government (2008) Future Water: The Government's Water Strategy for England
 HM Government (2009) Marine and Coastal Access Act
 HM Government (2009) The Groundwater (England and Wales) Regulations 2009
 HM Government (2009) The UK Renewable Energy Strategy
 HM Government (2009) Marine and Coastal Access Act 2009
 HM Government (2009) The Eels (England and Wales) Regulations 2009 (as amended 2011)
 HM Government (2010) Flood and Water Management Act 2010
 HM Government (2011) UK Marine Policy Statement
 HM Government (2011) UK Renewable Energy Roadmap
 HM Government (2011) Carbon Plan: Delivering our Low Carbon Future
 HM Government (2011) Water for Life: White Paper
 HM Government (2014) Water Act 2014
 HM Government (2015) Infrastructure Act 2015
 HM Government (2016) The Culture White Paper
 HM Government (2016) Environmental Permitting (England and Wales) Regulations 2016 SI 1154
 HM Government (2017) Conservation of Habitats & Species Regulations 2017
 HM Treasury (2016) National Infrastructure Delivery Plan
 Natural England (2011) UK Geodiversity Action Plan
 Ofwat (2008) Water Supply and Demand Policy
 Ofwat (2016) Water 2020
 JNCC and Defra (2012) UK Post-2010 Biodiversity Framework
 Countryside Council for Wales (2001) Register of Landscapes of Historic Interest
 Valuing Our Environment Partnership (2010) Valuing the Welsh Historic Environment
 Welsh Government (1998) Technical Advice Note 14: Coastal Planning
 Welsh Government (2006) Environment Strategy for Wales
 Welsh Government (2008) People, Places, Futures: The Wales Spatial Plan 2008 Update
 Welsh Government (2008) The Wales Transport Strategy
 Welsh Government (2009) One Wales One Planet: The Sustainable Development Scheme for Wales
 Welsh Government (2009) Technical Advice Note 5: Nature Conservation and Planning
 Welsh Government (2009) Technical Advice Note 16: Sport, Recreation and Open Space
 Welsh Government (2010) Climate Change Strategy for Wales
 Welsh Government (2010) Towards Zero Waste, One Wales: One Planet – Overarching Waste Strategy Document for Wales
 Welsh Government (2010) The Biodiversity Framework for Wales
 Welsh Government (2011) Welsh Government Policy Statement: Preparing for a Changing Climate
 Welsh Government (2011) National Strategy for Flood and Coastal Erosion Risk Management in Wales
 Welsh Government (2012) Energy Wales: A Low Carbon Transition
 Welsh Government (2013) Historic Environment Strategy for Wales
 Welsh Government (2013) Partnership for Growth: The Welsh Government Strategy for Tourism 2013 – 2020
 Welsh Government (2015) Water Strategy for Wales
 Welsh Government (2015) The Welsh National Marine Plan – Initial Draft
 Welsh Government (2015) Well-being of Future Generations (Wales) Act 2015
 Welsh Government (2015) Nature Recovery Plan
 Welsh Government (2015) Wales Rural Development Programme 2014-2020
 Welsh Government (2016) Technical Advice Note 12: Design
 Welsh Government (2016) Planning Policy Wales (Edition 9)
 Welsh Government (2016) Historic Environment (Wales) Act 2016
 Welsh Government (2016) The Environment (Wales) Act 2016
 Welsh Government (2016) The State of Natural Resources Report (SoNaRR)
 Welsh Government (2016) Guiding Principles for Developing Water Resources Management Plans
 Welsh Government (2017) Natural Resources Policy

Regional Plans and Programmes

Water Company (various) Drought Plans
 Water Company (various) Water Resources Management Plans
 Dŵr Cymru Welsh Water (2007) Our Sustainable Future
 Dŵr Cymru Welsh Water (2017) Making Time for Nature: Dŵr Cymru Welsh Water's Plan for Maintaining and Enhancing Biodiversity

Plan / Programme

Sub-regional/ Local Plans and Programmes

AONB Management Units (various) AONB Management Plans
 Defra (Various) Eel Management Plans
 Environment Agency / Natural Resources Wales (various) Flood Risk Management Plans
 Environment Agency / Natural Resources Wales (various) River Basin Management Plans
 Environment Agency / Natural Resources Wales (various) Catchment Abstraction Management Strategies
 Environment Agency (2017) Wye Waterway Plan
 Environment Agency and Natural Resources Wales (various) Salmon Action Plans
 Local Biodiversity Action Plans (LBAPs), including Species and Habitats Action Plans (various)
 Local Geodiversity Action Plans (LGAPs)
 Local Planning Authority (various) Land Use Plans
 National Park Management Plans (various)
 Shoreline Management Plans (various)

2.3 Policy Objectives Relevant to the Water Resources Management Plan

The Welsh Government's 'Guiding Principles for Developing Water Resources Management Plans' 2016 (the Guiding Principles) includes a section that identifies key policy objectives for WRMPs. It highlights the Water Strategy for Wales, which makes clear the importance that the Welsh Government attaches to adopting an integrated and sustainable approach to managing water resources. This requires the integrated management of natural resources to maximise economic and social benefits in an equitable way while protecting all ecosystems and the environment. WRMP's must ensure the long-term needs of a sustainable and resilient environment and that there are sufficient, reliable water resources available in Wales.

The Guiding Principles also highlight that WRMP's should focus on delivering towards improving the social, economic, environmental and cultural well-being of Wales as reflected in the seven well-being goals established in the Well-being of Future Generations (Wales) Act 2015, and they should support other organisations to meet their statutory requirements under that Act (**Section 1.9**).

Climate change adaptation and mitigation are also identified in the Guiding Principles as key areas for WRMPs. This includes taking account of future changes in the climate and their implications for water supply and management and the need to reduce the carbon footprint associated with the abstraction, storage, treatment and provision of water.

The Guiding Principles additionally reference the Environment (Wales) Act 2016 which introduces the objective for SMNR (**Section 1.10**). WRMPs should demonstrate how an area based approach has been used to promote strategic investment in sustainable water and drainage infrastructure that improves local environments.

The policy objectives and messages identified from the review of other plans and programmes are summarised in **Table 2.2**. It is important that the assessment takes these into account as this helps to highlight any areas where the WRMP will help or hinder the achievement of the objectives of the other plans. Only the key sources are included; however, it is acknowledged that many other plans and programmes could also be included. The relevance of the key objectives and policy measures to the assessment of the WRMP is also indicated in **Table 2.2**. Objectives and messages are set out for the following topic areas:

- ▶ Biodiversity;
- ▶ Geology and Soils;
- ▶ Water;
- ▶ Air Quality and Climate;
- ▶ Human Environment (including population and human health);
- ▶ Material Assets and Resource Use;
- ▶ Cultural Heritage; and

► Landscape.

Table 2.2 Key Policy Objectives Identified in Other Plans and Programmes relevant to the Assessment of the WRMP

Key Objectives and Policy Messages	Key Sources	Relevant to the Assessment of the WRMP?
Biodiversity		
Conservation and enhancement of the levels and variety of biodiversity, including designated sites, priority species and habitats	Bern Convention; Bonn Convention; Habitats Directive; Invasive Alien Species Regulation; Ramsar Convention on Wetlands; Birds Directive; EU Biodiversity Strategy to 2020; Marine Strategy Framework Directive; Biodiversity 2020; Natural Environment White Paper; UK post 2010 Biodiversity Framework; Better Sea Trout and Salmon Fisheries; Eel Regulations; Wildlife and Countryside Act; UK Biodiversity Action Plan; Marine and Coastal Access Act; Conservation of Habitats & Species Regulations; UK Marine Policy Statement; Countryside and Rights of Way Act; National Planning Policy Framework; Planning Policy Wales (Edition 9); Environment Strategy for Wales; TAN5: Nature Conservation and Planning; Environment (Wales) Act; Well-being of Future Generations (Wales) Act; Natural Resources Policy; Nature Recovery Plan; Local Biodiversity Action Plans (BAP) including Species and Habitats Action Plans (various); Local Planning Authority Local Plans (various); AONB Management Plans; National Park Management Plans (various); Making Time for Nature.	Yes
Geology and Soils		
Protection and enhancement of geology and soil quality	Thematic Strategy for Soil Protection; National Planning Policy Framework; Planning Policy Wales (Edition 9); TAN5: Nature Conservation and Planning; Natural Resources Policy; UK Geodiversity Action Plan; Local Planning Authority Local Plans (various); AONB Management Plans; National Park Management Plans (various); Local Geodiversity Action Plans (LGAPs).	Yes
Water		
Protection and enhancement of all water supplies and resources	Bathing Waters Directives; Drinking Water Directive; Nitrates Directive; Urban Waste Water Directive; Water Framework Directive; Environmental Quality Standards Directive; Restoring Sustainable Abstraction Programme; Future Water; National Planning Policy Framework; Planning Policy Wales (Edition 9); Water Strategy for Wales; River Basin Management Plans (various); Water Company Drought Plans (various); Water Company Water Resource Management Plans (various); Local Planning Authority Local Plans (various).	Yes
Promoting the sustainable and efficient use of water	Water Framework Directive; Water for People and the Environment; Managing Water Extraction; Restoring Sustainable Abstraction Programme; Water Act; Water Supply and Demand Policy; National Planning Policy Framework; Planning Policy Wales (Edition 9); Water Strategy for Wales; Natural Resources Policy; River Basin Management Plans (various); Water Company Drought Plans (various); Water Company Water Resource Management Plans (various); Local Planning Authority Local Plans (various).	Yes
Minimising flood risk and improving flood control infrastructure	Floods Directive; Water Framework Directive; Shoreline Management Plan Guidance; National Flood and Coastal Erosion Risk Management Strategy for England; Flood and Water Management Act; National Planning Policy Framework; Planning Policy Wales (Edition 9); TAN15: Development and Flood Risk; National Strategy for Flood and Coastal Erosion Risk Management in Wales; Shoreline Management Plans (various); Flood Risk Management Plans (various); River Basin Management Plans (various); Local Planning Authority Local Plans (various).	Yes
Air Quality and Climate		
Ensuring air quality is maintained or enhanced and	Ambient Air Quality and Cleaner Air for Europe; National Emissions Ceiling Directive; Industrial Emissions Directive; Air Quality Strategy for England,	Yes

Key Objectives and Policy Messages	Key Sources	Relevant to the Assessment of the WRMP?
that emissions of air pollutants are kept to a minimum	Scotland, Wales and Northern Ireland; Air Pollution: Action in a Changing Climate; Air Quality Plans; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various)	
Minimising the effects of climate change on natural resources, inhabitants and the economy	Strategy on Adaptation to Climate Change; National Adaptation Programme; Water for People and the Environment; UK Sustainable Development Strategy; National Flood and Coastal Erosion Risk Management Strategy for England; Adapting to Coastal Change; National Planning Policy Framework; People, Places, Futures: The Wales Spatial Plan 2008 Update; Planning Policy Wales (Edition 9); Environment Strategy for Wales; Climate Change Strategy for Wales; National Strategy for Flood and Coastal Erosion Risk Management in Wales; Natural Resources Policy; Water Resources Management Plans (various); River Basin Management Plans (various); Shoreline Management Plans (various); Flood Risk Management Plans (various); Local Planning Authority Local Plans (various).	Yes
Minimising emissions of greenhouse gases that may cause climate change	Kyoto Protocol; Paris Agreement; Europe 2020; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; Climate Change Act; Renewable Energy Roadmap; National Planning Policy Framework; UK Sustainable Development Strategy; UK Renewable Energy Strategy; Environment Strategy for Wales; Climate Change Strategy for Wales; Environment (Wales) Act; Planning Policy Wales (Edition 9); Energy Wales; Local Planning Authority Local Plans (various).	Yes
Human Environment		
Addressing deprivation and reducing inequality	World Summit on Sustainable Development; Europe 2020; Sustainable Development Strategy; National Planning Policy Framework; People, Places, Futures: The Wales Spatial Plan 2008 Update; Energy Wales; Planning Policy Wales (Edition 9); Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Promoting improvements to health and well-being	Aarhus Convention; Sustainable Development Strategy; World Summit on Sustainable Development; Seventh Environmental Action Programme to 2020; National Planning Policy Framework; Planning Policy Wales (Edition 9); TAN 16: Sport, Recreation and Open Space; Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Providing high quality services, community facilities and social infrastructure that is accessible to all	National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	Yes
Achieving sustainable economic growth and promoting key sectors in the local economy	World Summit on Sustainable Development; Europe 2020; UK Marine Policy Statement; Sustainable Development Strategy; National Planning Policy Framework; People, Places, Futures: The Wales Spatial Plan 2008 Update; Planning Policy Wales (Edition 9); Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Improving and expanding the tourism economy	National Planning Policy Framework; Planning Policy Wales (Edition 9); Partnership for Growth: The Welsh Government Strategy for Tourism 2013 – 2020; Local Planning Authority Local Plans (various); AONB Management Plans (various); National Park Management Plans (various).	No
Maximising job opportunities for all and enhancing the quality of employment opportunities	Europe 2020; National Planning Policy Framework; Planning Policy Wales (Edition 9); Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Minimising noise pollution	Environment Noise Directive; Guidelines for Community Noise; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	Yes
Promoting sustainable transport	Sustainable Development Strategy; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; The Wales Transport Strategy; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	No

Key Objectives and Policy Messages	Key Sources	Relevant to the Assessment of the WRMP?
Material Assets and Resource Use		
Minimising waste production, promoting re-use and recycling	Waste Framework Directive; Landfill of Waste Directive; Waste Management Plan for England; One Wales One Planet; Environment Strategy for Wales; National Planning Policy for Waste; Toward Zero Waste; Planning Policy Wales (Edition 9); Environment (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Promoting the most effective and efficient use of natural resources	World Summit on Sustainable Development; Seventh Environmental Action Programme to 2020; Energy 2020; Europe 2020; UK Sustainable Development Strategy; One Wales One Planet; National Planning Policy for Waste; Towards Zero Waste; Environment (Wales) Act; Natural Resources Policy; Local Planning Authority Local Plans (various).	Yes
Promoting the use of sustainable/renewable energy	Seventh Environmental Action Programme to 2020; Energy 2020; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; Renewable Energy Directive; Sustainable Development Strategy; Carbon Plan; Climate Change Act; UK Renewable Energy Strategy; UK Renewable Energy Roadmap; UK Sustainable Development Strategy; National Planning Policy Framework; Climate Change Strategy for Wales; Energy Wales; Natural Resources Policy; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	Yes
Promoting the use of sustainable design and construction and encouraging energy efficiency	Energy 2020; Energy Efficiency Directive; A Roadmap for Moving to a Competitive Low Carbon Economy in 2050; Renewable Energy Directive; UK Sustainable Development Strategy; Energy Wales; National Planning Policy Framework; Planning Policy Wales (Edition 9); Local Planning Authority Local Plans (various).	Yes
Cultural Heritage		
Protecting and enhancing cultural heritage and archaeological sites	World Heritage Convention; Heritage Protection for the 21st Century - White Paper; Ancient Monuments and Archaeological Areas Act; Planning (Listed Buildings and Conservation Areas) Act; National Planning Policy Framework; Planning Policy Wales (Edition 9); The National Heritage Act; Historic Environment (Wales) Act; Register of Landscapes of Historic Interest Well-being of Future Generations (Wales) Act; Local Planning Authority Local Plans (various).	Yes
Landscape		
Protecting and enhancing the quality and distinctiveness of natural landscapes and environmental resources	European Landscape Convention; National Planning Policy Framework; Planning Policy Wales (Edition 9); Environment Strategy for Wales; Register of Landscapes of Historic Interest; AONB Management Plans (various); Local Planning Authority Local Plans (various); National Park Management Plans (various).	Yes

This work has informed the selection of SEA objectives and guide questions in the SEA Framework, which is discussed in **Section 4.3** of this report.

3. Baseline Analysis

3.1 Introduction

The SEA Regulations require a report containing “*The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme*” (Schedule 2(2)), “*The environmental characteristics of areas likely to be significantly affected*” (Schedule 2(3)), and “*Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds(1) and the Habitats Directive*” (Schedule 2(4)).

This section of the report identifies and characterises current environmental baseline conditions, along with how these are likely to change in the future. Only with a knowledge of existing conditions, and a consideration of their likely evolution, can the effects of the WRMP be identified and appraised and its subsequent success or otherwise be monitored. This is also useful in determining the key issues for each topic that should be taken forward in the SEA, through the SEA objectives and guide questions. The analysis is presented for the following topics:

- ▶ Biodiversity;
- ▶ Geology, Land-use and Soils;
- ▶ Water;
- ▶ Air Quality and Climate;
- ▶ Human Environment (including population and human health);
- ▶ Material Assets and Resource Use;
- ▶ Cultural Heritage; and
- ▶ Landscape and Seascape.

The data has been drawn from a variety of sources, including a number of the plans and programmes reviewed as part of the SEA process (see **Section 2** of this report and **Appendix A**). Where appropriate, figures are referenced in this overview. The key sustainability issues arising from the review of baseline conditions are summarised for each topic.

3.2 Biodiversity

Baseline Characteristics

Biodiversity is defined as the variety of plants (flora) and animals (fauna) in an area, and their associated habitats. All ecological processes are the product of interactions between different groups of organisms and are dependent upon there being a range of these present. In this sense, biodiversity – the variety and variability of living organisms – ultimately underpins the functioning of all ecosystems and thereby the delivery of all ecosystem services (which are critical in: providing clean air and water, food and raw materials; helping to regulate the climate; and providing space for recreation and amenity). Protected sites are key in the protection of semi-natural habitats and species and can act as excellent examples of natural resource management. The importance of preserving biodiversity is recognised from an international to a local level.

The importance of biodiversity in Wales is reflected by the number and variety of international, national and local nature conservation designations. More than 10 per cent of Wales’ land cover is designated for nature conservation.

In the Welsh Water area there are a large number of sites that are designated as internationally, nationally or locally important for biodiversity. There are four categories of protected areas:

- ▶ Protected areas that are established through International Agreements (including Ramsar Sites, which are wetlands of international importance designated under the Ramsar Convention which are afforded the same degree of protection as European sites);
- ▶ Protected areas that are established under European Union Directives of other European Initiatives (including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) identified as making significant contribution to conserving designated habitats and species);
- ▶ Protected areas that are established under National Legislation (Sites of Special Scientific Interest (SSSIs) and National Nature Reserves)); and
- ▶ Marine Protected Areas.

Sites of European importance (SPAs and SACs) are designated to conserve natural habitats and species of wildlife which are rare, endangered or vulnerable in the European Community. In the UK, these form part of the 'Natura 2000' network of sites protected under the Habitats Directive (92/43/EEC). There are 112 'Natura 2000' sites in Wales (including along the border region with England, but excluding offshore). These include 10 Ramsar sites, 92 SACs, and 20 SPAs¹⁵. Interest features, associated with European sites, can be vulnerable (a function of sensitivity and exposure) to water resource permissions.

Approximately 70 per cent of the Welsh coastline is designated as either SAC or SPA, with a range of habitats such as coastal saltmarsh, grazing marsh, mudflats, reedbeds, cliffs, dunes and shingle. Management of the coast including shoreline reinforcements, flood defence, drainage and land reclamation have threatened coastal habitats and create challenges for future management.

As shown in **Table 3.1** within the Welsh Water supply area there are 9 Ramsar sites, 86 SACs, and 16 SPAs. Other internationally important sites to consider include the Rhinog Biogenetic Reserve in North Wales (Blaenau Ffestiniog WRZ) and the UNESCO biosphere reserve at Cors Fochno in the Dyfi estuary near Borth in Ceredigion (West Wales)¹⁶.

The location of designated sites across the Welsh Water supply area is shown in **Figure 3.1**.

Table 3.1 Designations in the Welsh Water Supply Area¹⁷

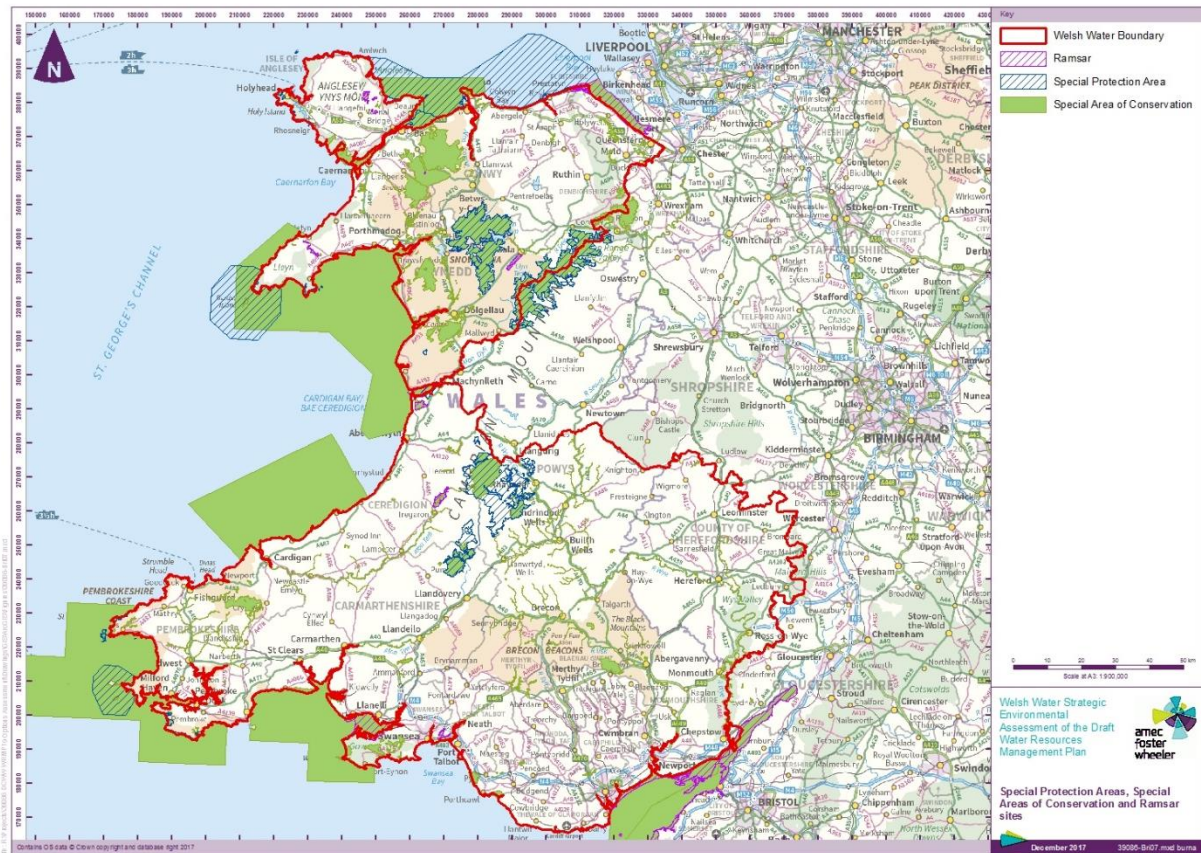
Designated Site Classification	Number of Sites within Welsh Water supply area (wholly or partially)	Total Area (hectares) within Welsh Water supply area	Number of sites in Wales (including cross border sites with England)
Ramsar	9	43,911	10
Special Area of Conservation (SAC)	86	676,562	92
Special Protection Areas (SPA)	16	245,004	20
Site of Special Scientific Interest (SSSI)	948	258,323	1,047
National Nature Reserve	64	24,086	76
Local Nature Reserve	91	8,733	

¹⁵ JNCC (2016). Protected Sites. Available at: www.jncc.gov.uk/page-4. [Accessed October 2017]

¹⁶ The UNESCO Biosphere Reserve status is awarded in recognition of the way a local community lives sustainably in an area of special landscape quality with a rich wildlife. The designated area includes Aberystwyth, Llanbrynmair, Llanydawddwy, Corris Uchaf, and Aberdyfi.

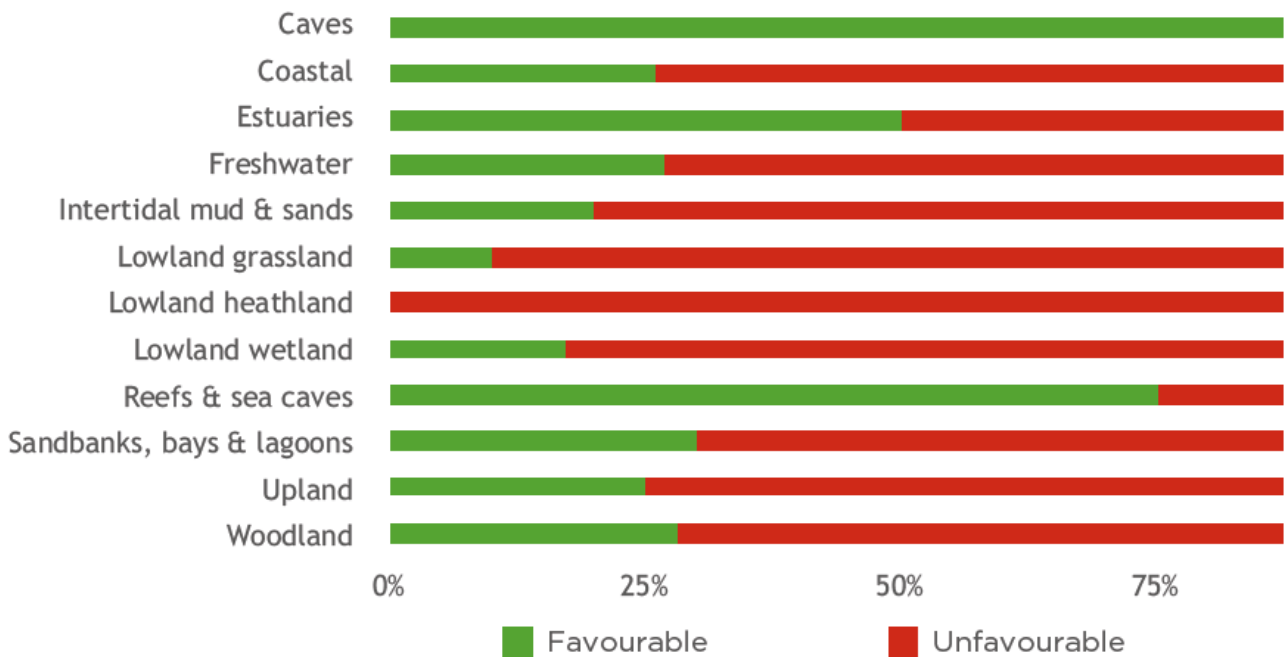
¹⁷ JNCC Protected Sites data (2017 data release). Available online at: www.jncc.gov.uk [Accessed October 2017]

Figure 3.1 European Sites in the Welsh Water Supply Area



The majority of SAC and SPA habitats in Wales are in unfavourable condition (75 per cent) with the exception of caves (100 per cent in favourable condition), as shown in **Figure 3.2**.

Figure 3.2 Percentage of SAC and SPA Habitats in Favourable and Unfavourable Condition¹⁸

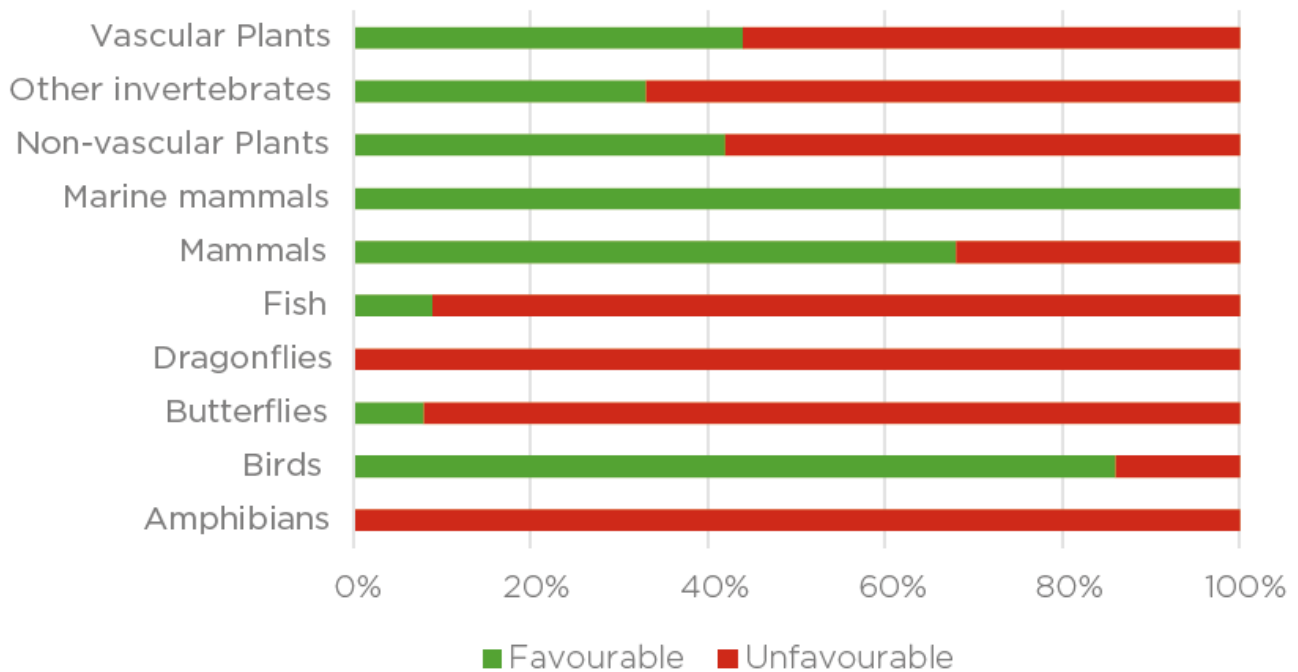


The condition of SAC and SPA species in Wales remains mostly unfavourable (55 per cent), with the exception of birds and mammals of which 86 per cent and 68 per cent are in favourable condition respectively (see **Figure 3.3**). Butterflies are an example of species in unfavourable condition. Thirty two species of butterflies (50 per cent) have decreased over the past 10 years with 20 of these showing statistically significant declines¹⁹. It is thought that fragmentation and loss of (and change in) habitat has caused these declines.

¹⁸ NRW (2015). A Snapshot of the State of Wales' Natural Resources, June 2015. Available online at: <http://naturalresources.wales/media/4797/snapshot-report.pdf> [Accessed February 2017]

¹⁹ Fox, R., Brereton, T.M., Asher, J., Botham, M.S., Middlebrook, I., Roy, D.B. and Warren, M.S (2011) The State of the UK's Butterflies 2011. Butterfly Conservation and the Centre for Ecology & Hydrology, Wareham, Dorset. Available at: <https://butterfly-conservation.org/files/soukb2011.pdf> [Accessed February 2017].

Figure 3.3 Percentage of SAC and SPA Species in favourable and Unfavourable Condition²⁰



There are 948 SSSIs either wholly or partly within the Welsh Water supply area, totalling 258,323 hectares. The 2006 Rapid Review recorded the condition of the 1,047 SSSIs in Wales. In Wales, 47 per cent of SSSIs were assessed to high confidence levels and the results showed that 32 per cent of sites were in favourable condition and 68 per cent were in unfavourable condition. However, based on individual features within a SSSI, 47 per cent of features were in favourable condition²¹.

There are 76 National Nature reserves (NNRs) in Wales and 64 either wholly or partially within Welsh Waters Supply Area. In 2008, 57 per cent of Wales’ NNRs were in favourable condition, and 43 per cent had one or more features in unfavourable declining condition.

There are 91 Local Nature Reserves within the Welsh Water Supply Area. **Figure 3.4** shows all sites but many will not show due to their small size.

There are 38 priority habitats in Wales (an increase from 37 in 2002). In 2008, 15 priority habitats (40 per cent) were classified as stable or increasing in Wales compared with 11 (30 per cent) in 2002, and 14 (36 per cent) in 2005. However, 20 priority habitats (53 per cent) were declining in 2008 compared to 17 habitats (50 per cent) in 2002, and 23 (59 per cent) in 2005²². Habitats within the Marine environment exhibit the greatest deterioration, with continued or accelerated decline across 60 per cent of marine habitats compared to only 8 per cent for terrestrial habitats and 33 per cent for freshwater habitats²³.

Priority species including Atlantic salmon and brown/sea trout are vulnerable to changes in water quality, quantity and barriers to migration, with salmon stocks at an all-time low across their North Atlantic range, and specific concern over trout rivers in south-west Wales. All of the 23 principal salmon rivers in Wales are classed as ‘At Risk’ of failing to achieve their conservation and management targets. Salmon supports the

²⁰ NRW (2015). A Snapshot of the State of Wales’ Natural Resources, June 2015. Available online at: <http://naturalresources.wales/media/4797/snapshot-report.pdf> [Accessed February 2017]

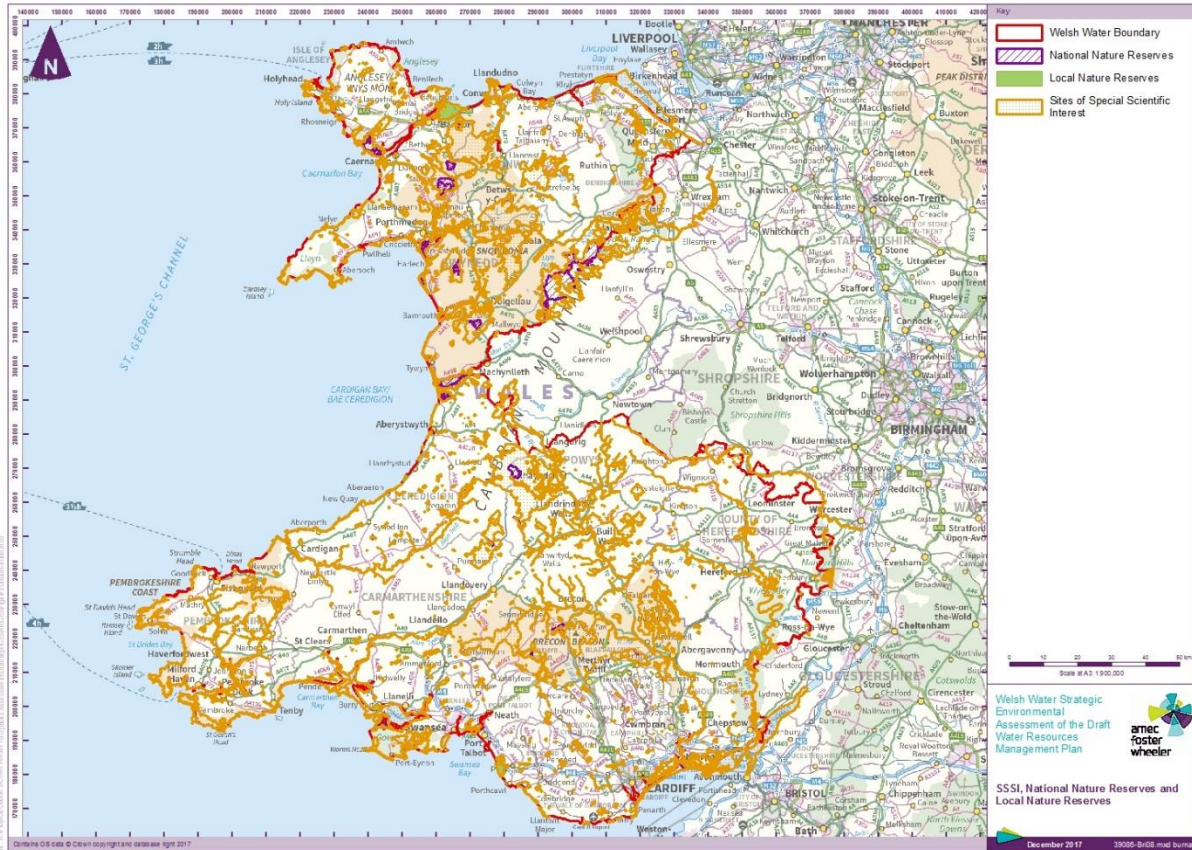
²¹ Countryside Council for Wales (2006) Condition of SSSI Sites and Features.

²² Welsh Government (2012) Trends in Biodiversity Action Plan by priority species and habitats. Available online at: <https://stats.wales.gov.wales/Catalogue/Environment-and-Countryside/State-of-the-Environment/Distinctive-Biodiversity-Landscapes-and-Seascapes/TrendsInBiodiversityActionPlan-by-PrioritySpeciesAndHabitats> [Accessed February 2017]

²³ NAT(2011) UK National Ecosystems Assessment Technical Report Available at <http://uknea.unep-wcmc.org/> [Accessed February 2017]

designation of six rivers in Wales under the Habitats Directive, and poor performance with respect to salmon will limit achievement of associated targets.²⁴

Figure 3.4 National and Local Nature Conservation Designations in the Welsh Water Supply Area



Wales' wider countryside/urban environments are also significant biodiversity resources. Wales has extensive, biodiverse and economically significant semi-natural grasslands (Wales' most extensive semi-natural habitat), as well as a large amount of heathland and peatland habitats (which are extremely significant in providing long-term storage of carbon). Sand dunes, saltmarsh and sea cliffs are the most extensive coastal habitats in Wales and are important for nature conservation as well as a range of regulating services, including coastal erosion protection (sand dunes are worth £53-199 million as natural sea defences in Wales). However, they are under pressure from development and land-use change and erosion, and their condition is considered to be poor.

Of the land that Welsh Water owns, 60 per cent is of national conservation and biodiversity importance, supporting considerable numbers of some key species, such as otter, water vole and dormouse. Welsh Water investment is targeted at key areas to improve the quality of treated water that wastewater treatment works discharge into the surface water system, and also undertakes initiatives to reduce the levels of pesticides in the environment to protect water supplies and wildlife, as well as measures to protect designated sites under Welsh Water ownership²⁵.

²⁴ Natural Resources Wales (2016) Board Paper: Salmon and sea trout stock management – update. Paper 22.16. Available online at: <https://naturalresources.wales/media/677203/salmon-and-sea-trout-stock-management-update-nrw-b-2216.pdf>

²⁵ Welsh Water 2017. Making time for nature: Dŵr Cymru Welsh Water's plan for maintaining and enhancing biodiversity. Available online at: <http://www.dwrcymru.com/en/Environment.aspx> [Accessed October 2017]

Green Infrastructure

Green infrastructure consists of high quality natural and semi-natural areas which form a network of green spaces, water and other environmental features in urban and rural areas. Examples include trees, parks, gardens, road verges, allotments, green roofs/walls, sustainable drainage systems (SuDS), rivers and wetlands. Green infrastructure can provide new or improved wildlife habitats, as well as refuges for vulnerable species. It also has numerous other benefits, including reducing flood risk; removing air and water pollution with associated health benefits; reducing urban heating effects and capturing greenhouse gases; and increasing wellbeing and community cohesion. Green infrastructure can also create attractive high quality landscapes.²⁶

Welsh Water already contributes to the development of green infrastructure through the RainScope programme, which delivers sustainable drainage schemes across the supply area to reduce the number of flooding incidents and discharges from overflows. Schemes include landscaped basins that capture and filter surface water runoff from roofs and roads; landscaped channels to reduce the speed of surface water, allowing infiltration into the soil; grass channels; porous paving; and Geocellular storage systems to manage surface water runoff either as a soakaway or as a storage tank. These schemes also have the benefit of improving the local environment, creating habitats and increasing resilience to climate change.²⁷

Green infrastructure has links across biodiversity, soils and geology, flood risk, air quality and climate, human health and wellbeing, and landscape. To avoid duplication, green infrastructure is discussed under biodiversity; however, key sustainability issues and assessment framework guide questions (see **Section 4.3**) are included under the relevant topic areas as appropriate.

Likely Evolution of the Baseline without the WRMP

The '2011 UK National Ecosystem Assessment'²⁸, the 2013 'State of Nature Report'²⁹ and the 2016 'State of Nature Report'³⁰ show a continuing decline in biodiversity. Although the picture is varied, with some species experiencing recovery and others a decline, overall the threat is high. Deterioration in habitat condition remains a significant concern with more than 50 per cent of Biodiversity Action Plan (BAP) habitats in decline in Wales. The alteration of the composition of lowland semi-natural grasslands (due mainly to changing farming practices and urbanisation) in particular was one of the most rapid and widespread vegetation changes to have taken place in Wales during the 20th Century. Examples of large-scale habitat loss in Wales include:

- ▶ 30 per cent loss of semi-natural ancient woodland, post war;
- ▶ 97 per cent loss of lowland semi-natural grassland over the last century; and
- ▶ 51 per cent loss of lowland heathland and 95 per cent loss of wet heathland on the Llŷn Peninsula between 1920/22 and 1987/88³¹.

Three quarters of all features within all designated sites are in unfavourable or declining condition and only around 14 per cent of woodland is ancient semi-natural (which is of the highest biodiversity value). There has also been a decline in the quantity and quality of hedges, copses, small woods, ponds and ditches which act as habitat corridors and contribute to connectivity in the landscape. Some of the most widespread and significant effects on ecosystems are damage to vegetation from pollution such as exposure to ozone,

²⁶ Wildlife Trusts Wales (2016) Green Infrastructure: A Catalyst for the Well-being of Future Generations In Wales. Available online at: http://www.wtwales.org/sites/default/files/green_infrastructure.pdf [Accessed October 2017]

²⁷ Welsh Water (2017) RainScope. Available online at: <http://www.dwrwymru.com/en/My-Wastewater/RainScope.aspx> [Accessed October 2017]

²⁸ UK National Ecosystem Assessment, June 2014. Available online at: <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx> [Accessed February 2017]

²⁹ State of Nature 2013 (prepared by a collaboration between UK conservation and research organisation). Available online at: <https://www.bto.org/research-data-services/publications/state-nature/2013/state-nature-report-2013> [Accessed February 2017]

³⁰ State of Nature 2016 (prepared by a collaboration between UK conservation and research organisation). Available online at: http://www.rspb.org.uk/Images/State%20of%20Nature%20UK%20report_%2020%20Sept_tcm9-424984.pdf [Accessed February 2017]

³¹ NRW (2015). A Snapshot of the State of Wales' Natural Resources, June 2015. Available online at: <http://naturalresources.wales/media/4797/snapshot-report.pdf> [Accessed February 2017]

eutrophication and acidification. Pollution from the use of herbicides, pesticides and fertilisers has direct impacts on the diversity of habitats and pollinators.

Historically, the marine environment around Wales has suffered significant habitat loss, with key examples being coastal habitat (particularly saltmarsh) and subtidal native oyster beds. It can be anticipated that the level of activities and developments in the marine environment will increase over the next 20 years, with potential negative impacts for marine ecology and biodiversity³².

There is currently limited data on the condition of SSSIs in Wales and consequently it has not been possible to identify trend-based data at this time. However, as it can take many years for habitats to recover from damage, it seems likely that there will be little change to SSSI conditions in the immediate future.

The key threats to Welsh biodiversity identified by the 2016 State of Nature report³³ include:

- ▶ Habitat loss and degradation, such as the loss of blanket bog;
- ▶ Fragmentation and isolation of habitats for many reasons, such as inappropriate development;
- ▶ Human population increases;
- ▶ Climate change;
- ▶ Excessive nutrient input and other forms of pollution;
- ▶ Over-exploitation and unsustainable use, including agricultural pressures; and
- ▶ Invasive alien species, for example rhododendron in Snowdonia.

Welsh Water proactively manages a number of sites, implementing biodiversity action plans to develop ongoing conservation work. This work is ongoing and has included providing or improving habitat for key species and monitoring species and habitat. Welsh Water also work with others to maintain and enhance biodiversity, including:

- ▶ Contributing to the Llyn Fens LIFE Project in Anglesey, the largest wetland restoration project in Wales;
- ▶ Working with NRW and the Brecon Beacons National Park Authority to deliver two peat restoration projects;
- ▶ Supporting charitable organisations to develop and deliver actions at a local level, contributing the wider national effort to ensure 'good ecological status' of watercourses under the Water Framework Directive; and
- ▶ Supporting organisations to deliver effective plans for the control or invasive non-native species. Two landscape projects have been supported to date – one in the Dee catchment and one in the Wye and Usk catchment.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP arising from the analysis of the biodiversity baseline are:

- ▶ the need to protect and enhance sites designated for nature conservation;
- ▶ the need to protect and enhance non-designated sites;

³² Welsh Government (2015) Wales' Marine Evidence Report
<http://gov.wales/topics/environmentcountryside/marineandfisheries/marine-planning/other-supporting-evidence/wales-marine-evidence-report/?lang=en> [Accessed February 2017].

³³ State of Nature 2016, Wales. Available online at:
http://www.rspb.org.uk/Images/StateofNature2016_Wales_English_1%20Sept%20pages_tcm9-425217.pdf [Accessed February 2017]

- ▶ the need to continue to increase and improve the condition of priority habitats and habitats of priority species, and restore populations of these species and other specially protected species;
- ▶ the need to prevent the spread/introduction of invasive non-native species;
- ▶ the need to maintain/enhance ecological connectivity;
- ▶ the need to sustainably manage biodiversity assets, taking into account the effects of climate change;
- ▶ the need to recognise the key role that green infrastructure plays in supporting (*inter alia*) biodiversity, landscape, wellbeing and climate change resilience;
- ▶ the need to protect and enhance the green infrastructure network;
- ▶ the need to continue monitoring biodiversity and ecological indicators; and
- ▶ the need to work within environmental limits and capacities.

3.3 Geology, Land Use and Soils

Baseline Characteristics

Geology

The bedrock geology of Wales is extremely varied and comprises sandstone, limestone and igneous rock. As a broad overview, the following rock types exist in a progression from North West to South East (predominant rock types): Ordovician; Silurian; and Devonian³⁴. The Permo-Triassic sandstone forms an important groundwater resource in North Wales, whilst peat, sand and gravel deposits along river valleys support strategic local water supplies.

Coal and metal mining has been very important to Wales historically. The South Wales Coalfield stretches across a large part of South Wales and is still mined to some extent, although less than previously (and from opencast or drift mines rather than deep mines). Lead and silver were once produced from mines in mid-Wales, from a series of mines inland from Aberystwyth. Copper, meanwhile, was mined in Snowdonia and at Parys Mountain on Anglesey, whilst gold was exploited around Dolgellau and Pumpsaint. A number of other metals were produced including zinc, arsenic, antimony and manganese. The geodiversity of Wales has led to the forming of landscapes and environmental settings that have strong cultural service value. For example, the mountains of Snowdonia attract tourists to Wales whilst coal mining has helped to define the cultural identity of the South Wales Valleys.

Within Wales, there are approximately 300 SSSIs designated for geology and earth science features. There are also 480 Geological Conservation Review (GCR) sites, 700 Regionally Important Geological / geomorphological Sites (RIGS), and two internationally recognised Geoparks. Fforest Fawr Global Geopark is within the Brecon Beacons National Park in South Wales and its geological heritage is of European significance, and the GeoMôn Global Geopark is located on Anglesey, north west Wales³⁵.

Land Use and Soil

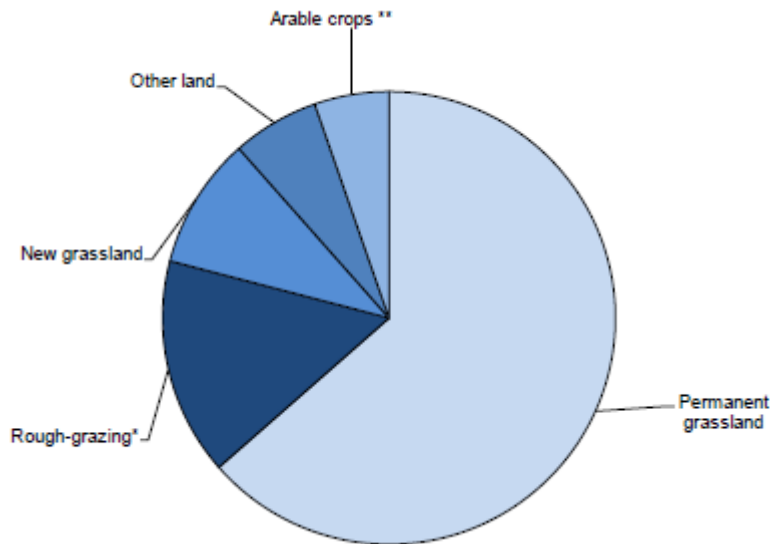
Land use in Wales is dominated by agricultural land under pasture and rough grazing (72.3 per cent); a small proportion of the land in Wales is under crop or 'other' types of agriculture (4.2 per cent) (urban land including land not otherwise specified accounts for 9.8 per cent of land area in Wales compared to 19.2 per

³⁴ CCW (2005). Strategic Environmental Assessment Guidance for Practitioners. Available at: www.ccg.gov.uk/landscape--wildlife/managing-land-and-sea/environmental-assessment/strategic-environmental-assess.aspx [Accessed June 2012]

³⁵ Natural Resources Wales. The State of Natural Resources Report (SoNaRR) 2016. Available at: <https://naturalresources.wales/evidence-and-data/research-and-reports/the-state-of-natural-resources-report-assessment-of-the-sustainable-management-of-natural-resources/?lang=en> [Accessed October 2017].

cent in England). These characteristics reflect the climate, relief and soil type. This is illustrated in the split of the land on agricultural holdings by usage, as shown in **Figure 3.5**. A total of 11.2 per cent of Wales is urban (compared to an 11.6 per cent UK average)³⁶ whilst 15 per cent is woodland³⁷.

Figure 3.5 Split of Land on Agricultural Holdings by Usage (2016)



*Rough grazing where holder has sole rights (i.e. excludes common rough grazing).

**Includes horticulture (vegetables and fruit grown in the open, hardy nursery stock and glasshouse)

Source: Welsh Government (2016) June 2016 Survey of Agriculture and Horticulture: Results for Wales. Available at <http://gov.wales/docs/statistics/2016/161124-survey-agriculture-horticulture-june-2016-en.pdf> [Accessed February 2017].

Land on farm holdings accounts for approximately 88 per cent of the total land area of Wales and which will include some 'urban' aspects such as roads and buildings as well as some woodland.³⁸ Agriculture is important for the Welsh language – a large proportion of agricultural workers use written and spoken Welsh regularly. However, agriculture can also bring challenges through associated greenhouse gas emissions, diffuse water pollution, biodiversity loss and potential increased flood risk³⁹. Agriculture and changes in agricultural practice, coupled with atmospheric deposition, climate change and infrastructure development also remain the main threats to Welsh habitats.⁴⁰

In terms of soil quality, the proportion of land area classified as either Grade 1 ('Excellent') or Grade 2 ('Very Good') in Wales is significantly lower than in England (2.5 per cent compared to 16.9 per cent) whilst over 80 per cent of land in Wales is classified as either Grade 4 ('Poor') or Grade 5 ('Very Poor'), significantly higher than in England (22.5 per cent).⁴¹ Poor soil quality combined with a hilly/mountainous landscape and wet climate means that the majority of agricultural land in Wales is restricted to the grazing of sheep and cattle (as illustrated in **Figure 3.5**).

Alongside their agricultural use, soils and particularly peats store a significant amount of carbon. Soils also provide storage for water, foundations for urbanisation and woodlands, provision of minerals and metals and for biodiversity acting as both a habitat and a foundation for a range of habitats. However, soil erosion and acidification are prominent pressures. Fertile topsoil develops at a rate of less than 1 cm/century. An

³⁶ ONS (2015) UK Natural Capital – Land Cover in the UK. Available at: <http://www.ons.gov.uk/ons/index.html> [Accessed February 2017].

³⁷ Forestry Commission (2017) Forestry Statistics 2017. Available at: <https://www.forestry.gov.uk/forestry/inf-d-7a9d9c> [Accessed October 2017].

³⁸ Welsh Government (2016) June 2016 Survey of agriculture and horticulture: Results for Wales. Available at: <http://gov.wales/docs/statistics/2016/141118-survey-agriculture-horticulture-june-2016-en.pdf> [Accessed February 2017].

³⁹ Spencer, J.W. and Kirby, K.J., 1992. An inventory of ancient woodland for England and Wales, Biological Conservation 62, 77-93

⁴⁰ NRW (2015) A Snapshot of the State of Wales' Natural Resources – June 2015. Available at <http://naturalresources.wales/media/4798/snapshot-report.pdf> [Accessed February 2017].

⁴¹ Derived from data at <https://data.gov.uk/dataset/provisional-agricultural-land-classification-alc2>

estimated 2.2 million tonnes of topsoil is eroded on an annual basis in the UK. Some agricultural practices (e.g. harvesting in wet conditions, leaving fields bare after harvest) result in large volumes of productive topsoil being compacted and degraded as well as eroded and deposited in adjacent water courses. There are also many impacts on the water environment as a result of eroded soils entering waterways.⁴²

Wales' peat habitats have been adversely affected by climate change, land management and atmospheric pollution and it is estimated that the extent of deep peat soils ($\geq 0.5\text{m}$) is now 90,995 ha.⁴³

Likely Evolution of the Baseline without the WRMP

Soils are dynamic and are influenced by many factors. Soil quality has deteriorated, soil erosion has increased and soil formation has been affected due to various human impacts including increased crop and livestock production, expanded urban areas, Wales' legacy of industrial land contamination from metal mines and other industry as well as atmospheric deposition and inappropriate management in some cases. Their function is therefore compromised. Soils in developed areas provide the same range of services as in other environments but their quality can be degraded and destroyed by construction of buildings and infrastructure⁴⁴.

There are various risks to soil formation including organic matter loss as a result of climate warming, inundation of coastal soils from sea level rise, erosion and compaction from agriculture and soil sealing from development. Soil contamination is an additional threat posed by industry, urbanisation and mineral extraction which can affect biological processes of soil formation. Degradation in soil structure can also potentially be a factor in flooding whilst dissolved organic carbon (DOC) concentrations have increased in upland waters which suggests soil carbon stocks may be destabilising due to climate change.⁴⁵

Woodlands are a fundamental part of the environment in Wales and there are a number of pressures on them. Pests and diseases are some of the major pressures which have had a significant impact on Welsh woodlands in recent years. The rate of new planting increased between 2009 and 2014 but in recent years it has fallen back⁴⁶, and many of the best examples of semi-natural woodland (on protected sites) are in poor condition⁴⁷.

The '*Natural Resources Policy*' identifies a number of aims of relevance to land use and soil, including:⁴⁸

- ▶ better management of soil for carbon storage and sequestration;
- ▶ safeguarding the best and most versatile agricultural land to improve soil quality, productive capacity and its resilience to degradation;
- ▶ increasing green infrastructure in and around urban areas;
- ▶ increasing canopy cover and well located woodland; and
- ▶ peat bog management.

⁴² NRW (2015) A Snapshot of the State of Wales' Natural Resources – June 2015. Available at <http://naturalresources.wales/media/4798/snapshot-report.pdf> [Accessed February 2017].

⁴³ Evans, C., Rawlins, B., Grebby, S., Scholefield, P. & Jones, P. (2015) Glastir Monitoring & Evaluation Programme. Mapping the extent and condition of Welsh peat. Welsh Government, NERC/Centre for Ecology & Hydrology.

⁴⁴ UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment (NEA): Technical Report. UNEP-WCMC, Cambridge. Chapter 20: Status and Changes in the UK's Ecosystems and their Services to Society: Wales. Pg 979-1044. Available at <http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=StRD4fVq72c%3d&tabid=82> [Accessed February 2017].

⁴⁵ NRW (2015) A Snapshot of the State of Wales' Natural Resources – June 2015. Available at <http://naturalresources.wales/media/4798/snapshot-report.pdf> [Accessed February 2017].

⁴⁶ Welsh Government (2016) Woodlands for Wales Indicators 2015-16. Available at: <http://gov.wales/docs/statistics/2016/161220-woodlands-wales-indicators-2015-16-en.pdf> [Accessed February 2017].

⁴⁷ UK National Ecosystem Assessment (2011) The UK National Ecosystem Assessment (NEA): Technical Report. UNEP-WCMC, Cambridge. Chapter 20: Status and Changes in the UK's Ecosystems and their Services to Society: Wales. Pg 979-1044. Available at <http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=StRD4fVq72c%3d&tabid=82> [Accessed February 2017].

⁴⁸ Welsh Government (2017) Natural Resources Policy. Available at: <http://gov.wales/docs/desh/publications/170821-natural-resources-policy-en.PDF> [Accessed October 2017]

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP arising from the analysis of the baseline for geology, land use and soils are:

- ▶ The need to protect, maintain and enhance geomorphological functions and services;
- ▶ The need to influence how land is managed, promoting sustainable patterns of land use;
- ▶ The need to conserve and enhance soil quality and function (including carbon sequestration);
- ▶ The need to protect and avoid damage to Wales' geodiversity and conserve and enhance sites designated for geological interest; and
- ▶ The need to manage impacts on soil resources, including control of pollution and remediation of contaminated land.

3.4 Water

Baseline Characteristics

The number and type of water bodies in Wales is shown in **Table 3.2**. Water is abstracted from water bodies for many purposes, including public water supply in Wales and England, agriculture, industry and electricity generation. In Wales, most of the water licensed for abstraction is from surface water rather than groundwater, with electricity generation being the sector abstracting the most (82 per cent), followed by public water supply (13 per cent), other industry (0.03 per cent), fish farming and amenity ponds (0.01 per cent). Spray irrigation, other agriculture and private water supplies account for a very low percentage of the total water abstracted⁴⁹. About 60 per cent of water bodies in Wales can provide a reliable source of water for new abstractions for at least 95 per cent of the time. Approximately 10 per cent of water bodies in Wales can only provide water for new abstractions 30 per cent or less of the time (less than 100 days a year)⁵⁰.

Table 3.2 Number and Type of Water Bodies in Wales⁵¹

Water body category	Natural	Artificial	Heavily modified	Total
River*	863	28	110	1001
Lake	29	3	90	122
Coastal	18	n/a	6	24
Estuarine	17	n/a	14	31
Groundwater	38	n/a	n/a	38
Total	965	31	220	1216

* River water bodies includes canals and surface water transfers.

Wales has relatively high rainfall compared to the rest of the UK, receiving on average 1,400mm per year. However, this hides the geographical differences across the Welsh Water supply area. Across Anglesey, the

⁴⁹ Environment Agency (2011) Case for change – current and future water availability. Available at <http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/research/planning/135501.aspx> [Accessed February 2017].

⁵⁰ Environment Agency & NRW (2013) Current and future water availability – addendum: A refresh of the Case for Change analysis, December 2013. Available at: <http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/research/planning/135501.aspx> [Accessed February 2017]

⁵¹ NRW (2015) River Basin Planning Progress Report for Wales 2009 – 2015. Available from: <https://naturalresources.wales/media/674595/progress-report-for-wales-2009-2015-final.pdf> [Accessed February 2017].

borders of Wales and Herefordshire, rainfall is around 700 mm per year⁵², whilst the mountainous areas of the Brecon Beacons and Snowdonia receive substantially more rainfall, with the latter typically receiving more than 3,000mm of rainfall per year⁵³.

Rainfall patterns combined with sources of demand drive the nature of the water resource system operated by Welsh Water. Only 3 per cent of the rainfall in Wales is used for public water supply, which is very different to the rest of the UK where up to 50 per cent of rainfall is used for public water supply.

Welsh Water manages its water supplies and demands across 24 water resource zones (WRZs). Welsh Water delivers some 850 million litres of drinking water per day to more than 3 million people living in Wales and some adjoining parts of England⁵⁴. Approximately 95 per cent of the water Welsh Water abstracts is taken from rivers and reservoirs, the majority of which is drawn from a total 66 impounding reservoirs^{55,56}. In response to weather, water supply and environmental needs 20 of these reservoirs feed water into five major rivers:

- ▶ Rivers Wye and Usk in South East Wales;
- ▶ Rivers Tywi and Eastern Cleddau in South West Wales; and
- ▶ the River Dee in North Wales⁵⁷.

River abstractions are most prevalent in Tywyn Aberdyfi, Llyswen, Hereford CU, Whitbourne, Ross on Wye, and Monmouth zones. Reservoir supplies dominate the rest of Welsh Water's company area, with the remainder drawn from the ground through springs, wells and boreholes. There are groundwater sources in the Pilleth, Brecon/Portis, Clwyd Coastal, and Vowchurch zones.

Water Availability

NRW has produced a series of Catchment Abstraction Management Strategies (CAMS) for the catchments within Wales and those that cross the England / Wales border. These CAMS set out how water resources will be managed in each catchment and provide information on how existing abstraction licenses are managed and the availability of water for further abstraction. Within each CAMS, river flows and groundwater levels are monitored at Assessment Points (significant points on rivers) and assessed alongside the amount of water which has been abstracted on average over the previous six years and the situation if all abstraction licences were used to full capacity. This data is used to determine the water availability for each water body. Water availability falls into the following categories:

- ▶ Water available for licensing: There is more water than required to meet the needs of the environment. New licences can be considered depending on local and downstream impacts;
- ▶ Restricted water available for licensing: If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licences would be granted and restrictions may be in place. Trading from an existing licence holder can occur; and
- ▶ Water not available for licensing: Water body flows are below the indicative flow requirement to help support Good Ecological Status (as required by the Water Framework Directive). No further consumptive licences will be granted. Trading from an existing licence holder can occur.

⁵² Welsh Water. Final Water Resources Management Plan. Technical Report. April 2014. Available from:

<http://www.welshwater.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017].

⁵³ Met Office (2016) Wales: Climate. Available from: <http://www.metoffice.gov.uk/climate/uk/regional-climates/wl> [Accessed October 2017].

⁵⁴ Welsh Water. Final Water Resources Management Plan. Technical Report. April 2014. Available from:

<http://www.welshwater.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017].

⁵⁵ Welsh Water (2017) Environment: Water Resources. Available from: <http://www.dwrcymru.com/en/Environment/Water-Resources.aspx> [Accessed October 2017].

⁵⁶ Welsh Water (2017) Dŵr Cymru Welsh Water: Key Facts. Available from: <http://www.dwrcymru.com/en/Company-Information/Dwr-Cymru-Welsh-Water/Key-Facts.aspx> [Accessed October 2017].

⁵⁷ Welsh Water. Final Water Resources Management Plan. Technical Report. April 2014. Available from:

<http://www.welshwater.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017].

Some of the water used to supply densely populated areas is taken from water bodies in statutory designated protected areas. Provisional condition information on SSSIs and SACs indicates that species and/or habitat features at a number of sites are either at risk or are in unfavourable condition due to water management or water quality issues. This is particularly an issue in South Wales.

Sustainability Reductions - Review of Consents

Under the Habitats Directive, the Environment Agency Wales⁵⁸ and the Environment Agency completed a review of all the consents (the RoC) that they regulated to ensure there were no detrimental impacts on the conservation interests in designated sites including SPAs and SACs. Discharge consents and water abstraction licences were included within this review.

The presence of a large number of SPAs and SACs in and adjacent to Welsh Water's supply area meant that a number of Welsh Water abstraction licences required modification in order to achieve the desired environmental outcomes for the primarily riverine European-designated sites (SACs) (River Wye, River Usk, River Teifi, Cleddau Rivers, Rhinog, Migneint-Arenig-Dduallt, Afon Gwyrfa and Llyn Cwellyn). The negative impacts of the licences on designated sites, as determined by the regulator, included impacts on river flow and lake levels, fish entrainment through intake structures, groundwater level impacts and obstructions to fish passage.

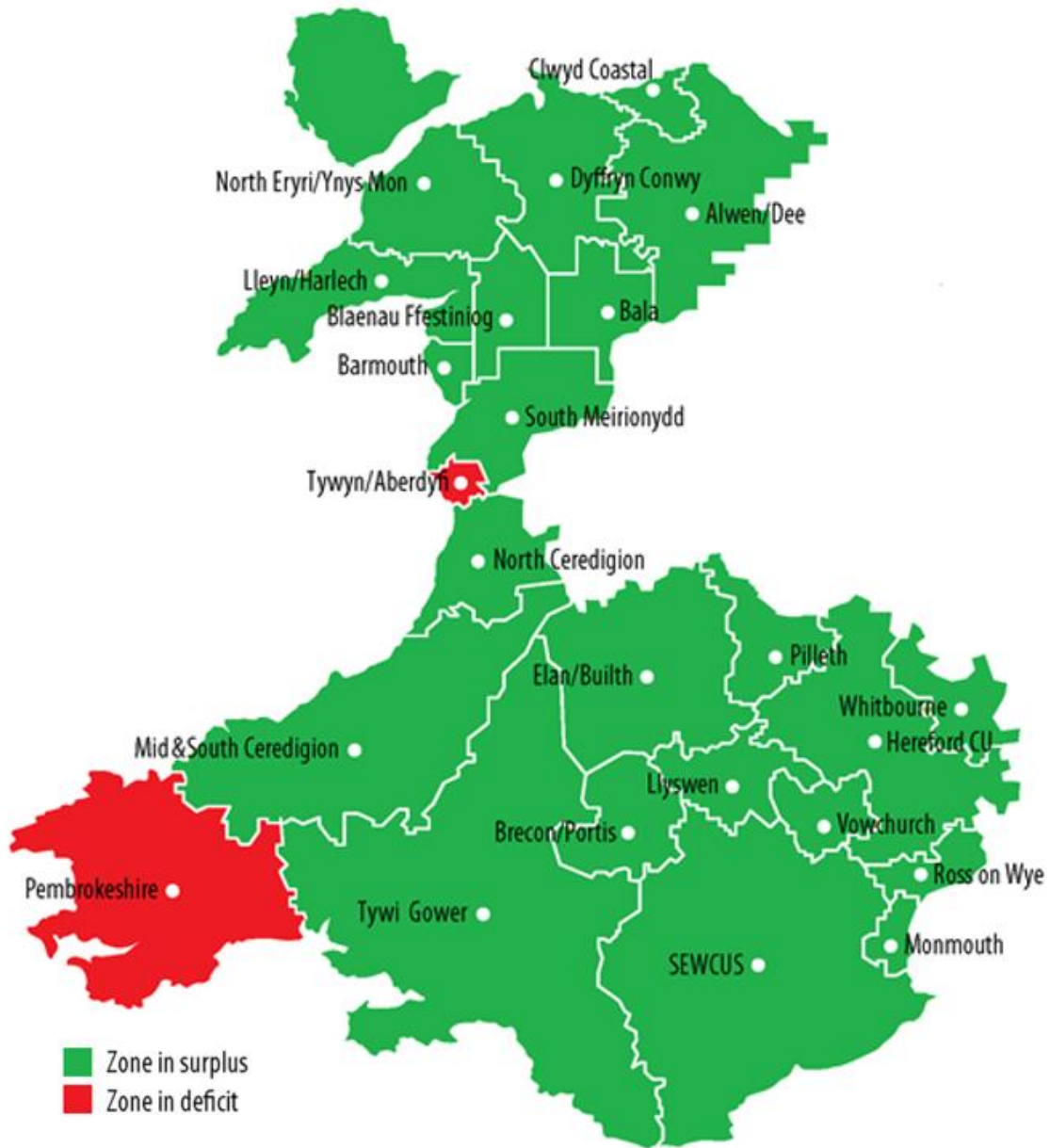
Supply and Demand

Welsh Water forecasts water supply and demand in all of the 24 water resource zones (WRZs) taking into account the RoC. To account for future uncertainties, an additional amount of water is included in the assessment of the supply demand balance called 'Target Headroom'. For the WRZ to have a 'surplus', the water available for supply must be equal to or greater than the sum of the total forecast demand plus the Target Headroom. Where a shortfall against target headroom occurs (i.e. the water resource zone has a supply demand deficit) measures are required to address the shortfall. These could include measures to increase supply, reduce demand or to address leakage across the WRZ.

The WRMP19 presents the outcome of this assessment and identifies that two of the 24 WRZs are forecast to have a supply demand deficit over the planning period to 2050 unless management interventions such as demand management measures or new resources are implemented. The two WRZs are Pembrokeshire and Tywyn/Aberdyfi, which are shown in red in **Figure 3.6**. The WRMP19 sets out a plan to ensure that a surplus of supply over demand is maintained in all WRZs.

⁵⁸ Natural Resources Wales (NRW) superseded Environment Agency Wales and became operational in April 2013. The RoC occurred between 2004 and 2012.

Figure 3.6 Welsh Water WRZs



Source: Welsh Water Draft Water Resources Management Plan 2019

Wastewater Treatment

Welsh Water collects wastewater, including surface water from homes and businesses across the Welsh Water area. The wastewater is transported by the 30,000km of sewer to one of the 838 wastewater treatment works (WwTWs) for treatment before being returned to the surface water system (rivers and the sea)⁵⁹.

WwTW discharge consent standards are set to maintain good water quality. In 2016 Welsh Water's WwTWs achieved 99.0 per cent compliance with their environmental permit conditions, an improvement from 2015 (98.6 per cent). NRW gives water companies a star rating for their overall performance in protecting the

⁵⁹ Welsh Water (2017) Dŵr Cymru Welsh Water: Key Facts. Available from: <http://www.dwrcymru.com/en/Company-Information/Dwr-Cymru-Welsh-Water/Key-Facts.aspx> [Accessed October 2017].

environment (including during return of treated water to rivers and the sea). Welsh Water have maintained a three out of four-star Environmental Performance Assessment (EPA) rating from 2013 to 2016⁶⁰.

Water Quality

The quality of the water body that receives the output from the WwTW is important and the Water Framework Directive (WFD) (2000/60/EC) provides a mechanism for management of the water environment to ensure sustainable use of water. The WFD also seeks to protect and improve the quality, both ecological and chemical, of inland surface waters, ground waters and coastal waters. Under the WFD, River Basin Management Plans (RBMP) are prepared for each River Basin District. The Welsh Government reported on the River Basin Planning progress in 2015 and **Table 3.3** shows the percentage of water bodies in each River Basin District achieving poor, moderate or good status, both in 2009 and 2015.

Table 3.3 Overall status of water bodies as a percentage between 2009 and 2015⁶¹.

River Basin District	2009			2015		
	Poor	Moderate	Good	Poor	Moderate	Good
Dee	11	58	30	5	63	31
Western Wales	7	63	30	5	57	38
Welsh part of the Severn River	12	50	37	8	47	43

In 2009, 10 per cent of all water bodies were in poor condition, 57 per cent were in moderate condition and 33 per cent were in good condition. Since then, many improvements have been made both in monitoring and data collection and assessment. The 2015 classification shows that the percentage of water bodies achieving good or better status has increased to 38 per cent. The number of water bodies at poor status, meanwhile, has reduced to 6 per cent with a resulting increase in the number of water bodies at moderate status.

The main reasons for water body failure in Wales are pollution from abandoned mines and contaminated land, agricultural pollution, barriers to fish migration and impoundments. Sewage discharges, acidification, forestry, flood protection and land drainage, surface water drainage from urban and transport development, abstraction and industrial discharges are also factors.

The 'Wales' Marine Evidence Report' (2015)⁶² highlights that no transitional or coastal water bodies in Wales fail the assessment of chemical status, based on priority hazardous substances defined in the WFD. However, in numerous instances, ecological status /potential has not been reported as good.

The Marine Strategy Framework Directive aims to achieve Good Environmental Status (GES) of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. The Directive sets out 11 high level descriptors of GES and the status of these in Welsh waters is monitored for assessment of progress towards achieving GES. The Wales National Marine Plan will be a key tool for ensuring that the targets and measures to be determined by the UK for the MSFD can be implemented.

Bathing waters are very important for coastal communities, visitors and the economy in Wales. In 2016, 102 of the 103 designated Welsh bathing waters met the standards set by the Bathing Water Directive (2006/7/EC). Of the 103 bathing waters assessed, 84 were of an excellent standard, 13 achieved a good

⁶⁰ Discover Water. Environmental Performance Assessment. Available online at: <http://www.discoverwater.co.uk/environmental-performance> [accessed October 2017]

⁶¹ Welsh Government. River Basin Planning Progress Report for Wales 2009-2015. Updated December 2015. Available online at: <http://naturalresources.wales/media/676155/progress-report-for-wales-2009-2015-english.pdf> [accessed February 2017]

⁶² Welsh Government (2015) Wales' Marine Evidence Report. Available online at: <http://gov.wales/topics/environmentcountryside/marineandfisheries/marine-planning/other-supporting-evidence/wales-marine-evidence-report/?lang=en> [Accessed February 2017].

standard and 5 achieved sufficient standard. One Welsh bathing water failed to comply with the Directive standards and was classified as poor. Two more Bathing Waters achieved an excellent classification compared with the results in 2015⁶³.

Across England and Wales new drinking water standards came into force in 2016, *The Water Supply (Water Quality) (Amendment) Regulations 2016*. Welsh Water's performance against the water quality tests (known as Overall Mean Zonal Compliance) for 2016 is 99.97 per cent, compared to the England and Wales average of 99.96 per cent. This returns Welsh Water's performance to 2013 levels, following a decrease to 99.94 per cent in 2014⁶⁴.

Nitrate Zones

Nitrate Vulnerable Zones (NVZs) are areas of land that drain into surface or ground water where nitrate levels are already high (greater than 50mg/l), or may have high levels of nitrate in the future. It is important to manage nitrate concentrations in coastal waters, estuaries, rivers, lakes and groundwaters as high nitrate concentrations can contaminate drinking water sources and can contribute to an overall deterioration in water quality leading to eutrophication. NVZ's account for 2.4 per cent of land area in Wales⁶⁵ and the most recent review of NVZ's in Wales was undertaken by the Environment Agency Wales in 2013.

The Welsh Government consulted on NVZ's and Action Programme requirements from September to December 2016, seeking views on the current measures for reducing pollution caused by nitrates from agricultural sources⁶⁶. The review recommended that all existing NVZ's, designated due to eutrophication in lakes, and surface water and groundwater contamination, are maintained. The review also recommended the designation of further NVZs (three for eutrophic freshwater areas, one eutrophic marine area, one groundwater area and two surface water areas).

Flood Risk

Flood risk in Wales is a significant issue with many urban settlements built alongside rivers and streams and on river and coastal floodplains. The loss of natural coastal flood defences through coastal erosion, habitat loss and development pressure is also a key challenge. Climate change is likely to increase the frequency of extreme weather events resulting in more frequent and severe flooding. Coupled with rising sea levels, this is likely to affect Wales' natural resources, economy and communities.

The 2011 Welsh Government National Strategy for Flood and Coastal Erosion Risk Management in Wales⁶⁷ provides the framework for flood and coastal erosion risk management in Wales. Within this framework the Flood Risk Management Plans (FRMPs) prepared by NRW and the Environment Agency set out what measures will be taken to help manage the risk of flooding to people, the environment and economic activity at a River Basin District level. The published FRMPs provide a comprehensive overview of flood risk to people, economic activity and the natural and historic environment. **Table 3.4** provides a summary of flood risk to people from rivers and the sea based on the information contained in the published FRMPs for the Western Wales⁶⁸, Severn River⁶⁹ and Dee River⁷⁰ River Basin Districts. Local Flood Risk Maps for Wales

⁶³ Natural Resources Wales (2017) Bathing Waters in Wales 2016. Available online at:

<https://naturalresources.wales/media/681414/wales-bathing-water-report-2016.pdf> [Accessed February 2017].

⁶⁴ Discover Water. Water quality results for all water companies. Available online at: <http://www.discoverwater.co.uk/quality> [Accessed October 2017]

⁶⁵ NRW (2017). Nitrate Vulnerable Zones. Information. Available online at: <https://naturalresources.wales/guidance-and-advice/environmental-topics/water-management-and-quality/water-quality/nitrate-vulnerable-zones/?lang=en> [Accessed October 2017]

⁶⁶ Welsh Government. 2016. Consultation Nitrate vulnerable zones in Wales. Available online at:

<https://consultations.gov.wales/consultations/nitrate-vulnerable-zones-wales> [Accessed February 2017]

⁶⁷ Welsh Government. National Strategy for Flood and Coastal Erosion Risk Management in Wales. November 2011. Available online at: <http://gov.wales/docs/desh/publications/111114floodingstrategyen.pdf> [Accessed February 2017]

⁶⁸ NRW. Western Wales Flood Risk Management Plan. Available online at: https://naturalresources.wales/media/675146/final_frmp_-_western-wales_pk26b82.pdf [Accessed February 2017]

⁶⁹ NRW and EA. 2016. Severn River Basin District Flood Risk Management Plan 2015-2021. Part A – Background and River basin District wide information. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/507832/LIT_10213_SEVERN_FRMP_PART_A.pdf

[Accessed February 2017]

⁷⁰ NRW and EA. 2016. Dee River Basin District Flood Risk Management Plan 2015-2021. Available online at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/507153/LIT_10199_DEE_FRMP.pdf [Accessed February 2017]

are also available from NRW⁷¹, which incorporates the Welsh Government's Development Advice Map, in addition to separate local flood mapping for England⁷².

Table 3.4 People at risk from flooding from Rivers and the sea in Wales

River Basin District	High Risk	Medium Risk	Low Risk	Very Low Risk
Western Wales	16,857	24,095	105,719	1,170
Severn	32,600	62,100	240,650	33,050
Dee	3,300	2,500	20,500	150
Total	52,757	88,695	366,869	34,370

Fluvial and coastal flood risk is a problem within the Welsh Water area which is pertinent as water resources infrastructure can be rendered non-operational by flooding, putting customers' water supply at risk and increasing the risk of pollution. Gwyndd has the largest number of properties at significant risk (greater than a 1 in 75 chance in any given year). This is largely because of the coastal flood risk. Coastal flooding is also the cause of the significant risk to property in Newport⁷³. At Newport, flood risk is primarily attributable to tidally influenced flooding from the River Usk and tributaries running through Newport.⁷⁴ Newport is reliant on flood defences of which will become more important in the future due to extreme flood or tidal events that could have serious consequences.

Likely Evolution of the Baseline without the WRMP

Wales records some of the highest rainfall levels in the UK, and relies on this rainfall which is collected in the rivers, lakes and reservoirs as sources of water supply. However, in significant parts of Wales, there are no further reliable supplies of water available for new abstractions. Whilst population increase estimates are lower for Wales than for many other parts of the UK, growth will place further pressure on water resources. Climate change is also expected to have significant effects on river flows in Wales, with most major watercourses experiencing a 10-15 per cent increase in mean monthly winter flows and 50-80 per cent decreases in summer flows. These predictions are generally more pronounced than in England, primarily due to the lack of groundwater storage capacity in Wales.

Under the WFD, rivers in England and Wales were required to have achieved 'good ecological status' by 2015. Where this was not possible and subject to criteria set out in the Directive, the aim is to achieve good status by 2021 or 2027. The second River Basin Management Plan cycle, 2015 – 2021 recognises the large degree of uncertainty about achieving such significant increases to achieve good status or better by 2021. NRW propose in Wales to improve compliance with good status by delivering measures locally in an integrated way to achieve improvements. This will involve targeting 21 water bodies in the Western Wales River Basin District⁷⁵ and seven in the Dee River Basin District⁷⁶.

The State of Natural Resources Report (SoNaRR)⁷⁷ highlights that climate change may affect groundwater recharge in Wales and that by 2025, it is likely that groundwater recharge will decrease, resulting in

⁷¹ Natural Resources Wales. 2017. Long term flood risk. Available online at: <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en> [Accessed October 2017]

⁷² GOV.UK. 2017. Learn more about this area's flood risk. Available online at: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?> [Accessed October 2017]

⁷³ Environment Agency (2009). Flooding in Wales: A National Assessment of Flood Risk. Cardiff.

⁷⁴ Environment Agency Wales (2010) Managing Flood Risk: Wye and Usk Catchment Flood Management Plan

⁷⁵ Western Wales River Basin Management Plan 2015 – 2021 Summary December 2015. Available online at: <https://naturalresources.wales/media/676165/wwrbdsummary.pdf> [Accessed February 2017]

⁷⁶ Dee River Basin Management Plan 2015 – 2021 Summary Updated December 2015 <http://www.naturalresources.wales/media/682463/deerbdsummary.pdf> [Accessed October 2017]

⁷⁷ Natural Resources Wales (2016) *The State of Natural Resources Report (SoNaRR)* [available at <https://naturalresources.wales/evidence-and-data/research-and-reports/the-state-of-natural-resources-report-assessment-of-the-sustainable-management-of-natural-resources/?lang=en> [Accessed October 2017].

decreased dry weather river flows and a general lowering of groundwater levels. This may have impacts on base-flow to rivers and wetlands in dry periods and affect small domestic and agricultural water supplies.

Reducing the risk of flooding as a key challenge in the future. Increased soil sealing and compaction from farming practices and urban development resulting in loss of water storage capacity and more surface water run-off will increase flood risk. The loss of natural coastal flood defences is also considered to be an important issue. Climate change is likely to exacerbate coastal erosion and flooding as a result of sea level rise and increased intensity, severity and frequency of storms over the next 100 years. The most recent information for Wales from the UK Climate Impacts Programme (UKCP09) forecasts that by 2080 (under a medium emissions scenario), there will be an increase in winter mean precipitation of 19 per cent (it is very unlikely to be less than 4 per cent and is very unlikely to be more than 42 per cent) whilst sea levels are forecast to increase by 36.2 cm compared to 1990 levels.⁷⁸

Under the second UK Climate Change Risk Assessment evidence report, there are also projected to be large deficits by the 2050s in the provision of public water supplies under the upper bound scenario (high population growth and a high climate change impact), with projected deficits becoming more acute and widespread by the 2080s. Under a lower bound scenario (a low population and medium climate change projection), Wales is projected to be in surplus at a national scale, with deficits more locally.⁷⁹ Additionally, the Water Resources Long-Term Planning Framework highlights a significant and growing risk of severe drought, with impacts arising from climate change, population growth and environmental drivers to reduce abstraction.⁸⁰

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the water baseline are:

- ▶ the need to maintain and improve water quality;
- ▶ the need to maintain seasonal flows in groundwater and surface water;
- ▶ the need to ensure that the continued risk of flooding is reduced or where this is not possible, mitigated effectively;
- ▶ the need to restore sustainable and appropriate abstraction levels and water flow/levels in Wales' waters across the full range of regimes from low to high conditions;
- ▶ the potential effects of climate change and the need to build climate change resilience into the water environment and water management; and
- ▶ the need to prevent the deterioration of Water Framework Directive (WFD) waterbodies, achieve protected area objectives and achieve water body status objectives.

3.5 Air Quality and Climate

Baseline Characteristics

Good air quality is essential to ensure people and ecosystems are healthy, productive and balanced. The emission of pollutants to air can pose a hazard to human health (e.g. respiratory illnesses and lung conditions) and can also have a negative impact on the environment (e.g. changes to ecosystems and damage to vegetation when present within the atmosphere in excess of certain concentrations). Air quality

⁷⁸ UK Climate projections (2009) Maps and key findings. Available at <http://ukclimateprojections.metoffice.gov.uk/21708> [Accessed February 2017].

⁷⁹ HR Wallingford (2015) CCRA2: Updated projections for water availability for the UK. Available online at: <https://www.theccc.org.uk/publication/climate-change-risk-assessment-ii-updated-projections-for-water-availability-for-the-uk/> [Accessed October 2017]

⁸⁰ Water UK (2016) Water Resources Long-Term Planning Framework (2015-2065). Available online at: <https://www.water.org.uk/water-resources-long-term-planning-framework> [Accessed October 2017]

within this context concerns the levels of pollutants emitted into the air and their significance, in terms of the risk of adverse effects on the environment and/or human health.

Emissions of gases into the air from transport, industry and agriculture can be transported significant distances by prevailing weather patterns and, via precipitation and deposition, eventually cause diffuse water pollution, the effects of which may be very long term. Pollutants may persist in groundwaters or sediments for decades or centuries and nutrient-enriched lakes and acidified waters may take many years to recover. All sectors will be required to make cuts in air emissions to meet the targets of the National Emissions Ceilings Directive and the WFD.

The UK Government and Devolved Administrations are required to produce a national ambient air quality strategy, outlining objectives and standards for improving air quality. Local Authorities must regularly assess air quality in their area against the standards and objectives of the National Air Quality Strategy⁸¹. Air Quality Management Areas (AQMAs) are declared by Local Authorities in specific locations where atmospheric concentrations of one or more pollutants (including pollutants such as nitrogen dioxide (NO₂), sulphur dioxide (SO₂) volatile organic compounds (VOCs) and fine particles (known as 'particulates') are either close to or exceeding statutory objectives set out within the National Air Quality Strategy.

As of 2017 there are 38 AQMAs in Wales⁸². **Table 3.5** outlines the AQMAs in Wales by source and all but one AQMA is in place around roads. As shown in **Table 3.6** Rhondda-Cynon-Taff Council has the most AQMAs in place (15), all for nitrogen dioxide and half have been in place for more than seven years.

Table 3.5 Number of AQMAs in Wales by source⁸³

Source	Number of current AQMAs
County or Unitary Authority Road	19
Road transport unspecified	12
Mixture of road types	5
Highways Agency Road	1
Industrial Source	1

Table 3.6 Number of AQMAs per Local Authority⁸⁴

Local Authority	Number of Active AQMA	Pollutant AQMA in place for
Caerphilly County Borough Council	2	Nitrogen dioxide NO ₂
Cardiff County Council	4 (and 3 revoked)	Nitrogen dioxide NO ₂
Carmarthenshire County Council	1	Nitrogen dioxide NO ₂
City and County of Swansea	1	Nitrogen dioxide NO ₂
Monmouthshire Council	1	Nitrogen dioxide NO ₂
Neath Port Talbot County Borough Council	1	Particulate Matter PM ₁₀
Newport City Council	9	Nitrogen dioxide NO ₂

⁸¹ Defra (2007). Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Available online at: www.defra.gov.uk/publications/2011/03/28/air-quality-strategy-vol2-pb12670/ [Accessed February 2017]

⁸² Defra (2017). Summary AQMA data. Available online at: <https://uk-air.defra.gov.uk/aqma/summary> [Accessed October 2017]

⁸³ Defra (2017). Summary AQMA data. Available online at: <https://uk-air.defra.gov.uk/aqma/summary> [Accessed October 2017]

⁸⁴ Defra (2017). List of Local Authorities with AQMAs. Available online at: <https://uk-air.defra.gov.uk/aqma/list> [Accessed October 2017]

Local Authority	Number of Active AQMA	Pollutant AQMA in place for
Pembrokeshire Council	2	Nitrogen dioxide NO ₂
Powys County Council	1	Nitrogen dioxide NO ₂
Rhondda-Cynon-Taff Council	15 (and 1 revoked)	Nitrogen dioxide NO ₂

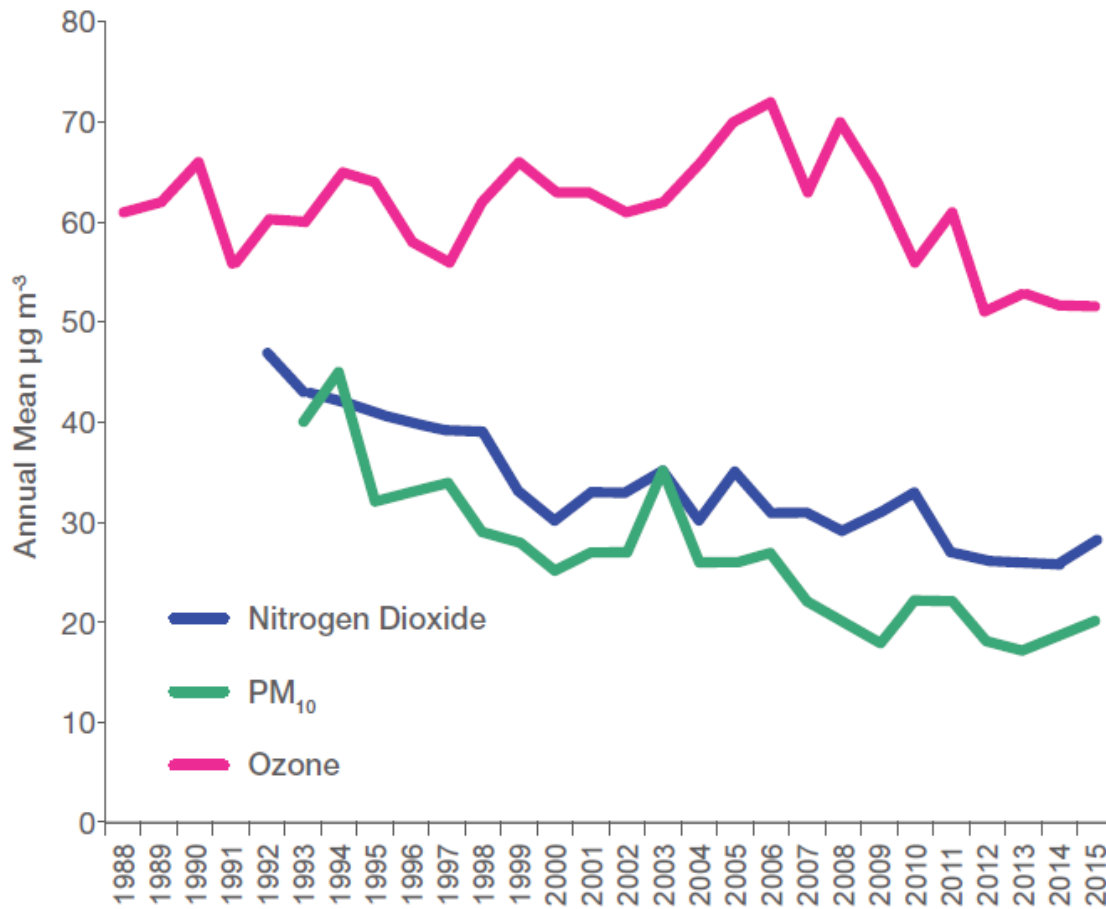
Levels of individual pollutants are measured at National Automated Monitoring Network sites across Wales with concentrations of the pollutants analysed to determine the number of days at each site on which the pollution is moderate or higher i.e. when concentrations for at least one of the pollutants exceeds the National Air Quality Standards (AQS). In 2015 the overall pollution levels for Wales were very high for 8 days, high for 16 days, moderate for 137 days and low for 204 days (56 per cent of the year).

As shown in **Figure 3.7** the longer term trend is a reduction in nitrogen dioxide and particulate matter up to 10µm in size (PM₁₀) in Wales. This trend shows a steady improvement in air quality in Wales confirming that the local measures being put in place for in nitrogen dioxide and PM₁₀ are having the desired result, all be it on a national scale. The Welsh Government Air Quality Report 2015⁸⁵ notes that ozone is a regional pollutant, transboundary in nature, making it more difficult to manage.

Urban air quality in Wales is generally worse than in rural areas. The main causes of pollution at urban sites are fine particles (PM₁₀) and ozone (O₃) whilst the main cause of pollution in rural areas is the variation in ozone levels, which is affected by the weather. The Welsh Government Air Quality Report identifies that in 2015 no monitoring sites in Wales showed exceedance of Air Quality Strategy Objectives for carbon monoxide, sulphur dioxide, benzene or lead. Four monitoring sites (Rhondda Mountain Ash, Caerphilly Hafodyrynys, Newport M4 Junction 25 and Swansea Station Court High Street) exceeded the annual mean objective of 40 µg m⁻³ for nitrogen dioxide and one site (Pembroke Power Station) exceeded the AQS objective for ozone on more than the permitted 10 occasions.

⁸⁵ Welsh Government. Air Pollution in Wales 2015. Available online at: http://www.welshairquality.co.uk/documents/reports/507161019_AQ_wales_2015_v12_Press.pdf [Accessed February 2017].

Figure 3.7 Ambient Pollutant Trends in Wales 1990 – 2015 (taken from Welsh Government Air Pollution in Wales 2015)⁸⁶



Poor air quality is a significant public health issue. The Committee on the Medical Effects of Air Pollutants (COMEAP) has estimated that the burden of particulate air pollution in the UK in 2008 was equivalent to nearly 29,000 deaths at typical ages and an associated loss of population life of 340,000 years. It has been estimated that removing all fine particulate air pollution would have a bigger impact on life expectancy in England and Wales than eliminating passive smoking or road traffic accidents. The economic cost from the impacts of air pollution in the UK is estimated at £9-19 billion every year; this is comparable to the economic cost of obesity (over £10 billion)⁸⁷.

Some of the most widespread and significant effects on ecosystems are damage from air pollution such as exposure to ozone and acidification. For example, emissions to air of sulphur and nitrogen containing pollutants from heavy industry, power generation and transport have caused acidification of freshwaters across Wales. A recent NRW WFD assessment estimated that 21 per cent of Welsh river and 36 per cent of Welsh lake water bodies were at risk of acidification.⁸⁸

⁸⁶ Welsh Government. Air Pollution in Wales 2015. Available online at:

http://www.welshairquality.co.uk/documents/reports/507161019_AQ_wales_2015_v12_Press.pdf [Accessed February 2017].

⁸⁷ Defra (2015) Appendix 5: international, European and national standards for air quality in 2010 to 2015 Government policy: Environmental quality. Policy Paper. Available at: <https://www.gov.uk/government/publications/2010-to-2015-government-policy-environmental-quality/2010-to-2015-government-policy-environmental-quality> [Accessed February 2017].

⁸⁸ NRW (2015) A Snapshot of the State of Wales' Natural Resources – June 2015. Available at <http://naturalresources.wales/media/4797/snapshot-report.pdf> [Accessed February 2017].

Climate

Through the Climate Change Act 2008, the UK has set itself a target of reducing greenhouse gas emissions by at least 80 per cent compared to 1990 levels by 2050; and aims to meet 15 per cent of final energy consumption from renewable sources by 2020. The two key overarching targets for reducing greenhouse gas emissions in Wales are firstly to reduce emissions by 3 per cent annually in areas of devolved competence and, secondly, to reduce overall emissions by 40 per cent by 2020, against a 1990 baseline⁸⁹.

Greenhouse gases including carbon dioxide (CO₂) emitted from human actions are a major contributor to climate change. As seen in **Table 3.7** the largest CO₂ emissions in Wales in 2015 were from the industrial and commercial sectors, a similar trend to the UK. However, the 2015 CO₂ per capita emissions (**Table 3.8**) of 8.7 tonnes of CO₂ per person were higher than all other UK regions due to emissions from the industrial and commercial sector, highlighting the larger industrial base of the country compared to the UK and other regions. Since 2005 there has been an overall reduction in CO₂ emissions in Wales, and Wales has achieved a 19 per cent reduction over the 10 year period to 2015. There have been periods of fluctuation within this trend, such as rises in 2010 and 2012 due to economic factors and temperature variations. In 2013 there was also a notable increase in industrial and commercial emissions in Neath Port Talbot due to increased activity at large industrial sites.

Table 3.7 End User Carbon Dioxide Emissions 2015⁹⁰

	Million Tonnes CO ₂					Change from previous year
	Industrial & commercial	Domestic	Transport	Land Use, Land Use Change and Forestry	Total	
UK	162.4	107.3	125.8	-9.0	386.5	-4%
Wales	15.6	5.3	6.3	-0.3	26.9	-6%

Table 3.8 End User Carbon Dioxide Emissions per Capita 2015⁹⁰

	Tonnes CO ₂ per person					Change from previous year
	Industrial & commercial	Domestic	Transport	Land Use, Land Use Change and Forestry	Total	
UK	2.5	1.6	1.9	-0.1	5.9	-5%
Wales	5.0	1.7	2.0	-0.1	8.7	-6%

In 2016/17 Welsh Water operational carbon emissions fell 8 per cent to 212 ktCO₂e from 230 ktCO₂e in 2015-16. The majority of emissions were due to grid supplied electricity and gas. Part of the reduction was due to a reduction in the carbon content of grid supplied electricity (which fell 11 per cent as coal power stations came offline), in addition to Welsh Water's electricity consumption falling by 3.5 per cent. Welsh Water's renewable energy production reduced to 87 GWh in 2016/17 from 97 GWh in 2015/16,

⁸⁹ Welsh Government (2010) Climate Change Strategy for Wales. Available online at: <http://gov.wales/docs/desh/publications/101006ccstratfinalen.pdf> [Accessed February 2017].

⁹⁰ DECC (2017) Local authority carbon dioxide emissions estimates 2015 Statistical Release: National Statistics. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/623015/2005_to_2015_UK_local_and_regional_CO2_emissions_statistical_release.pdf [Accessed October 2017]

predominately due to a fall in the volume of green energy generated by hydro-turbines due to one of the driest winters on record⁹¹.

A study commissioned by Welsh Water reviewing trends in the historical record showed that catchments in Welsh Water supply areas are now generally warmer, with wetter winters and autumns than during the 1961 to 1990 period⁹². The study also showed that temperatures in Wales were higher in the 1971 to 2000 and 1991 to 2004 periods compared to the 1961 to 1990 period in both the summer and winter seasons. Winter and autumn rainfall have increased across Wales whereas summer rainfall has declined in some areas, notably North West Wales.

Likely Evolution of the Baseline without the WRMP

Air Quality

Emissions of all seven priority air quality pollutants have declined since 1990. Of these, the rate of decline is similar for particulates, nitrogen oxides, non-methane volatile organic compounds, sulphur dioxide and carbon monoxide. Lead shows a much higher rate of reduction from 1990 due to the phasing out of leaded petrol. Ammonia emissions have declined at a slower rate than other pollutants⁹³ and increased demand for meat will increase the need for intensive farming /units in Wales which could increase emissions.

In Wales (and the rest of the UK), the most widely exceeded limit value is for the annual mean NO₂ concentration (40 µg m⁻³). The mean for the long-running sites shows a slight decrease through the 2000s, although 2010 was a high year. Annual mean PM₁₀ concentrations have generally decreased in recent years, at both urban background and urban traffic sites. Ozone concentrations, meanwhile, have tended to be highest at rural locations, although there are no clear trends as concentrations vary considerably from year to year because of variation in metrological factors⁹⁴.

Despite population growth, NO₂ and PM₁₀ emissions are predicted to reduce in the future. The predicted reduction in NO₂ is a result of a core package of measures known collectively as 'combined measure R'. This includes three components:

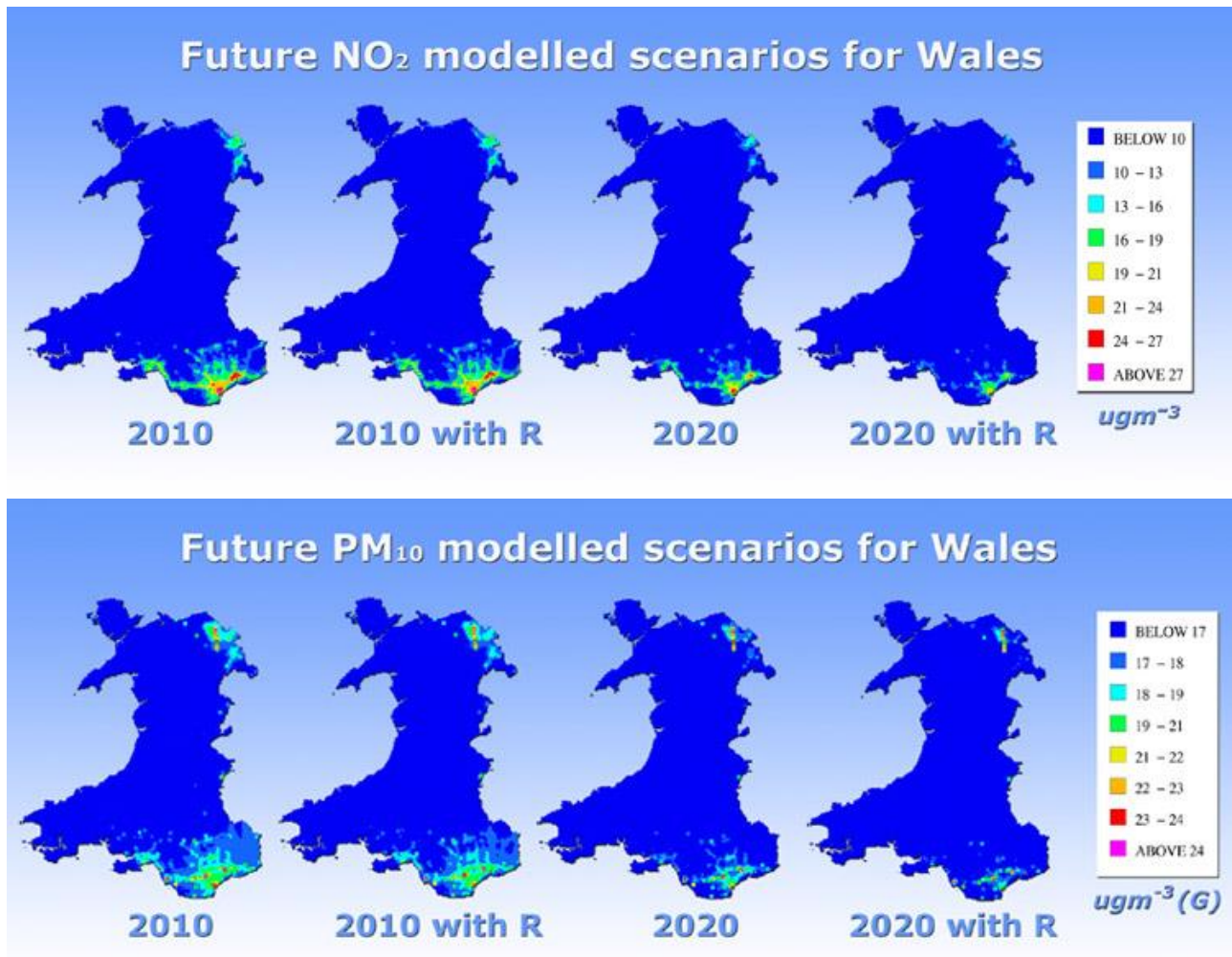
- ▶ Measures to reduce NO_x and PM₁₀ emissions from cars and light good vehicles (Euro 5 and 6) and heavy-duty vehicles (Euro VI);
- ▶ A programme of incentives to increase the penetration of low emission vehicles into the national vehicle fleet;
- ▶ Measures to reduce SO₂ and NO_x emissions from international shipping through the International Maritime Organisation; and
- ▶ **Figure 3.8** demonstrates the impact of these combined measures on improving air quality in Wales (to 2020).

⁹¹ Glas Cymru Report & Accounts 2016-2017. Available online at: http://www.dwrcymru.com/en/Reading_Room_Library/Company-Reports.aspx [Accessed October 2017]

⁹² HR Wallingford (2007). Dŵr Cymru Welsh Water Draft Water Resources Plan, Trends in hydrological variables and drought frequency in Wales. Report EX 5457, March 2007. Wallingford, HR Wallingford.

⁹³ NRW (2015) A Snapshot of the State of Wales' Natural Resources – June 2015. Available at <http://naturalresources.wales/media/4797/snapshot-report.pdf> [Accessed February 2017].

⁹⁴ Welsh Government. Air Pollution in Wales 2015. Available online at: http://www.welshairquality.co.uk/documents/reports/507161019_AQ_wales_2015_v12_Press.pdf [Accessed February 2017].

Figure 3.8 Air Quality Projections, Wales⁹⁵

Climate

UKCP09 provides the following predictions on changes in climate in Wales for 2080 (based on a medium emission scenario with 90 per cent probability):

- ▶ 2080 mean winter temperature: a change in temperature of 2.8°C;
- ▶ 2080 mean summer temperature: a change in temperature of 3.5°C;
- ▶ 2080 mean winter precipitation: an increase of 19 per cent; and
- ▶ 2080 mean summer precipitation: a decrease of 20 per cent.

Sea levels are also forecast to rise, with relative sea level in Cardiff forecast to be approximately 45cm greater than 1990 levels by 2095. The changes in climate are expected to result in an increase in the number of flash flooding events, increased pressure on the capacity of the sewerage system, increased frequency of summer water shortages and low flows in rivers which will result in the loss of habitats and species⁹⁶.

⁹⁵ Trends – Air Quality Indicators, Modelled Scenarios. Available online at: <http://www.welshairquality.co.uk/trend.php?t=5> [Accessed February 2017]

⁹⁶ WAG (2010). Climate Change Strategy for Wales. Available online at: <http://gov.wales/docs/desh/publications/101006ccstratfinalen.pdf> [Accessed February 2017]

The changes in average temperatures and rainfall as a result of climate change are likely to cause hotter, drier summers which will potentially result in:

- ▶ increased maximum summer temperatures that are likely to lead to increased thermal discomfort in buildings;
- ▶ increased health problems in the summer, including heat related deaths and those linked to high air pollution. Elevated summer temperatures cause health problems both directly and indirectly, via elevated levels of air pollutants;
- ▶ increased summer water shortages as summer rainfall decreases;
- ▶ growth in summer tourism; and
- ▶ changes to the natural environment including impacts on habitats and species associated with changing temperatures and water availability (in both summer and winter).

Milder winters are expected to result in:

- ▶ a reduction in the number and severity of annual frosts and snowfall, caused by the likely increased temperatures during the winter months which could lead to longer growing seasons for suitable crops and grasslands;
- ▶ less cold weather transport disruption;
- ▶ reduced demand for winter heating;
- ▶ less cold weather related illnesses;
- ▶ increased river and urban flooding, due to the increased incidence and severity of extreme rainfall events;
- ▶ increased pressure on sewer systems with associated water quality impacts; and
- ▶ increased localised flooding as a result of pressures on the sewerage/drainage network due to exceeded capacity.

Under the second UK Climate Change Risk Assessment evidence report, there are significant reductions projected in the availability of public water supplies by the 2050s and the 2080s under both a medium and high climate change scenario.⁷⁹ Climate change is also identified as one of the potential key drivers associated with a significant and growing risk of severe drought.⁸⁰

The Kyoto Protocol's first commitment period ended in 2012, which had set a legally binding target for the UK to reduce its greenhouse gas emissions by 12.5 per cent (compared to the 1990 base year) across 2008 to 2012. The 2015 United Nations Climate Change Conference (COP21) negotiated the Paris Agreement, a global agreement to (*inter alia*) hold the increase in the global average temperature to well below 2 °C above pre-industrial levels and to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development.

The UK Climate Change Act 2008 set legally binding targets for the UK to reduce greenhouse gas emissions by at least 80 per cent by 2050, and CO₂ emissions by at least 26 per cent by 2020, both set against a 1990 baseline. Under the requirements of the Act, the Government has set five-year carbon budgets to set out a trajectory for emissions reductions to 2050. Budgets have been set covering the periods 2008-12, 2013-17, 2018-22, 2023-27 and 2028-32, equivalent to 22 per cent, 28 per cent, 34 per cent, 50 per cent and 57 per cent reductions in carbon emissions compared to 1990 levels respectively.

The Climate Change Strategy for Wales⁹⁷ sets out the Welsh Government's policy intentions in relation to climate change. It reiterates the One Wales commitments to 3 per cent annual carbon reductions and states that, by 2020, the Welsh Government expects to see:

⁹⁷ WAG (2010). Climate Change Strategy for Wales. Available online at: <http://gov.wales/docs/desh/publications/101006ccstratfinalen.pdf> [Accessed February 2017]

- ▶ Businesses have reduced energy costs and emissions;
- ▶ Employees actively engaged in reducing emissions from their workplaces;
- ▶ Consumers demanding low carbon goods and services and concerned about sustainability performance of businesses;
- ▶ Growth of social enterprises and community businesses providing low carbon goods and services locally; and
- ▶ More businesses operating, and people employed in, businesses that provide low carbon goods and services.

In 2007, Welsh Water committed to reducing carbon emissions by 25 per cent by 2015 and by 50 per cent by 2035⁹⁸. In 2015 Welsh Water reported failing to meet the 2015 target (of 230ktCO₂e) with emissions totalling 233 ktCO₂e which Welsh Water state was principally due to an increased carbon content of grid supplied electricity⁹⁹.

There is a degree of conflict between increasing the level of treatment of waste water required to meet stricter environmental quality standards and the energy use and associated emissions that result from the improved treatment processes.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP, arising from the analysis of the air quality and climate baseline are:

- ▶ the need to minimise emissions of pollutant gases and particulates and enhance air quality;
- ▶ the need to reduce the need to travel and promote sustainable modes of transport;
- ▶ the need to reduce greenhouse gas emissions arising from implementation of the WRMP;
- ▶ the need to take into account, and where possible adapt to, the potential effects of climate change; and
- ▶ the need to increase environmental resilience to the effects of climate change.

3.6 Human Environment

Baseline Characteristics

The population of Wales at the time of the 2011 Census was 3,063,800. The 2016 mid-year population estimate indicates the population of Wales to be 3,113,200, an increase of 49,400 from 2011¹⁰⁰. The 2016 mid-year population estimates indicate that population density in Wales had increased from 140.3 people per square kilometre in 2001 to 150.1 people per square kilometre in 2016¹⁰¹.

⁹⁸ Welsh Water (2007). Our Sustainable Future. Available online at: http://www.dwrcymru.com/library/leaflets_publications_english/our_sustainable_future/our_sustainable_future.pdf [Accessed February 2017]

⁹⁹ Welsh Water Report and Accounts 2015. Available online: http://www.dwrcymru.com/en/Reading_Room_Library/Company-Reports.aspx [Accessed February 2017]

¹⁰⁰ ONS Wales population mid-year estimate. Available online at: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/timeseries/wapop/pop> [Accessed October 2017]

¹⁰¹ Population density (persons per square kilometre) by local authority and year. Available online at: <https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Density/populationdensity-by-localauthority-year> [Accessed October 2017]

The change in Wales' population between 2001 - 2011 and 2011 - 2016 is shown in **Table 3.9**. The table includes all counties in Welsh Waters area, in both Wales¹⁰² and England¹⁰³.

Table 3.9 Population of Welsh Water Area by County

County	2001 Population	2011 Population	Population change between 2001 and 2011	2016 Population	Population change between 2011 and 2016
Isle of Anglesey	67,806	69,913	3.1%	69,979	0.1%
Gwynedd	116,844	121,523	4.0%	122,864	1.1%
Conwy	109,674	115,326	5.2%	116,218	0.8%
Denbighshire	93,070	93,919	0.9%	94,691	0.8%
Flintshire	148,629	152,666	2.7%	154,074	0.9%
Wrexham	128,540	135,070	5.1%	136,647	1.2%
Powys	126,398	133,071	5.3%	132,642	-0.3%
Ceredigion	75,417	75,293	-0.2%	74,642	-0.9%
Pembrokeshire	113,058	122,613	8.5%	123,464	0.7%
Carmarthenshire	173,652	183,961	5.9%	185,123	0.6%
Swansea	223,463	238,691	6.8%	242,382	1.5%
Neath Port Talbot	134,380	139,880	4.1%	140,992	0.8%
Bridgend	128,735	139,410	8.3%	142,092	1.9%
Vale of Glamorgan	119,277	126,679	6.2%	127,592	0.7%
Cardiff	310,088	345,442	11.4%	357,160	3.4%
Rhondda Cynon Taf	231,910	234,373	1.1%	237,411	1.3%
Merthyr Tydfil	56,207	58,851	4.7%	59,324	0.8%
Caerphilly	169,546	178,782	5.4%	180,164	0.8%
Blaenau Gwent	70,000	69,812	-0.3%	69,544	-0.4%
Torfaen	90,912	91,190	0.3%	91,836	0.7%
Monmouthshire	84,984	91,508	7.7%	92,476	1.1%
Newport	137,642	145,785	5.9%	147,769	1.4%
WALES	2,910,232	3,063,758	5.3%	3,113,150	1.6%

¹⁰² Components of population change, by local authority and component. Available online at: <https://stats.wales.gov.wales/Catalogue/Population-and-Migration/Population/Components-of-Change/components-of-population-change-by-local-authority-component> [Accessed October 2017]

¹⁰³ ONS All people population County of Herefordshire. Available online at: https://www.nomisweb.co.uk/reports/lmp/la/1946157169/subreports/pop_time_series/report.aspx [Accessed October 2017]

County	2001 Population	2011 Population	Population change between 2001 and 2011	2016 Population	Population change between 2011 and 2016
Herefordshire	174,900	183,600	5.0%	189,300	3.1%

Welsh Water provides water supply and sewerage services to over 3 million people⁵⁶. Although the majority of people are located in Wales, the company also supplies water to areas of England (approximately 228,000 customers¹⁰⁴).

Figure 3.9 below shows the breakdown of population by age and gender for each local authority. Highlighting variations across local authorities, for example the percentage of population aged 45 to 64 in Powys is relatively high at 29.0 per cent for males and 29.4 per cent for females, compared to the figure for Wales of 26.2 per cent and 26.5 per cent respectively. Women aged 75 and over represent 10.3 per cent of the population in Wales but in some areas the percentage is higher, e.g. Isle of Anglesey at 12.4 per cent and Conwy at 14.5 per cent.

¹⁰⁴ Estimate based on June Return 2011 population by WRZ and percentage of WRZ land area lying within England

Figure 3.9 Age Distribution of Population by Gender and Local Authority

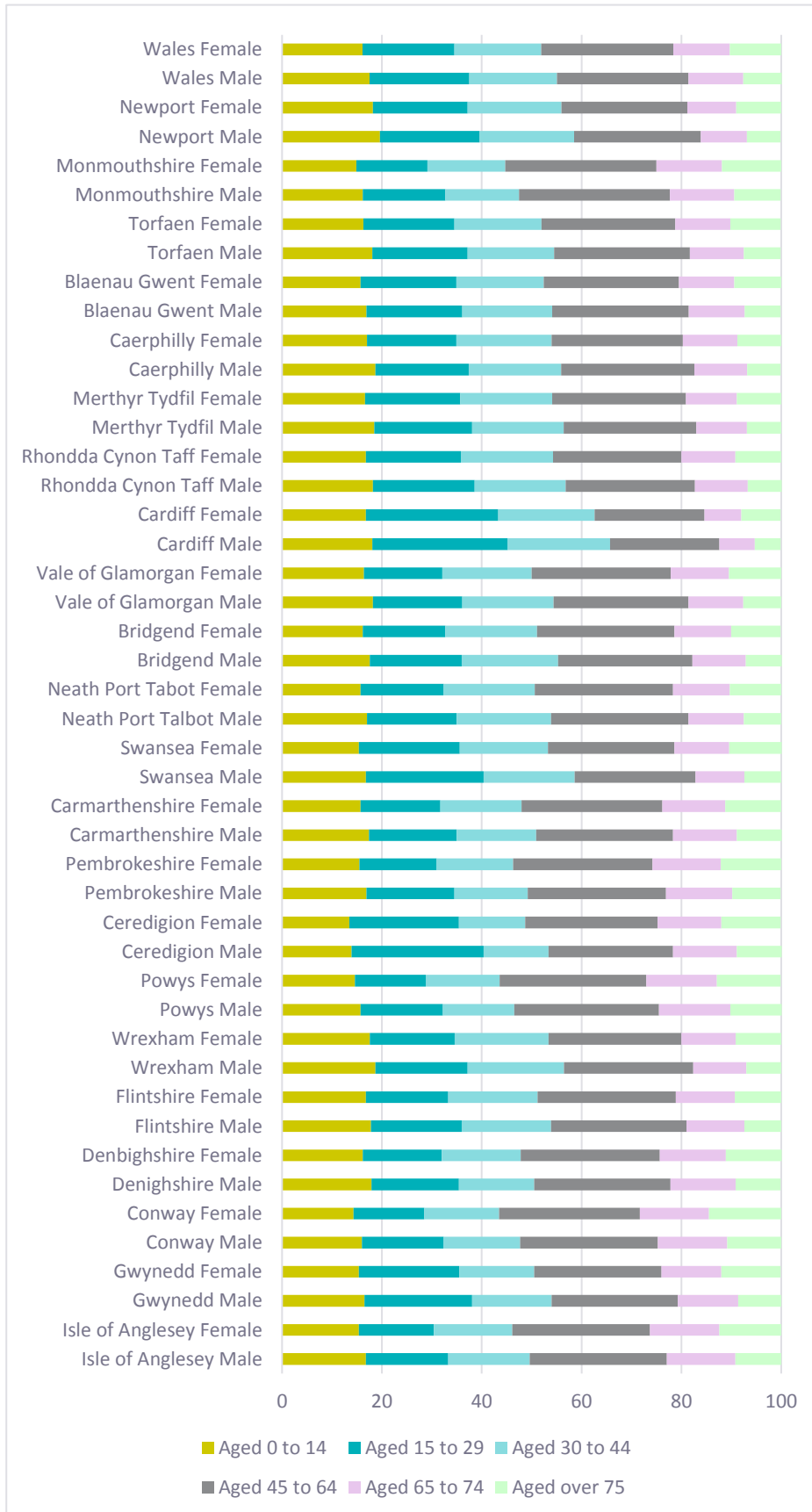


Table 3.10 below provides information in relation to changes in population density between 2001 and 2016. Overall densities have increased although there are instances where densities have fallen.

Table 3.10 Population Density per square kilometre of land area by Welsh Authorities¹⁰⁵

	Population Density Mid-year 2001	Population Density Mid-year 2016	Change 2001-2016	% Change 2001- 2016
Wales	140.3	150.1	9.8	7.0%
Isle of Anglesey	95.3	98.0	2.7	2.8%
Gwynedd	46.1	48.8	2.7	5.9%
Conwy	97.4	103.5	6.1	6.3%
Denbighshire	111.2	113.3	2.1	1.9%
Flintshire	339.7	353.0	13.3	3.9%
Wrexham	255.2	271.4	16.2	6.3%
Powys	24.4	25.5	1.1	4.5%
Ceredigion	42.2	41.5	-0.7	-1.7%
Pembrokeshire	69.8	76.6	6.8	9.7%
Carmarthenshire	73.3	78.3	5.0	6.8%
Swansea	588.5	643.9	55.4	9.4%
Neath Port Talbot	304.5	320.8	16.3	5.4%
Bridgend	513.4	571.0	57.6	11.2%
Vale of Glamorgan	360.3	388.0	27.7	7.7%
Cardiff	2,200.8	2565.5	364.7	16.6%
Rhondda Cynon Taf	546.8	561.8	15.0	2.7%
Merthyr Tydfil	504.3	536.7	32.4	6.4%
Caerphilly	611.2	650.6	39.4	6.4%
Blaenau Gwent	643.8	640.4	-3.4	-0.5%

¹⁰⁵ Welsh Government. Population density (persons per square kilometre) by local authority and year. Available online at: <https://stats.wales.gov.wales/Catalogue/Population-and-Migration/Population/Density/populationdensity-by-localauthority-year> [Accessed October 2017]

	Population Density Mid-year 2001	Population Density Mid-year 2016	Change 2001-2016	% Change 2001- 2016
Torfaen	723.3	732.3	9.0	1.2%
Monmouthshire	100.1	109.3	9.2	9.2%
Newport	722.4	782.8	60.4	8.4%

There were 1,295,135 households in Wales in 2010, increasing to 1,341,624 in 2016¹⁰⁶, a 3.6 per cent increase.

Information on the size of households is provided below in **Table 3.11**. This shows a decline in household size in the majority of areas although the rate varies from -0.6 per cent in Denbighshire to -5.7 per cent in Rhondda Cynon Taf.

Table 3.11 Change in Household Size (2001-2016)¹⁰⁷

	2001	2016	Change	% change
Wales	2.36	2.28	-0.08	-3.5%
Isle of Anglesey	2.33	2.23	-0.10	-4.4%
Gwynedd	2.31	2.22	-0.09	-3.8%
Conwy	2.23	2.17	-0.06	-2.5%
Denbighshire	2.28	2.27	-0.01	-0.6%
Flintshire	2.44	2.34	-0.10	-3.9%
Wrexham	2.38	2.30	-0.08	-3.2%
Powys	2.32	2.20	-0.12	-5.2%
Ceredigion	2.32	2.22	-0.10	-4.4%
Pembrokeshire	2.34	2.23	-0.11	-4.8%
Carmarthenshire	2.33	2.28	-0.05	-2.3%
Swansea	2.33	2.23	-0.10	-4.2%
Neath Port Talbot	2.32	2.28	-0.04	-1.5%

¹⁰⁶ Welsh Government. Households by Type and Year. Available online: <https://statswales.gov.wales/Catalogue/Housing/Households/Estimates/households-by-type-year> [Accessed October 2017]

¹⁰⁷ Welsh Government. Average household size (persons) by local authority and year. Available online: <https://statswales.gov.wales/Catalogue/Housing/Households/Estimates/averagehouseholdsize-by-localauthority-year> [Accessed October 2017]

	2001	2016	Change	% change
Bridgend	2.38	2.31	-0.07	-2.9%
Vale of Glamorgan	2.41	2.28	-0.13	-5.3%
Rhondda Cynon Taf	2.42	2.28	-0.14	-5.7%
Merthyr Tydfil	2.4	2.40	0.00	0.0%
Caerphilly	2.43	2.36	-0.07	-3.0%
Blaenau Gwent	2.34	2.24	-0.10	-4.4%
Torfaen	2.4	2.32	-0.08	-3.5%
Monmouthshire	2.37	2.31	-0.06	-2.5%
Newport	2.39	2.33	-0.06	-2.5%
Cardiff	2.4	2.31	-0.09	-3.6%

Health

Life expectancy is used as a broad measure of the health of an area and where a person is born largely influences how long they will live. In Wales the average life expectancy at birth for the period 2014-2016 was 78.4 for men and 82.4 for women, compared to 79.2 and 82.9 years respectively for the United Kingdom.¹⁰⁸

The Welsh Health Survey 2015¹⁰⁹ identified that 33 per cent of adults reported that their day-to-day activities were limited because of a health problem/disability, including 15 per cent who were 'limited a lot'. A total of 20 per cent of adults reported being treated for high blood pressure, 14 per cent for a respiratory illness, 13 per cent for a mental illness, 12 per cent for arthritis, 8 per cent for a heart condition, and 7 per cent for diabetes.

Rates of illness have changed fairly slowly since the survey started in 2003/04. There has been a slight increase in adults reporting being treated for mental illness and diabetes (4 per cent and 2 per cent respectively). Levels of high blood pressure are higher (a 2 per cent increase over the period 2003/4 to 2015) and there has been a 2 per cent decrease in heart conditions and a 2 per cent decrease in arthritis reported. There has also been a 3 per cent decrease in the reporting of fair or poor general health over the survey period.

Figure 3.10 below shows the geographical variations in reported health status. The percentage of adults who reported their general health status as fair / poor is highest in Blaenau Gwent (27 per cent) and lowest in Gwynedd (14 per cent). Generally, the incidence of fair/poor reported health status is higher in more southerly counties when compared to north Wales counties; however, this is likely to reflect the legacy of employment in industries such as mining and steel working in communities, levels of deprivation and demography. There is a substantial difference in healthy life expectancy between the least and most deprived areas in Wales, with those in the most deprived areas having a lower healthy life expectancy. In

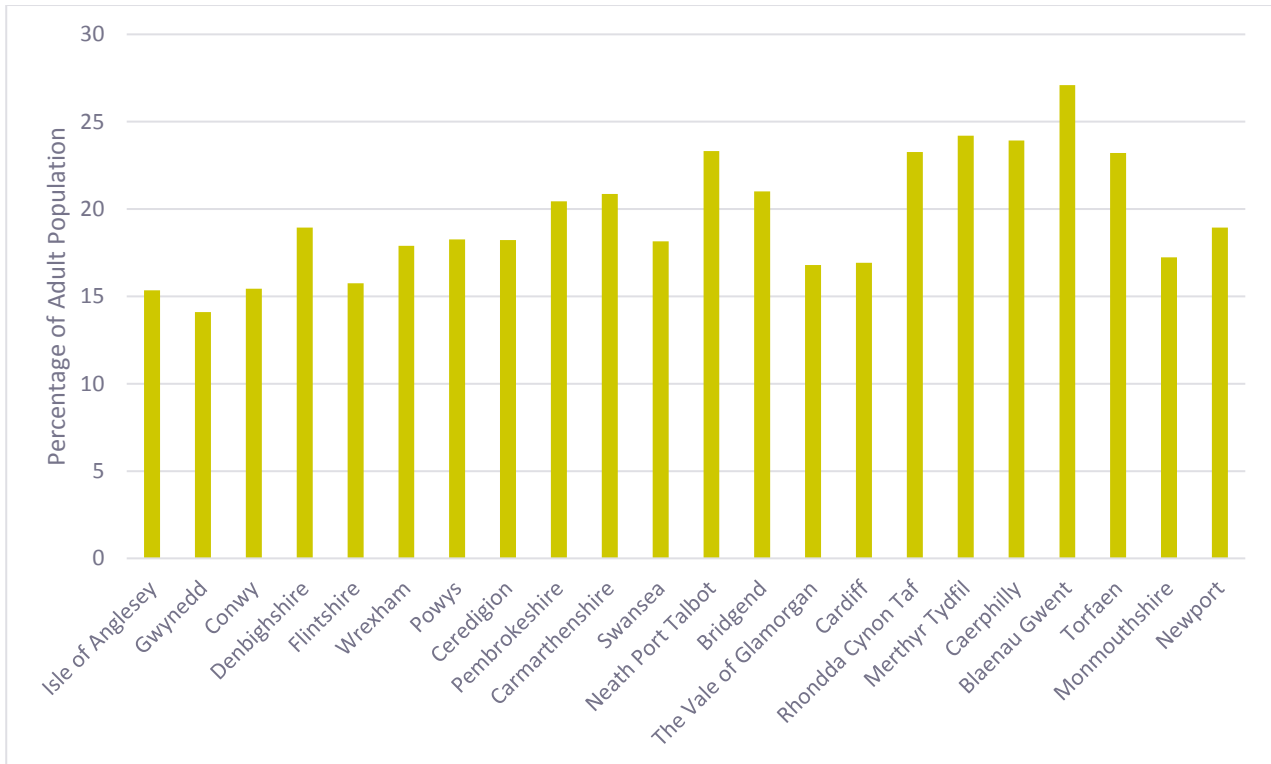
¹⁰⁸ ONS (2017) Statistical bulletin: National life tables, UK: 2014 to 2016. Available at: <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/nationallifetablesunitedkingdom/2014to2016> [Accessed October 2017]

¹⁰⁹ Welsh Government (2016) Welsh Health Survey 2015: Initial Headline Results. Available at: <http://gov.wales/docs/statistics/2016/160601-welsh-health-survey-2015-initial-headline-results-en.pdf> [Accessed February 2017]

males, the gap in healthy life expectancy is approximately 19 years between the least and most deprived areas in Wales, and in females, the gap is approximately 18 years.¹¹⁰

Vulnerable populations such as less mobile people (due to age, infirmity or illness) are more likely to be negatively affected by any adverse effects of water shortages, for example being less able to access standpipes in periods of extreme shortage.

Figure 3.10 Percentage of Adult Population who reported their general health status as fair/poor (2014 and 15)¹¹¹



Economy

Table 3.12 shows the proportion of economically active people during the period May 2017 to July 2017 in Wales was 75.8 per cent of the 16 – 64 year age group. This is 3 percentage points lower than the figure for the United Kingdom (UK) over the same period (78.8 per cent). Economically active in this context is defined by the ONS as those persons of working age who are employed or looking to be employed. 4.3 per cent of those aged 16 and over were unemployed over the period May 2017 to July 2017 in Wales, the same as for the UK.

Table 3.12 Economic Activity (May 2017 – July 2017)¹¹²

	Wales	Wales (%)	UK	UK (%)
Economically Active	1,496,000	75.8	33,591,000	78.8
In employment	1,431,000	72.4	32,136,000	75.3

¹¹⁰ Public Health Wales NHS Trust (2016) Measuring Inequalities 2016: Trends in mortality and life expectancy in Wales. Available online at: <http://www.publichealthwalesobservatory.wales.nhs.uk/measuring-inequalities-2016-overview/> [Accessed October 2017]

¹¹¹ Table 1 of Welsh Health Survey 2003/04 to 2015: Local Authority and Local Health Board Trends. Available online: <http://gov.wales/statistics-and-research/welsh-health-survey/?lang=en> [Accessed February 2017]

¹¹² Labour Supply Headline indicators – seasonally adjusted (May 2017-Jul 2017). Available online: <https://www.nomisweb.co.uk/reports/lmp/gor/2013265930/report.aspx?town=wales> [Accessed October 2017]

	Wales	Wales (%)	UK	UK (%)
Unemployed	65,000	4.3	1,455,000	4.3

Table 3.13 shows the breakdown of the workforce by industry sector as at June 2017. The table indicates that the largest proportion of jobs in Wales are in human health and social work activities, and wholesale and retail trade, similar to UK trends. A total of 12,000 jobs (0.8 per cent) in Wales are within the water supply, sewerage and waste management sector, similar to the proportion of jobs in this sector for the UK as a whole (0.6 per cent). In 2017 Welsh Water directly employed almost 3,200 people and supported a further 3,000 jobs⁹¹.

Table 3.13 Workforce jobs by industry – seasonally adjusted (June 2017)¹¹³

Industry Sector	Wales	Wales (%)	UK	UK (%)
A : Agriculture, forestry and fishing	60,000	4.0	402,000	1.2
B : Mining and quarrying	2,000	0.1	63,000	0.2
C : Manufacturing	158,000	10.5	2,666,000	7.6
D : Electricity, gas, steam and air conditioning	12,000	0.8	150,000	0.4
E : Water supply; sewerage, waste management	12,000	0.8	208,000	0.6
F : Construction	91,000	6.0	2,286,000	6.5
G : Wholesale and retail trade; repair of vehicles	207,000	13.8	5,112,000	14.6
H : Transportation and storage	50,000	3.3	1,748,000	5.0
I : Accommodation and food service activities	121,000	8.0	2,376,000	6.8
J : Information and communication	28,000	1.9	1,482,000	4.2
K : Financial and insurance activities	33,000	2.2	1,094,000	3.1
L : Real estate activities	24,000	1.6	550,000	1.6
M : Professional, scientific and technical activities	74,000	4.9	2,997,000	8.6
N : Administrative and support service activities	91,000	6.0	2,986,000	8.5
O : Public administration and defence	86,000	5.7	1,489,000	4.3
P : Education	139,000	9.2	2,980,000	8.5
Q : Human health and social work activities	229,000	15.2	4,382,000	12.5
R : Arts, entertainment and recreation	48,000	3.2	973,000	2.8
S : Other service activities	40,000	2.7	940,000	2.7

¹¹³ Labour Demand, Workforce jobs by industry section (SIC 2007) – seasonally adjusted (June 2017). Available online: <https://www.nomisweb.co.uk/reports/lmp/gor/2013265930/report.aspx?town=wales> [Accessed October 2017]

Industry Sector	Wales	Wales (%)	UK	UK (%)
T : Activities of households as employers	1,000	0.1	66,000	0.2

Table 3.14 shows that in 2015 there were 95,010 active business enterprises in Wales. This is an 8.2 per cent increase since 2005. However, the national increase has seen regional variations. The Mid Wales region has seen a decrease of -1.4 per cent over the period 2005 to 2015, with Ceredigion seeing the biggest decrease in Wales (-4.3 per cent). The South East Wales region had the biggest increase of 14.1 per cent, with Merthyr Tydfil (21.6 per cent) and Cardiff (19.9 per cent) having the greatest increase in Wales over the period.

Table 3.14 Number of Active Business Enterprises between 2005 and 2015¹¹⁴

Area	2005	2010	2015	Change between 2005 and 2015 (%)
WALES	87,780	90,435	95,010	8.2
North Wales	21,250	22,135	22,770	7.2
Isle of Anglesey	2,015	2,100	2,045	1.5
Gwynedd	4,360	4,455	4,425	1.5
Conwy	3,770	3,835	3,945	4.6
Denbighshire	3,140	3,195	3,330	6.1
Flintshire	4,510	4,690	5,105	13.2
Wrexham	3,455	3,860	3,920	13.5
Mid Wales	8,795	8,975	8,670	-1.4
Powys	5,800	5,985	5,805	0.1
Ceredigion	2,995	2,990	2,865	-4.3
South West Wales	19,840	20,310	20,335	2.5
Pembrokeshire	4,615	4,640	4,500	-2.5
Carmarthenshire	5,920	6,040	5,960	0.7
Swansea	6,320	6,515	6,730	6.5
Neath Port Talbot	2,985	3,115	3,145	5.4
South East Wales	37,895	39,015	43,235	14.1
Bridgend	3,555	3,700	3,950	11.1
Vale of Glamorgan	3,770	3,925	4,340	15.1
Cardiff	10,080	10,340	12,090	19.9
Rhondda Cynon Taff	4,950	5,170	5,745	16.1

¹¹⁴ Active Business Enterprises by area and year (2016). Available online: <https://stats.wales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/Businesses/Business-Demography/activebusinessenterprises-by-area-year> [Accessed February 2017]

Area	2005	2010	2015	Change between 2005 and 2015 (%)
Merthyr Tydfil	1,090	1,150	1,325	21.6
Caerphilly	3,615	3,760	4,105	13.6
Blaenau Gwent	1,275	1,250	1,315	3.1
Torfaen	2,100	2,085	2,220	5.7
Monmouthshire	3,680	3,795	4,015	9.1
Newport	3,780	3,840	4,130	9.3

Although the majority of customers are located in Wales, the company also supplies water to areas of the West Midlands. The number of active business enterprises in the West Midlands in 2005 was 182,995 and in 2015 was 207,980. This is an increase of 13.7 per cent over the period 2005 to 2015.

Transport

Welsh Transport Statistics states that the total combined length of roads in Wales in 2015/16¹¹⁵ was 34,642 km, an increase of 800 km since 2000. In 2015/16, 4.3 per cent of the motorway network and 5.7 per cent of the trunk road network required close monitoring of structural condition compared with 6.3 per cent and 10.6 per cent respectively in 2005.

The volume of traffic has grown by 5.3 per cent between 2005 and 2015, from 26.98 billion vehicle km to 28.40 billion vehicle km¹¹⁶. In 2015 the majority of motorised traffic in Wales were cars/taxis (79 per cent), light vans (15 per cent) and goods vehicles (four per cent). In 2015, there were 5,543 Police recorded road accidents¹¹⁷ involving personal injury, a six per cent reduction from 2014 and a continuation of the longer-term trend of fewer road accidents.

Vehicle movements are essential to everyday operations within Welsh Water. In 2015, six per cent of Welsh Water's gross annual operational greenhouse gas emissions was from the company owned office and transport fleet.¹¹⁸

Tourism

In 2015, 10.45 million UK domestic tourist trips were made to Wales generating £1,975 million¹¹⁹. In 2015 3.6 million domestic tourist trips were made to North Wales. This figure compares with 1.74 million trips to Mid Wales, 2.12 million to the South West and 2.92 million to the South East¹²⁰. Data for 2010 shows that £333 million was generated from 890,000 overseas visits¹²¹.

¹¹⁵ Welsh Government. Road lengths and conditions, 2015-16. Available online at: <http://gov.wales/docs/statistics/2017/170208-road-lengths-conditions-2015-16-en.pdf> [Accessed October 2017]

¹¹⁶ Welsh Government. Road Traffic in Wales during 2015. Available online at: <http://gov.wales/docs/statistics/2016/161130-road-traffic-2015-en.pdf> [Accessed February 2017]

¹¹⁷ Welsh Government. Police recorded road casualties in Wales, 2015. Available online at: <http://gov.wales/docs/statistics/2016/160628-police-recorded-road-casualties-2015-en.pdf> [Accessed February 2017]

¹¹⁸ Welsh Water Report and Accounts 2015. Available online at: http://www.dwrcymru.com/en/Reading_Room_Library/Company-Reports.aspx [Accessed February 2017]

¹¹⁹ The GB Tourist Statistics 2015. Available online at: <http://gov.wales/docs/statistics/2016/161006-gb-tourist-statistics-2015-en.pdf> [Accessed February 2017]

¹²⁰ Great Britain Tourism Survey online viewer – Wales level data. Visit Wales TNS website. Available online at: <http://dservuk.tns-global.com/GBTSWalesLightViewer/> [Accessed February 2017]

¹²¹ Overseas residents tourism to Wales by measure area of residence and year of travel. Available online at: <https://stats.wales.gov.wales/Catalogue/Tourism/OverseasResidentsTourismToWales-by-Measure-AreaOfResidence-YearOfTravel> [Accessed February 2017]

In 2015, the number of people directly employed in tourism in Wales was 132,400, 10 per cent of the Welsh workforce¹²². The highest numbers of tourism jobs are in Cardiff and Swansea. However, the tourism industries in the coastal areas of North and West Wales play a vital role in local economies¹²³.

With specific regard to water resources, large seasonal fluxes in tourist numbers create additional demand on water resources in summer months when demand is already at its highest. There may be an increasing trend in the near future in light of the expected increase in domestic holidays due to the current economic situation.

Welsh Water manages 91 reservoirs and 40,000 hectares of land which includes four visitor centres, sporting recreational and leisure facilities that between them attract around one million visitors each year, making a valuable contribution to tourism and the local economy^{56,91}. The principal reservoirs also support angling. Inland fisheries contribute strongly to the economic wellbeing of Wales, and are estimated to generate £74 million expenditure per year by anglers in Wales²⁴. Welsh Water's waste water management activities influence the tourist industry due to the impacts on River and Bathing Water quality.

Welsh Index of Multiple Deprivation

The Welsh Index of Multiple Deprivation (WIMD) is the official measure of deprivation for small areas in Wales and identifies whether an area is more or less deprived relative to other small areas in Wales. It was developed for the Welsh Government by the Statistical Directorate and the Local Government Data Unit (Wales). Deprivation refers to unmet need, which is caused by a lack of resources. The WIMD is based on eight different indicators of deprivation: income, employment, health, education, access to services, community safety, physical environment and housing.

Figure 3.11 shows the WIMD 2014 by Lower Super Output Area (LSOA) for Wales¹²⁴. There are 1,909 LSOA in Wales. The indices highlight that there are some distinct pockets of deprivation, which are predominantly in the South Wales valleys and cities, and some North Wales coastal and border towns. Blaenau Gwent is the local authority with the highest proportion of LSOAs (23.4 per cent) in the most deprived 10 per cent in Wales.

Levels of deprivation, particularly income deprivation, affect the ability of customers to pay for water and may also impact on total water usage. In 2016/17 Welsh Water helped approximately 70,000 customers who were struggling to pay their bills through a range of customer assistance funds. In 2016/17, the amount owed by Welsh Water customers who could not pay or chose not to pay their bills was £23 million (3 per cent of annual turnover), a decrease of £5 million from 2014.⁹¹

¹²² Welsh Government Partnership for Growth: Strategy for Tourism 2013-2020. Strategy Progress Review. November 2016. Available online at: <http://llyw.cymru/docs/drah/publications/161116-strategy-review-en.pdf> [Accessed February 2017]

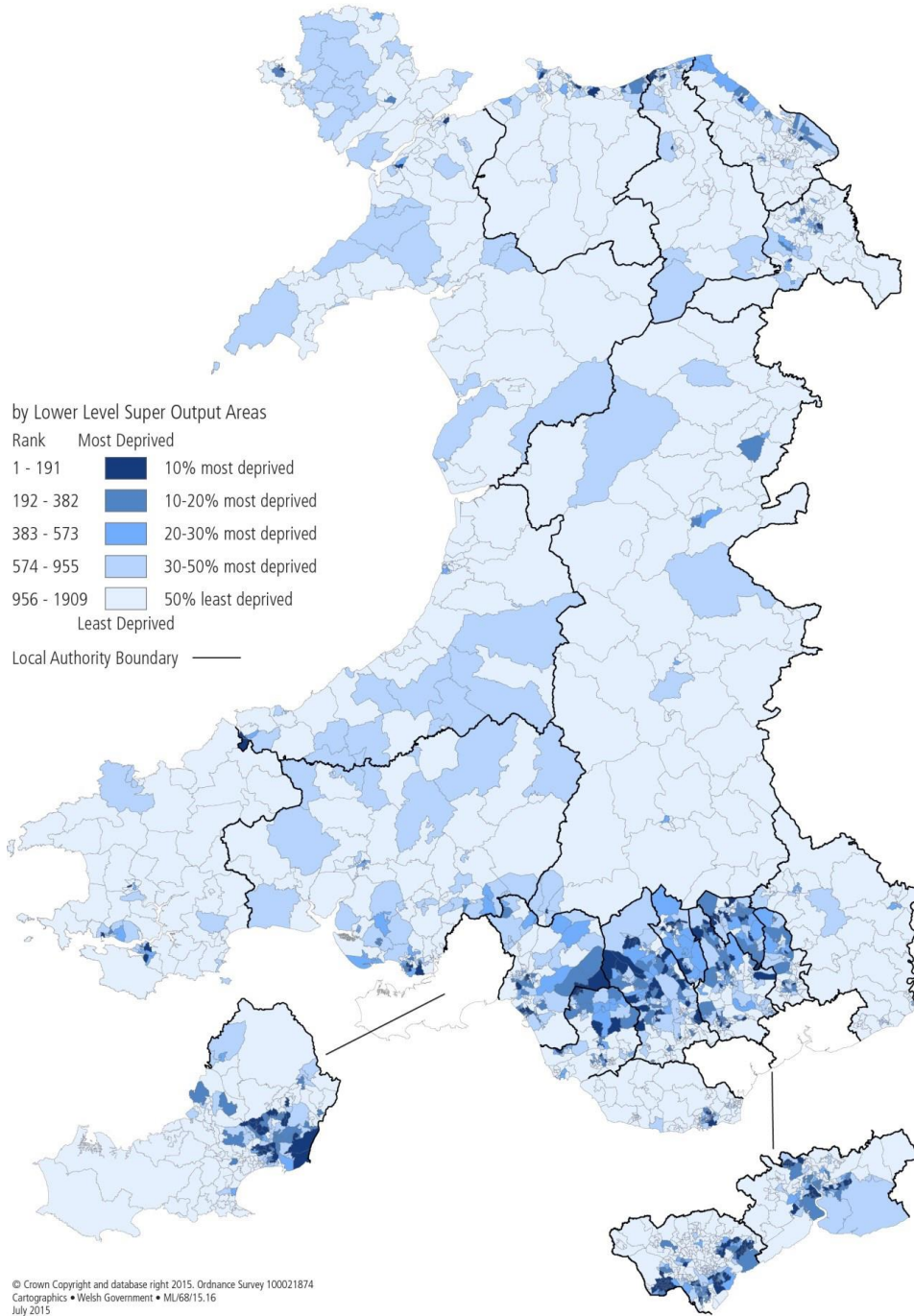
¹²³ Wales Tourism Alliance (2008). Tourism Industry analysis and action plan. Wales Tourism Alliance: Cardiff

¹²⁴ Welsh Government Welsh Index of Multiple Deprivation 2014. Executive Summary, revised. Available online at: <http://gov.wales/docs/statistics/2015/150812-wimd-2014-summary-revised-en.pdf> [Accessed February 2017]

Figure 3.11 Index of Multiple Deprivation in Wales (taken from WIMD 2014 Executive Summary)¹²⁵

Welsh Index of Multiple Deprivation 2014

Welsh Index of Multiple Deprivation



¹²⁵ Welsh Government Welsh Index of Multiple Deprivation 2014. Executive Summary, revised. Available online at: <http://gov.wales/docs/statistics/2015/150812-wimd-2014-summary-revised-en.pdf> [Accessed February 2017]

Welsh Language

As at the 2011 Census, 19.0 per cent (562,016) of people living in Wales aged 3 and over could understand, speak, read or write Welsh. The local authority of Blaenau Gwent had the lowest percentage of people able to speak Welsh at 7.8 per cent, whilst Gwynedd had the highest percentage at 65.4 per cent¹²⁶.

Of the 562,016 people that could understand, speak, read or write Welsh in 2011, 76.6 per cent could speak, read and write Welsh; 8.1 per cent could speak and read but could not write Welsh; 14.3 per cent could speak but could not read or write Welsh; 23.1 per cent could understand spoken Welsh only; and 13.1 per cent had a combination of skills¹²⁷. This represents a decline in the number of people able to understand, speak, read or write Welsh since 2001.

All Welsh Water publications are bilingual and there is a dedicated Welsh language line for customers.

Likely Evolution of the Baseline without the WRMP

As shown in **Figure 3.12** the population within Wales is projected to increase from 3,092,036 in 2014 to 3,259,522 in 2039, and increase of 5.42 per cent.

Figure 3.12 Projected Population Change for Wales 2014 - 2039¹²⁸

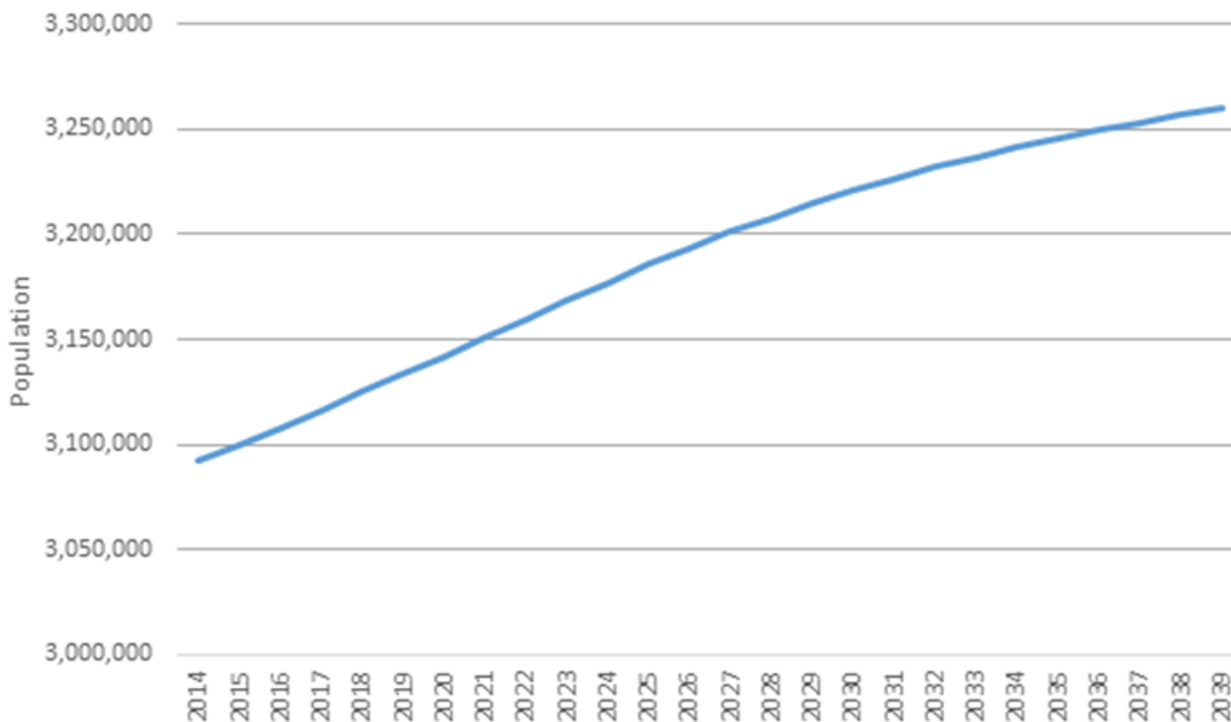


Table 3.15 outlines the projected population change for each of the counties within the Welsh Water area over the same period. There are population decreases for a number of Welsh counties (shown by a negative

¹²⁶ Welsh speakers by local authority, gender and detailed age groups, 2011 Census. Available at: <https://statswales.wales.gov.uk/Catalogue/Welsh-Language/WelshSpeakers-by-LocalAuthority-Gender-DetailedAgeGroups-2011Census> [Accessed December 2015].

¹²⁷ Welsh language skills by local authority, gender and detailed age groups, 2011 Census. Available at: <https://statswales.wales.gov.uk/Catalogue/Welsh-Language/WelshLanguageSkills-by-LocalAuthority-Gender-DetailedAgeGroups-2011Census> [Accessed December 2015].

¹²⁸ Local Authority Population projection Wales 2014. Available online at: <http://gov.wales/statistics-and-research/local-authority-population-projections/?lang=en> [Accessed February 2017]

number in the table). The biggest population increase, 25.51 per cent, is predicted to be in Cardiff over the period 2014 to 2039, with the second biggest increase in Herefordshire, 11.49 per cent.

Table 3.15 Projected Population Change 2014 – 2039 by County¹²⁸

County	Population change between 2014 and 2039 (%)	County	Population change between 2014 and 2039 (%)
Isle of Anglesey	-2.59	Bridgend	4.99
Gwynedd	8.43	Vale of Glamorgan	0.35
Conwy	1.66	Rhondda Cynon Taf	4.05
Denbighshire	2.67	Merthyr Tydfil	-1.70
Flintshire	1.34	Caerphilly	1.10
Wrexham	9.70	Blaenau Gwent	-4.90
Powys	-7.73	Torfaen	-0.41
Ceredigion	8.79	Monmouthshire	0.13
Pembrokeshire	-1.17	Newport	7.93
Carmarthenshire	2.17	Cardiff	25.51
Swansea	8.97	Herefordshire	11.49
Neath Port Talbot	1.58		

The 2011-based household projections show that, by 2036, the number of households in Wales is projected to increase by 14.6 per cent to 1,494,188¹²⁹. As shown in **Table 3.16**, 2011-based household projections for Wales's areas indicate that the greatest population increase will be in Cardiff (41.3 per cent). Whilst there is no overall change in the number of households in Blaenau Gwent, the numbers are predicted to fluctuate to a peak in 2025 before reducing again.

Table 3.16 Projected Percentage Change in Household Numbers 2014 – 2039 by County¹²⁹

County	Number of households change between 2011 and 2036 (%)	County	Number of households change between 2011 and 2036 (%)
Isle of Anglesey	2.0	Bridgend	14.5
Gwynedd	12.5	Vale of Glamorgan	13.9
Conwy	3.6	Rhondda Cynon Taf	9.4
Denbighshire	10.5	Merthyr Tydfil	8.0
Flintshire	7.8	Caerphilly	7.7
Wrexham	27.3	Blaenau Gwent	0.0

¹²⁹ Welsh Government, Stats Wales. Household Projections by local authority and year. 2011-based. Available online at: <https://statswales.gov.wales/Catalogue/Housing/Households/Projections/Local-Authority/2011-Based/HouseholdProjections-by-LocalAuthority-Year> [Accessed February 2017]

County	Number of households change between 2011 and 2036 (%)	County	Number of households change between 2011 and 2036 (%)
Powys	8.0	Torfaen	5.5
Ceredigion	8.3	Monmouthshire	4.0
Pembrokeshire	8.4	Newport	21.1
Carmarthenshire	14.6	Cardiff	41.3
Swansea	21.1	Herefordshire	19.9
Neath Port Talbot	4.6		

In addition to population growth driving household demand, economic growth is likely to increase water use by businesses. During periods of water stress, the provision of water to a larger population could mean less water is available for business use.⁸⁰

The Welsh Government's Understanding Wales' Future¹³⁰ outlines some key trends:

- ▶ The number of older people will rise significantly;
- ▶ The number of children is projected to rise in the medium term, before falling slightly in the longer term;
- ▶ Life expectancy is expected to continue to increase;
- ▶ The number of households is growing faster than the population, and there is a long run trend to smaller households (with a large increase in the number of single person households);
- ▶ Current rates of house building are not keeping pace with growth in the number of households, and on current trends this gap will widen, contributing to further house price inflation in the long term;
- ▶ All other things remaining unchanged, the projected increase in population and ageing demographic profile means the number being treated for illnesses will increase; and
- ▶ Health inequalities within Wales are widening.

Recognising the impact of deprivation upon some household's ability to pay their water bill, Welsh Water's social tariff called 'HelpU' helps the most disadvantaged customers. This tariff caps eligible households' bills at £190 per year.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP arising from the analysis of the human environment baseline are:

- ▶ the need to ensure that water resource requirements of people and visitors can be met at all times, in a sustainable way;
- ▶ the need to ensure that water resources remain affordable;
- ▶ the need to ensure that the WRMP measures do not adversely affect the health and well-being of any member of the community;

¹³⁰ Welsh Government. Understanding Wales' Future, A resource to help us think systematically about the future of Wales. Available online at: <http://gov.wales/docs/caecd/research/120109futureswalesen.pdf> [Accessed February 2017]

- ▶ the need to ensure that vulnerable people are not affected by implementation of the WRMP measures;
- ▶ the need to ensure that the WRMP measures do not have an adverse economic impact;
- ▶ the need to avoid disruption through effects on the transport network; and
- ▶ the need to ensure resilience of water supply/treatment infrastructure against climate change effects.

3.7 Material Assets and Resource Use

Baseline Characteristics

Assets

In 2015 Welsh Water supplied water to a population of 3,023,024 and sewerage to a population of 3,206,763¹³¹. To facilitate this Welsh Water operates a large network of infrastructure assets including⁵⁹:

- ▶ 66 impounding reservoirs;
- ▶ 838 sewage treatment works;
- ▶ 65 water treatment works;
- ▶ 369 service reservoirs;
- ▶ Over 1,900 sewage pumping stations;
- ▶ Circa 3,200 combined sewer overflows;
- ▶ 26,500km of water mains;
- ▶ Over 30,000km of sewers;
- ▶ Four visitor centres; and
- ▶ 42,000 hectares of land, much of which has high nature conservation and recreational value.

In 2011, as a requirement of the *Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011*, approximately 17,000km of private sewers and lateral drains transferred to Welsh Water, almost doubling Welsh Waters' sewer network. In 2013 Welsh Water commenced a process of adopting the 800 or more private pumping stations in Welsh Waters operating area by 2016. 115 private sewer pumping stations were adopted in 2014, many in a poor state of repair.

Between 2010 and 2015 Welsh Water:

- ▶ Rebuilt, refurbished or upgraded 12 water treatment works (investing £120 million);
- ▶ Replaced or upgraded 40 wastewater treatment works (investing £29 million);
- ▶ Built a new watersports and visitor centre at Llandegfedd Reservoir (investing £2.5 million);
- ▶ Provided two new laboratories in Glaslyn, Newport and Bretton, North Wales (investing £11 million);
- ▶ Implemented 'RainScape' urban drainage project at Llanelli and Gowerton (investing £15 million).

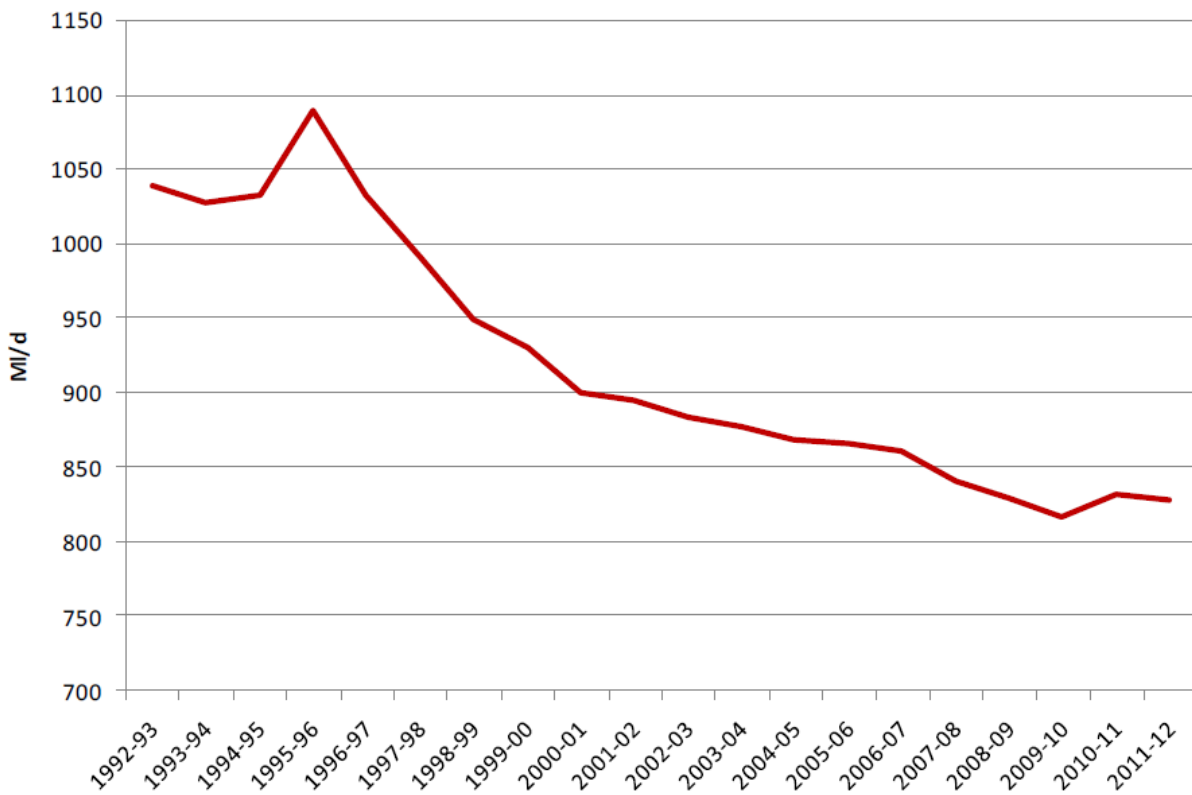
¹³¹ Water UK. Industry facts and figures 2015. Scale information. Available online at: <https://dl.dropboxusercontent.com/u/299993612/Publications/Reports/Industry%20Data/November%202015/Scale%20information.pdf> [Accessed February 2017]

Water Demand

Welsh Water¹³² currently abstract around 800 MI/d from the environment for public water supply. This increases by 15-20 per cent during the summer. During extreme conditions demands on the Welsh Water supply system can increase by over 25 per cent, and up to 50 per cent in localised areas. The geographical variation regionally within the Welsh Water area results in regional variation in water source. The source of supply can be divided into two broad categories, storage (e.g. a reservoir) and non-storage (e.g. a river), and this will affect the ability to respond to demand. Welsh Water’s supplies are almost entirely made up from upland reservoir and river sources and of the 24 Welsh Water WRZs the primary source of water is groundwater for three WRZs, reservoir storage for six WRZs and surface water for 15 WRZs.

There has been a long term steady decline in water demand in the Welsh Water area, see **Figure 3.13** and this trend continues.

Figure 3.13 Welsh Water long term water demand (taken directly from Welsh Waters WRMP 2014¹³²)



During the 2016/17 period the average daily water usage in the Welsh Water area was 145 litres per person per day (l/p/d)¹³³, slightly above the average for England and Wales for the same period (141 l/p/d). As shown in **Table 3.17** the average daily water usage has returned to 2013/14 levels, following a period of decrease in the previous few years. The average for England and Wales shows a similar trend to the Welsh Water area.

¹³² Welsh Water (2014) Final Water Resources Management Plan, Technical Report. Available on line at: <http://www.dwrcymru.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017]

¹³³ Discover Water. The amount we use. Available online at: <http://www.discoverwater.co.uk/amount-we-use> [Accessed October 2017]

Table 3.17 Average Daily Water Usage (litres per person)

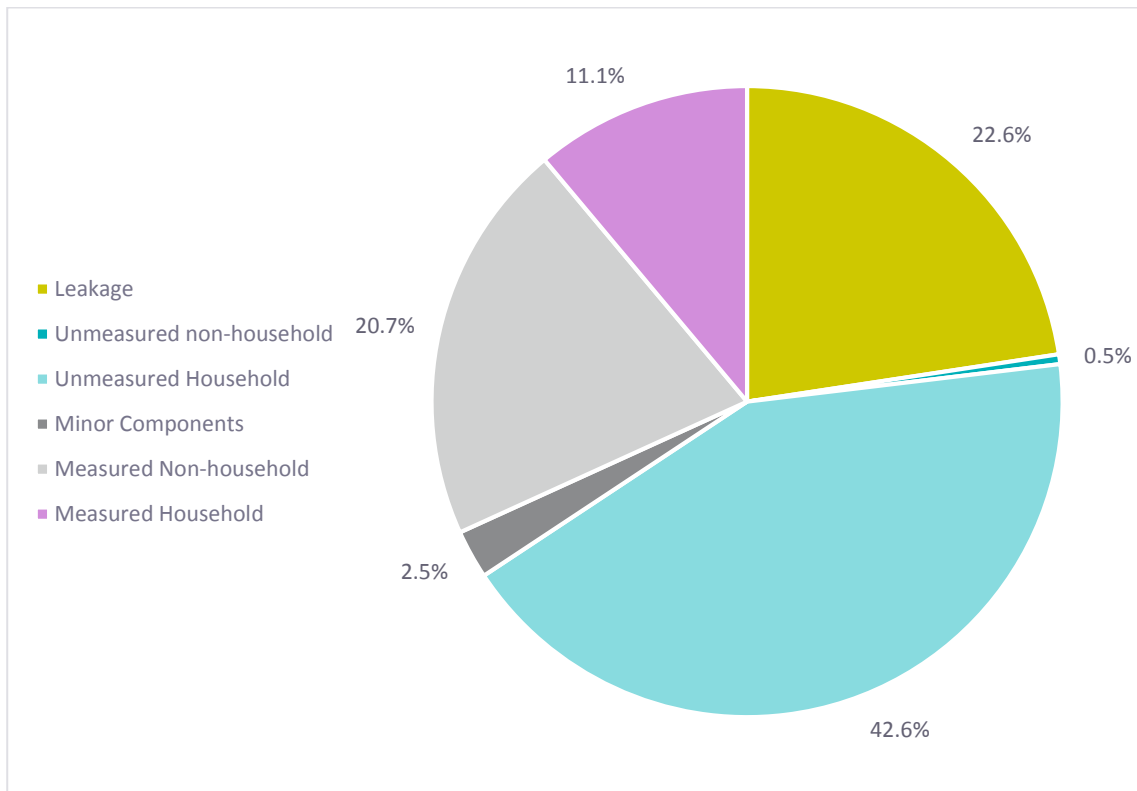
	2013-14	2014-15	2015-16	2016-17
England and Wales Average	141	138	139	141
Welsh Water	145	142	139	145

There is a difference between metered and non-metered water usage, with metered water usage in the Welsh Water area in 2016/17 being 117 l/p/d, which is lower than the average for England and Wales (127 l/p/d). The non-metered water usage levels in the Welsh Water area in 2016/17 was 159 l/p/d, marginally lower than the average for England and Wales (160 l/p/d). This confirms that less water is used in households with a meter compared to ones without.

Welsh Water has not placed any restrictions on the use of water since 1989¹³⁴.

Figure 3.14 shows the components of the Welsh Water demand in 2012/13. Over half of the demand is from households.

Figure 3.14 Components of the 2012/13 Welsh Water Demand¹³⁵



¹³⁴ Welsh Water (2014) Final Water Resources Management Plan, Technical Report. Available on line at: <http://www.dwrcymru.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017]

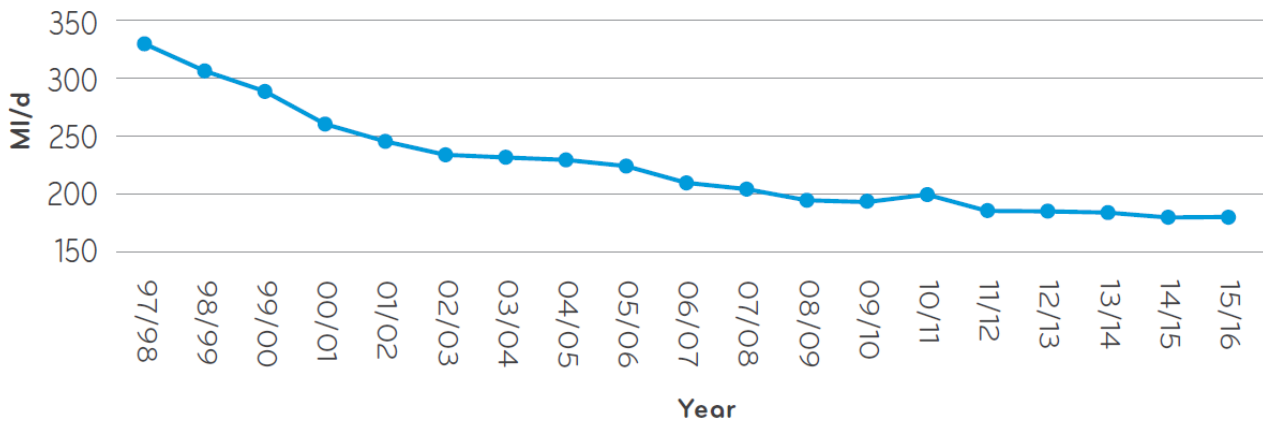
¹³⁵ Welsh Water (2014) Final Water Resources Management Plan, Technical Report. Available on line at: <http://www.dwrcymru.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017]

Leakage

Leakage levels¹³⁶ are affected by a number of factors including the length, age and condition of the water mains network as well as weather conditions. The change in climate to hotter, drier summers, combined with a growing population means waters resources need to be managed more efficiently.

In 2016/17 Welsh Water had reduced leakage by 4.43 million litres per day (Ml/day), from 179.86 Ml/day in 2015/16 to 175.43 Ml/day in 2015/16¹³⁷. **Figure 3.15** shows how leakage in Welsh Waters area has decreased significantly since 1997.

Figure 3.15 Welsh Water leakage volumes (taken directly from Welsh Waters Helping to manage and sustain our environment¹³⁸)



A pipe burst is the most common cause of loss of water and water supply. Welsh Water estimate that around 75 per cent of water lost is due to leaks within the Welsh Water network of water mains, the rest being lost from customers’ pipes.¹³⁹ Although the number of Welsh Water pipe bursts has risen since 2015/16, there has been an overall decrease across the period 2013/14 to 2016/17, from 140 pipe bursts per 1,000km of pipe to 133 pipe bursts per 1,000km of pipe. As shown in **Table 3.18**, this is lower than the same figures for England and Wales.

Table 3.18 Number of pipe bursts in company pipe network (per 1,000 km of pipe)¹⁴⁰

	2013-14	2014-15	2015-16	2016-17
England and Wales Average	151	155	130	151
Welsh Water	140	129	110	133

¹³⁶ Leakage - The water lost between the treatment works and the customer.

¹³⁷ Glas Cymru Report & Accounts 2016-2017. Available online at: http://www.dwrcymru.com/en/Reading_Room_Library/Company-Reports.aspx [Accessed October 2017]

¹³⁸ Welsh Water. Helping to manage and sustain our environment 2015-2016. Available on line at: <http://www.dwrcymru.com/en/Environment/Our-Sustainable-Future/Environment-Report.aspx> [Accessed February 2017]

¹³⁹ Welsh Water. Helping to manage and sustain our environment 2015-2016. Available on line at: <http://www.dwrcymru.com/en/Environment/Our-Sustainable-Future/Environment-Report.aspx> [Accessed February 2017]

¹⁴⁰ Discover Water. Number of pipe (main) bursts. Available online at: <http://www.discoverwater.co.uk/loss-of-supply> [Accessed October 2017]

Sewer flooding is unpleasant and distressing and the worst situation is where properties become flooded. In 2016/17 the Welsh Water target was 300 properties flooded with sewage, the actual figure for that period was 242 properties, showing Welsh Water have beaten their target for the period. **Table 3.19** shows the number of properties in the Welsh Water Area flooded with sewage between 2011/12 and 2016/17. The number of properties flooded has fluctuated over the period with an overall reduction in the number from the peak in 2013/14 to 2016/17. Variations in these figures are likely as there are a number of things that can cause a sewer to flood, with blockages becoming a more frequent cause. Also, changes in climate resulting in heavier, more intense rainfall can overwhelm the sewer and drainage system. Whilst newer systems keep drainage separate from sewer systems, in locations such as cities these systems are often combined. Pressure on the sewerage/drainage system also poses a risk of more frequent localised flooding as a result of exceeding network capacity.

Table 3.19 Number of properties in Welsh Water area flooded with sewage^{141,137}

Year	11/12	12/13	13/14	14/15	15/16	16/17
Number of properties flooded	186	219	306	265	223	242

Water Efficiency

In 2014 Welsh Water had achieved efficiency related savings of 3.41Ml/d since 2010. Welsh Water projected savings by the end of 2015 (based on maintain the same level of intervention) is 9.44 Ml/d¹⁴². The 2010-2015 water efficiency activity is distributed across the supply area, with greater concentrations around denser conurbations. **Figure 3.16** provides a graphical representation of this.

Table 3.20 summarises the water efficiency interventions and the actual saving values for the base year (2010).

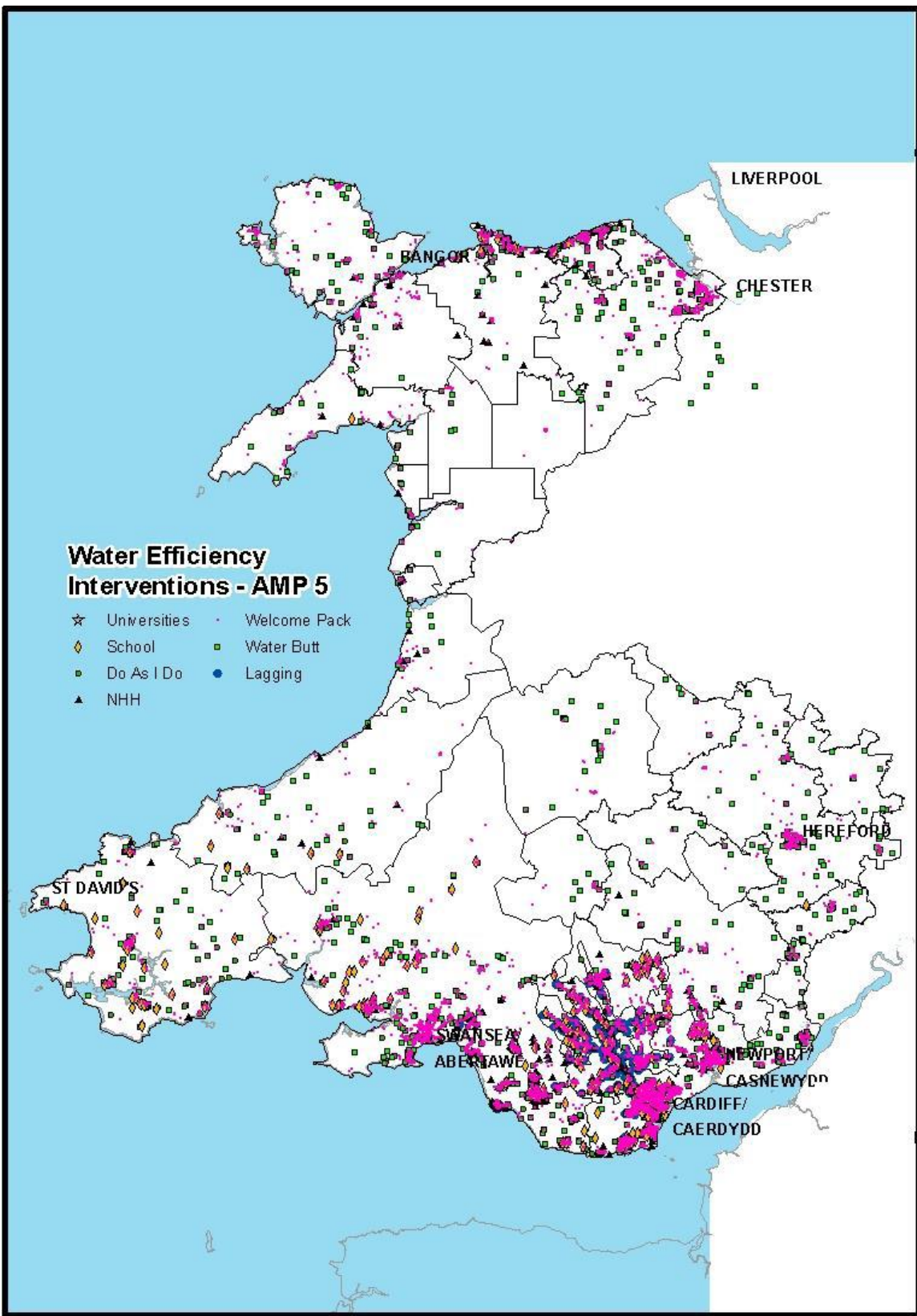
Table 3.20 Welsh Water's Water Efficiency Policy Interventions (2010-2015)

Intervention	Saving (Ml/d)
Toilet Cistern Displacement Devices	0.197
Water Butts delivered	0.0006
Schools Activity including retrofits	0.226
Business customers including retrofits	0.472
Welcome Packs to optant customers	0.466
Universities including retrofits	0.13
'Do as I do', Own company assets	0.017
Total	1.492
Educational and communication activity with volumetric impact derived from WR27	0.39
Total Savings	1.899

¹⁴¹ Welsh Water. Helping to manage and sustain our environment 2015-2016. Available online at: <http://www.dwrcymru.com/en/Environment/Our-Sustainable-Future/Environment-Report.aspx> [Accessed February 2017]

¹⁴² Welsh Water (2014) Final Water Resources Management Plan, Technical Report. Available on line at: <http://www.dwrcymru.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017]

Figure 3.16 Welsh Water's Water Efficiency Interventions 2010 – 2015 (taken directly from the Welsh Water WRMP 2014¹⁴²)



Energy Use

To supply drinking water and remove and treat wastewater requires energy. Topography and volumes can increase or decrease this energy demand further. The topography and size of the Welsh Water area means water and wastewater have to be pumped over large areas, and Welsh Water is one of the largest energy uses in Wales¹⁴³. In 2014 Welsh Water used 470 Million kWh of energy¹⁴⁴.

Total energy consumption in Wales over the period 2005 to 2015 has reduced year-on-year from 108,524 Gigawatt hours (GWh) to 93,455 GWh, a decrease of 13.9 per cent. Over the same period, total UK energy consumption has decreased by 15.4 per cent. Industry and Commercial was the largest energy consuming sector in Wales in 2015 (accounting for 49.9 per cent of total energy consumption) ahead of Domestic (25.1 per cent) and Transport (25.0 per cent). This contrasts to trends for the UK as a whole where there is a more even distribution of energy consumption across these three sectors (Industrial and Commercial 37.1 per cent, Domestic 31.7 per cent and Transport 31.2 per cent), a split which is similar for Herefordshire also¹⁴⁵.

Petroleum is the most consumed fuel type in Wales, followed by gas and then electricity.

Figure 3.17 shows that the amount of electricity in Wales produced from renewable sources steadily increased from 2003 and 2015, with a slight drop in 2016. Welsh Water's renewable energy generation in 2016/17 was 86.5 GWh, a reduction on 2015/16 levels (97.4 GWh) which was predominately due to a fall in the volume of green energy generated by hydro-turbines due to one of the driest winters on record. The largest sources of renewable energy for Welsh Water was Combined Heat and Power (CHP) engines, fuelled by biogas produced at sludge treatment centres (generating 39 GWh), followed by 13 GWh of biomethane injected into the gas grid at Five Fords Energy park. There are also 24,000 solar panels installed on 25 different Welsh Water sites, and an organic waste treatment centre adjacent to the wastewater site in Cardiff. Green energy accounts for around 20 per cent of Welsh Water's electricity use¹⁴⁶.

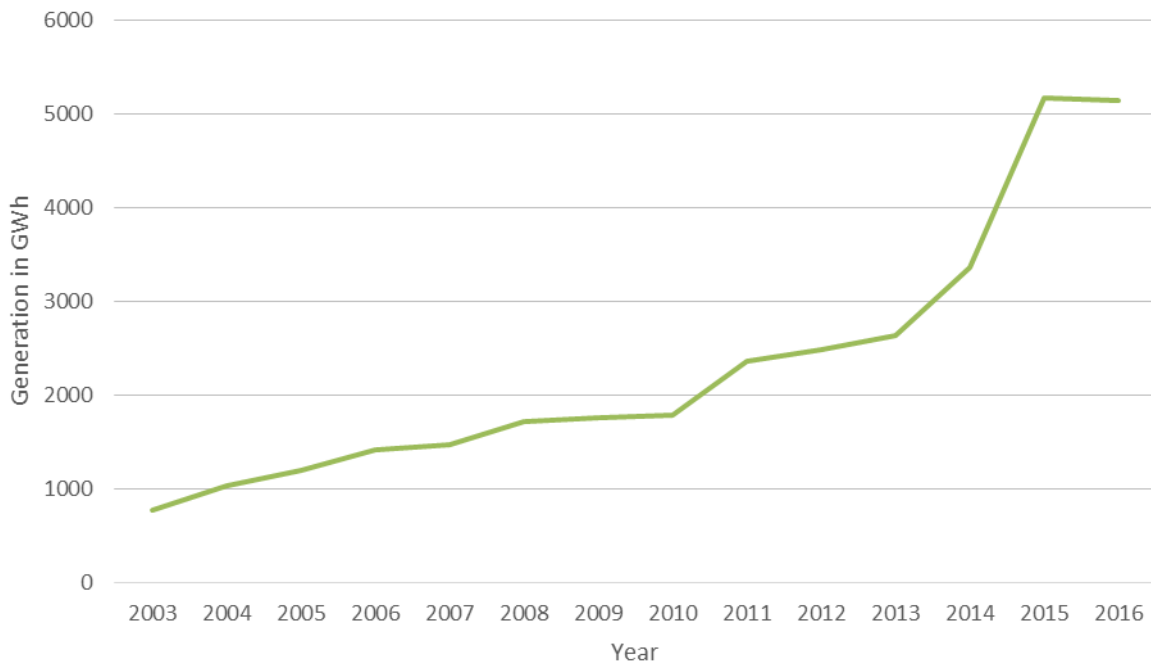
¹⁴³ Welsh Water Report and Accounts 2015. Available online at: http://www.dwrcymru.com/en/Reading_Room_Library/Company-Reports.aspx [Accessed February 2017]

¹⁴⁴ Welsh Water Sustainable Energy factsheet. Available online at: <http://www.dwrcymru.com/en/Education/Secondary/Sustainable-energy.aspx> [Accessed February 2017]

¹⁴⁵ Department for Business, Energy and Industrial Strategy (2017) Sub-national total final energy consumption statistics: 2005 - 2015. Available online at: <https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level> [Accessed October 2017]

¹⁴⁶ Glas Cymru Report & Accounts 2016-2017. Available online at: http://www.dwrcymru.com/en/Reading_Room_Library/Company-Reports.aspx [Accessed October 2017]

Figure 3.17 Total Electricity Generated from Renewable Sources in Wales per Year¹⁴⁷



Material Use and Waste Generation

Municipal waste volumes in Wales have been steadily decreasing from a peak of 1.93 million tonnes in 2004/05 to 1.56 million tonnes in 2013/14 (see **Table 3.21**). The percentage of local authority municipal waste that was prepared for reuse, recycled or composted in Wales has continued to increase from 5 per cent in 1998/99 to 54.3 per cent in 2013/14. Welsh industrial and commercial sectors, meanwhile, generated an estimated 3.7 million tonnes of waste in 2012 – 58 per cent was prepared for reuse, recycled and composted and 26 per cent was sent to landfill. Around 87 per cent of construction and demolition waste generated in Wales was prepared for reuse, recycled and recovered in 2012 with 12 per cent sent to landfill. Waste sent to landfill in Wales continues to decrease with 2.1 million tonnes landfilled in 2013, a 52 per cent reduction over 12 years¹⁴⁸.

Table 3.21 Annual Waste Arisings by Sector in Wales, Kilotonnes per Annum, 2000/01 – 2013/14¹⁴⁹

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Industrial and commercial waste			5,272				3,573							
Construction and demolition waste			6,014		9,890	12,200								

¹⁴⁷ Department of Business, Energy and Industrial Strategy (2017) Regional Renewable Statistics 2003 – 2016: Generation. Available online at: <https://www.gov.uk/government/statistics/regional-renewable-statistics> [Accessed October 2017]

¹⁴⁸ NRW (2013) Wales Waste Data Information 2013. Natural Resources Wales. Online source: <https://naturalresources.wales/evidence-and-data/research-and-reports/waste-reports/wales-waste-data-information-2013/?lang=en> [Accessed October 2017]

¹⁴⁹ Welsh Government, StatsWales. 7a. Waste – Waste arisings by sector (RES). Available online at: <https://statswales.gov.wales/Catalogue/Sustainable-Development/Sustainable-Development-Indicators/waste-arisings-by-sector-year> [Accessed February 2017]

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Municipal waste (excluding abandoned vehicles)	1,652	1,717	1,769	1,820	1,928	1,898	1,834	1,794	1,724	1,670	1,621	1,567	1,554	1,557

Operationally, Welsh Water requires materials in the water treatment processes including a wide range of chemicals for both water and wastewater treatment. In 2007/08, Welsh Water used approximately 3.8 million tonnes of chemicals in liquid and gas form including chlorine, orthophosphate, lime and coagulants (information provided by Welsh Water). Operationally, Welsh Water also produces waste mainly in the form of 'sludge' through the treatment of water for water supply (water treatment work sludge) and the treatment of wastewater (sewage sludge, or 'biosolids'). During 2015 a gas-to-grid plant was also completed at the Five Fords Wastewater Treatment Works in Wrexham to enable gas created during the waste treatment process to be upgraded to bio-methane gas and then redirected into the local gas distribution network. Other forms of waste include administrative waste.

Likely Evolution of the Baseline without the WRMP

Welsh Water are investing £1.7 billion between 2015 and 2020 to maintain and improve the extensive network of Welsh Water assets. By 2020 Welsh Water aim to have improved the resilience score of water assets to 87 per cent and wastewater assets to 78 per cent (in 2014 resilience score for water was 84.7 per cent and wastewater 75.6 per cent).

The quantity of water supplied in the Welsh Water area in a normal year reduced over the 20 years preceding 2014 by 200 MI/day, from 1,000 MI/day to 800 MI/day. This is down to a reduction in leakage and a reduction in demand from heavy industry.¹⁵⁰

In WRMP19, Welsh Water projects that demand during a normal year will reduce from 794.73 MI/d in 2016 to 777.7 MI/d in 2045. The forecast consumption per user type for 2045 is presented in **Table 3.22**. There is an overall increase in the number of measured households and a corresponding reduction in unmeasured households between 2016 and 2045. This is where the most significant change occurs with the other components of demand only changing by a small amount over the same period.

Table 3.22 Components of the 2045 Welsh Water Demand and the difference between 2016 demand

	2016	2045	Difference
Total Demand	794.7 MI/d	777.72 MI/d	- 17.01
Leakage	22.6%	21.1%	- 1.5%
Minor Components	3.2%	3.8%	0.6%
Unmeasured Non-household	0.6%	0.3%	- 0.3%
Measured Non-household	21.2%	21.4%	0.2%
Unmeasured household	39.6%	22.4%	- 17.2%
Measured household	12.8%	31.0%	18.2%

¹⁵⁰ Welsh Water (2014) Final Water Resources Management Plan, Technical Report. Available on line at: <http://www.dwcymru.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017]

Even with the reduction in demand predicted from 2016 to 2045, Welsh Water predict that two WRZs will fall into a potential supply deficit over this period. The WRMP19 contains measures to address these forecast deficits.

Table 3.23 outlines the WRZ and the likely deficit.

Table 3.23 Welsh Water WRMP deficit zones (taken from WRMP19)

Water Resource Zone	Max. deficit over planning period (MI/d)	First year of deficit	Reasons for deficit	Measures in WRMP19 to address forecast deficit in WRZ
Pembrokeshire	14	2022	<ul style="list-style-type: none"> Review of Consents driven licence changes Climate Change impact on Target Headroom and DO Revised demand forecast and base year position 	Welsh Water is proposing asset upgrades at Canaston Bridge raw water pumping station which would allow finer control of abstraction volumes from the Afon Cleddau, and hence reduce unnecessary over-release of compensation flows from Llys y Fran reservoir. This would require new variable rate low-lift pumps in addition to an increase in available bankside storage.
Tywyn Aberdyfi	1.52	2020	<ul style="list-style-type: none"> Climate Change impact on Target Headroom and DO Revised demand forecast and base year position Single source zone 	<p>Welsh Water is proposing a new abstraction from Afon Dysynni at Pont y Garth, with transfer to Pen y Bont Water Treatment Works (WTW) via a new raw water transfer main. A new pumping station would also be required. This will operate within the maximum WTW capacity.</p> <p>An 8MI non-impounding raw water reservoir is also proposed adjacent to Pen y Bont WTW in order to provide a buffer raw water supply and improve the resilience of the Tywyn Aberdyfi system. The reservoir will be filled from the existing Afon Fathew source in winter (under existing licence volumes).</p> <p>The two schemes are not expected to supply water to Pen y Bont WTW at the same time.</p>

Welsh Water manages leakage control through the establishment of District Metering Areas (DMA). In 2011 there were 1,003 DMA's covering 1.3 million customers and 27,000km of distribution main. DMA's have been used to target planned interventions to detect leakage, monitoring over 5,000 data signals on a 30 minute basis. Active leakage control takes place and is reactive (e.g. responding to a customer) or planned. During 2015-2020, the Asset Management Policy (AMP) 6 period, leakage control policies have been updated from the previous AMP5 policies. The accumulated suppression of leakage during 2015-2020 with the implementation is projected to be 5MI/day¹⁵¹.

Wales' energy consumption has declined since 2005 and this trend is expected to continue due to energy efficiency improvements (although an increase in economic activity and fluctuations in oil and gas prices may affect this). There is also expected to be an increase in energy use from renewables and in this context, the UK has a legally binding target for 15 per cent of energy consumption to be from renewable sources by 2020. In this wider context Welsh Water plan to significantly increase its renewable energy generation, with a target of doubling generation from renewable sources by 2020 and reducing energy use by 5 per cent over the same period.

¹⁵¹ Welsh Water (2014) Final Water Resources Management Plan, Technical Report. Available on line at: <http://www.dwcymru.com/en/Environment/Water-Resources/Water-Resource-Management-Plan.aspx> [Accessed February 2017]

In 2010 the Welsh Government launched the 'Towards Zero Waste' (TZW) initiative, which sets out the aim to be recycling 70 per cent of waste in Wales by 2025 and to be a zero waste nation by 2050¹⁵². The July 2015 progress report¹⁵³ states that total waste arisings per annum have decreased from 14.5 million tonnes in 2007 to 8.4 million tonnes in 2012. This is an 8.4 per cent reduction per year, against a target of a 1.4 per cent reduction per year. The report also outlines that Wales leads the UK in recycling municipal waste, achieving 54.3 per cent in 2013/14. In 2012 the 50 per cent of commercial waste and 68 per cent of industrial waste was sent to recycling. The TZW sets the target of 67 per cent per cent of commercial and industrial waste to be recycled by 2019-20 and 70 per per cent by 2024-25.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP arising from the analysis of the material assets and resource use baseline are:

- ▶ the need to promote water efficiency measures (including metering);
- ▶ the need to ensure that leakage is managed at a sustainable economic level;
- ▶ the need to maintain the balance between supply and demand for water;
- ▶ the need to reduce energy consumption;
- ▶ the need to ensure the sustainable and efficient use of resources such as construction materials; and
- ▶ the need to minimise waste arisings, promote reuse, recovery and recycling and minimise the impact of wastes on the environment and communities.

3.8 Cultural Heritage

Baseline Characteristics

The historic environment of Wales is both unique and irreplaceable and contributes greatly to the Welsh sense of identity and culture and is an important economic and social asset. In Wales, there are three World Heritage Sites (Pontcysyllte Aqueduct and Canal, Blaenavon Industrial Landscape, and Castles and Town Walls of King Edward in Gwynedd) and approximately 4,184 scheduled monuments. Additionally, there are 29,964 listed buildings, 529 conservation areas and 390 historic parks and gardens. The Historic Landscapes Register for Wales, meanwhile, has identified 58 landscapes across Wales which are regarded as representing the best examples of the variety of historic landscapes in Wales¹⁵⁴.

The Welsh Water Supply Area contains, either wholly or overlaps with, the following national and local designations:

- ▶ 3 World Heritage Sites;
- ▶ 14,864 scheduled monuments;
- ▶ 436 Grade I listed buildings;
- ▶ 1,861 Grade II* listed buildings;
- ▶ 24,364 Grade II listed buildings;

¹⁵² Welsh Government. Towards Zero Waste. One Wales: One Planet. June 2010. Available online at: <http://gov.wales/docs/desh/publications/100621wastetowardszeroen.pdf> [Accessed February 2017]

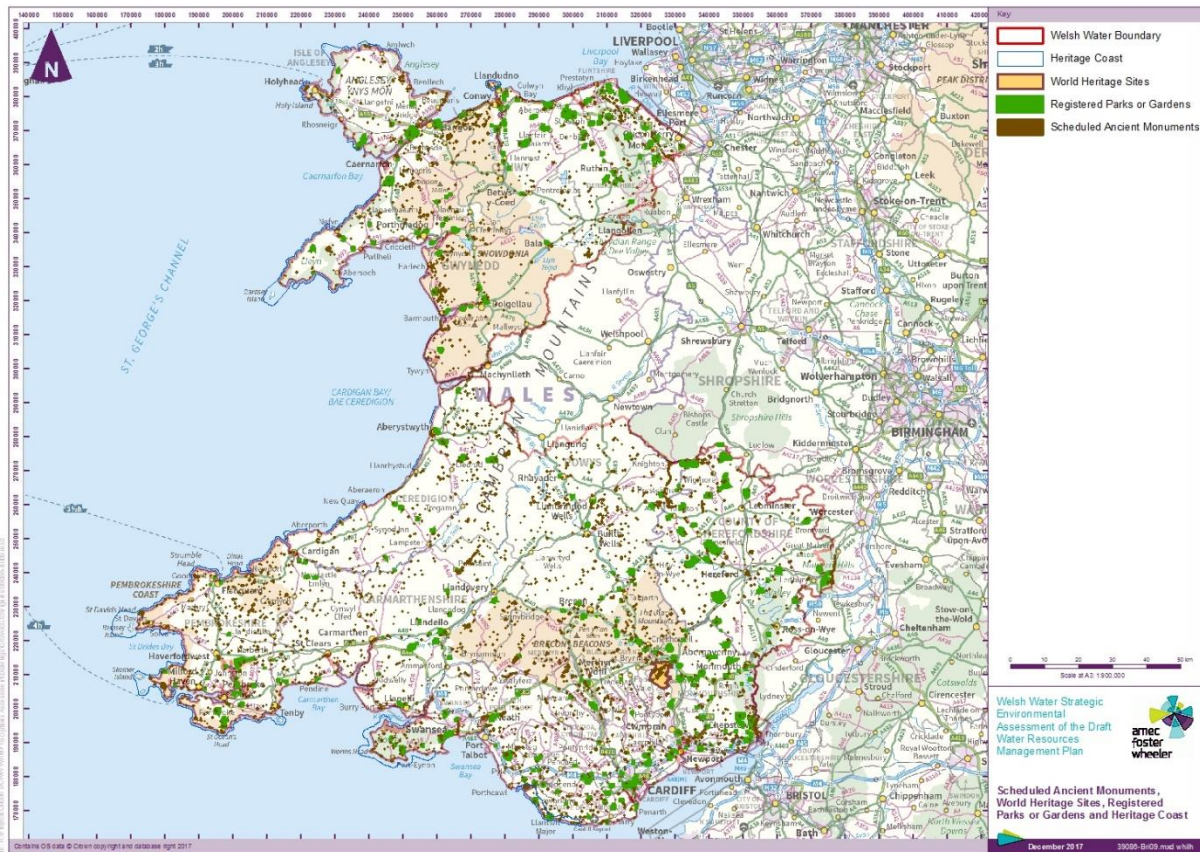
¹⁵³ Welsh Government. Towards Zero Waste 2010-2015. Progress report. July 2015. Available online at: <http://gov.wales/docs/desh/publications/150724-towards-zero-waste-progress-report-en.pdf> [Accessed February 2017]

¹⁵⁴ CADW (2007) Caring for Historic Landscape. Available at http://cadw.gov.wales/docs/cadw/publications/Caring_for_Historic_Landscapes_EN_CY.pdf [Accessed February 2017].

- ▶ 451 Conservation Areas;
- ▶ 670 registered parks and gardens; and
- ▶ 1 protected wreck site.

Cadw's regional field monument wardens monitor the condition of all statutorily protected monuments on a five-year programme. In both 1996 and 2003, nearly 80 per cent of scheduled monuments were reported to be stable, and around 10 per cent improved or greatly improved¹⁵⁵. Heritage features within the WRMP area are shown in **Figures 3.18 and 3.19**.

Figure 3.18 Cultural Heritage Features in Welsh Water Supply Area



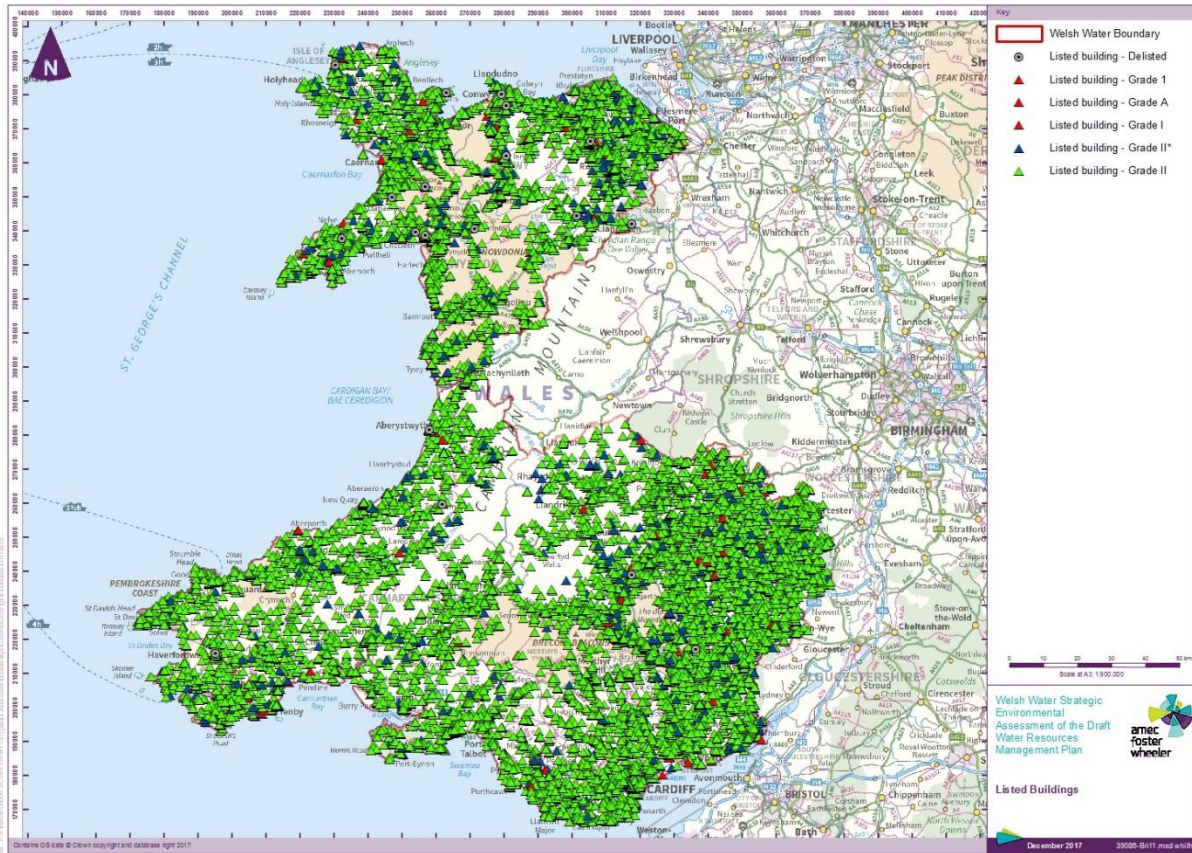
A 2015 report by Cadw found that for a sample percentage of listed buildings in Wales between 2013 and 2015, those classed as 'at risk' fell slightly from 9 per cent to 8 per cent in 2015; those classed as 'vulnerable' fell slightly from 14 per cent to 12 per cent; and those classed as 'not at risk' increased slightly from 77 per cent to 79 per cent. The percentage of listed buildings in 'Very bad' condition remained at around 2 per cent over the period and 'Good' condition increased from 53 per cent to 55 per cent from 2013 to 2015. Buildings in 'Poor' or 'Fair' condition decreased from 2013 to 2015.¹⁵⁶ The distribution of Listed Buildings within Welsh Waters Supply Areas is shown on **Figure 3.19**.

¹⁵⁵ WAG (2009). State of the Environment: Indicator 26.

¹⁵⁶ Cadw. Condition & use Survey of Listed Buildings in Wales. 2015 Update. Available online at:

<http://cadw.gov.wales/docs/cadw/publications/historicenvironment/20161206conditionandusesurveyoflistedbuildings2015.pdf> [Accessed February 2017]

Figure 3.19 Listed Buildings in Welsh Water Supply Area



Cadw and other stakeholders produced the Register of Landscapes of Historic Interest in Wales¹⁵⁷ as a means of identifying, and to provide information on, the most important and best-surviving historic landscapes in Wales. The Register has been issued in two parts, covering thirty six ‘outstanding’ and twenty-two ‘special’ historic landscape areas. All landscape areas identified on the Register are of national importance in the Welsh context. **Section 3.9** provides more detail on the extent of ‘outstanding’ and ‘special’ landscape areas.

The Welsh Water area may contain a large number of undesigned cultural heritage assets, many of which may be of considerable significance (some of national quality, although not formally designated). Historic Environment Records (HERs) held by local authorities include both designated and undesigned assets.

Likely Evolution of the Baseline without the WRMP

Wales’ cultural heritage assets are vulnerable to disturbance from development, land management and the effects of climate change. However, (as a broad indicator) the percentage of listed buildings classified as ‘At risk’ or ‘Vulnerable’ by Cadw fell between 2013 and 2015 (as outline above).

Managing water resources can impact on, or enhance, the historic components of the Welsh landscapes and built assets including historic woodlands, field systems and hedgerows, traditional buildings and ancient monuments and archaeological sites. The protection, preservation and settings of cultural heritage assets needs to be considered when locating any new development including water resources management infrastructure.

¹⁵⁷ Cadw, Welsh Government and Countryside Council for Wales. Historic Landscapes, 2007. Available online at: http://cadw.gov.wales/docs/cadw/publications/Caring_for_Historic_Landscapes_EN_CY.pdf [Accessed February 2017]

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP and the SEA, arising from the analysis of the cultural heritage baseline are:

- ▶ the need to conserve and enhance the historic significance of buildings, monuments, features, sites, places, areas and landscapes of archaeological and cultural heritage interest, and their settings;
- ▶ the need to promote access to Wales' cultural heritage sites within Welsh Water's ownership where possible and safe to do so; and
- ▶ the need to avoid damage to important wetland areas with potential for paleoenvironmental deposits.

3.9 Landscape and Seascape

Baseline Characteristics

Landscape is defined by The European Landscape Convention as *“an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors”*. This definition is stated as covering natural, rural, urban and peri-urban (i.e. the urban-rural fringe) and includes land, inland water and marine areas. There is currently no legal definition for seascape although the UK Marine Policy Statement (MPS) (2011) sets out that seascape should be taken as meaning landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other.

Wales is characterised by a beautiful and rugged landscape, which ranges from the mountains and lakes of Snowdonia and the estuaries of the mid-Wales coast, to the beaches and cliffs of Pembrokeshire, and the industrial heritage of the South Wales Valleys. Wales is generally a predominantly pastoral landscape with agriculturally improved grassland being the single most extensive habitat type, followed by semi-improved grassland.

There are three National Parks covering 20 per cent (287,830 ha) of Wales (Brecon Beacons, Snowdonia and Pembrokeshire Coast National Parks) and five AONBs (one of which straddles England and Wales (the Wye Valley AONB), covering 65,926 ha (see **Figure 3.20**). Collectively these are referred to as 'designated landscapes', which have specific Special Qualities that should be protected and enhanced. Other areas designated for their landscape quality include 495 km of Heritage Coast (see **Figure 3.18**) and 58 landscapes of outstanding/special historic interest.¹⁵⁸ In total, over 52 per cent of Wales is nationally or internationally valued for its scenic quality and character, often recognised as iconic landscapes providing a clear sense of place and identity.¹⁵⁹

The large area of designated landscapes throughout Wales demonstrates their value to people as a cultural service. Many people find beauty, tranquillity or aesthetic value in the landscapes and seascapes of Wales and which in-turn promotes social and mental wellbeing as well as the physical benefits of recreational ways of appreciating such landscapes (such as walking, climbing and cycling).

The Landscape Map of Wales¹⁶⁰ recognises 48 sub-regional Landscape Character Areas across Wales, as shown in **Figure 3.21**. Each has a distinctive sense of place that enables it to be recognised as a single area (for example, a range of hills or a major urban area). Local detail is recorded in LANDMAP, an all-Wales landscape resource where landscape characteristics, qualities and influences on the landscape are recorded and evaluated. It includes nationally consistent, quality assured spatial datasets covering

¹⁵⁸ The National Association of Outstanding Natural Beauty. Areas of Outstanding Natural Beauty – Landscapes for Life. Available at <http://www.landscapesforlife.org.uk/> [Accessed January 2016]

¹⁵⁹ NRW (2015) A Snapshot of the State of Wales' Natural Resources – June 2015. Available at <https://naturalresources.wales/media/4475/a-snapshot-of-the-sownr.pdf?lang=en> [Accessed December 2015]

¹⁶⁰ Natural Resources Wales. Interactive Maps – LANDMAP. Available at <http://landmap-maps.naturalresources.wales/default.aspx> [Accessed October 2017]

geological landscape, landscape habitats, visual and sensory, historic landscape and cultural landscape, evaluating their importance from a national to local scale.

Cadw and other stakeholders produced the Register of Landscapes of Historic Interest in Wales¹⁶¹ as a means of identifying, and to provide information on, the most important and best-surviving historic landscapes in Wales. The Register has been issued in two parts, covering thirty six 'outstanding' and twenty-two 'special' historic landscape areas. All landscape areas identified on the Register are of national importance in the Welsh context.¹⁶² **Figure 3.22** shows the extent of the areas.

The coastlines and seascapes of Wales are also important to the nation's sense of identity and are valued resources for nature conservation with substantial historic environment interest. Wales has 4,067 km² (20 per cent) of land designated as National Park on or near the coast and 844 km² (4 per cent) as AONB. As noted in **Section 3.6**, Wales' coastlines also provide an important contribution to the nation's economy. For example, 3,594 million visitor trips were attributed to coastal tourism in 2013 with the most popular draws being landscape, countryside and the beach. This brought £602m to the economy, with growth predicted at 10 per cent¹⁶³.

A suite of National Marine Character Areas have been identified by NRW and which reflect the unique combinations of natural, cultural and perceptual influences in different areas. There are a total of 29 Marine Character Areas, as shown in **Figure 3.23**.

In 2009, over 11,5600 km² of Wales (55 per cent of the total area) was identified as 'tranquil', as defined by the Countryside Council for Wales (now NRW) Wales Tranquil Areas Map. The 2009 Tranquil Areas Map is shown in **Figure 3.24**. Factors that contribute to how tranquil a place feels include the presence of nature, feeling safe, low noise, visually pleasing surroundings and a relaxing atmosphere¹⁶⁴. The two largest tranquil areas in Wales are both over 1,000 km². These areas are part of the Berwyn Mountains, bordered by the towns of Dolgellau, Bala, Llangollen and Welshpool, and the southern part of the Cambrian Mountains, bordered by Llangurig, Rhayader, Llandoverly, Lampeter and Tregaron. Between 1997 and 2009, there was a loss of tranquil areas of nearly 1,500km² of land. This is over 6 per cent of the total land area of Wales, and is greater than the area of the Brecon Beacons National Park¹⁶⁵.

¹⁶¹ Cadw, Welsh Government and Countryside Council for Wales. Historic Landscapes, 2007. Available online at:

http://cadw.gov.wales/docs/cadw/publications/Caring_for_Historic_Landscapes_EN_CY.pdf [Accessed February 2017]

¹⁶² Cadw (et al) (2007) Guide to Good Practice on using the Register of Landscapes of Historic Interest in Wales in the Planning and Development Process

¹⁶³ Welsh Government (2015) Wales' Marine Evidence Report. Available from: <http://gov.wales/docs/drah/publications/151008-wales-marine-evidence-report-master-october-2015-en.pdf> [Accessed February 2017].

¹⁶⁴ Welsh Government. Tranquillity. Available at <http://gov.wales/topics/environmentcountryside/epg/noiseandnuisance/environmentalnoise/tranquillity/?lang=en> [Accessed February 2017].

¹⁶⁵ Landscape Institute Technical Information Note (2017) Tranquillity – An Overview. Available online at: <https://www.landscapeinstitute.org/wp-content/uploads/2017/01/Tranquillity-An-Overview.pdf> [Accessed October 2017]

Figure 3.20 Landscape Designations in Wales

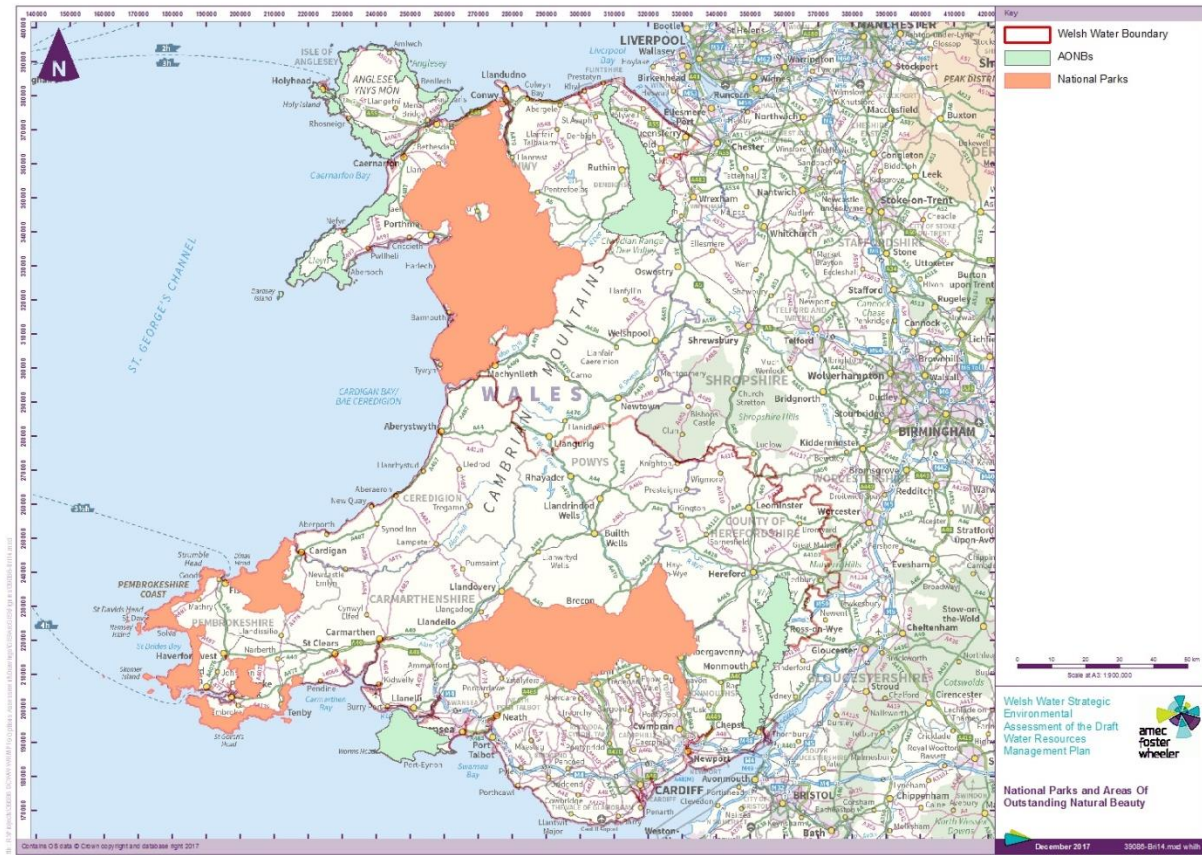


Figure 3.21 National Landscape Character Areas of Wales



- | | |
|--|--|
| 1 Anglesey Coast | 25 Ceredigion |
| 2 Central Anglesey | 26 Upper Wye Valley |
| 3 Arfon | 27 The Spas and Wells of Central Wales |
| 4 Llyn | 28 Eppynt Plateau and Valleys |
| 5 Tremadoc Bay | 29 Wye and Usk Vales |
| 6 Eryri | 30 Brecon Beacons and Black Mountains |
| 7 Conwy Valley | 31 Central Monmouthshire |
| 8 Colwyn and Northern Coastline | 32 Wye Valley and Wentwood |
| 9 Y Rhos | 33 Gwendraeth Vales |
| 10 Denbigh Moors | 34 Gwent Levels |
| 11 Vale of Clwyd | 35 Cardiff and Newport |
| 12 Clwydian Range | 36 Vale of Glamorgan |
| 13 Deeside and Wrexham | 37 South Wales Valleys |
| 14 Maelor | 38 Swansea Bay |
| 15 Vale of Llangollen and Dee Valley | 39 Gower |
| 16 Y Berwyn | 40 Teifi Valley |
| 17 Montgomeryshire Hills and Vales | 41 Tywi Valley |
| 18 Shropshire Hills (part) | 42 Pembroke and Carmarthen Foothills |
| 19 Severn Valley | 43 West and North Pembrokeshire Coast |
| 20 Radnorshire Hills | 44 Taf and Cleddau Vales |
| 21 Cambrian Mountains | 45 Taf, Tywi and Gwendraeth Estuaries |
| 22 Aberdyfi Coast | 46 Preseli Hills |
| 23 Rheidol and Ystwyth Hills and Valleys | 47 South Pembrokeshire Coast |
| 24 Ceredigion Coast | 48 Milford Haven |

Source: Natural Resources Wales. National Landscape Character Areas (NLCA). Available at <https://naturalresources.wales/evidence-and-data/maps/nlca/?lang=en> [Accessed October 2017].

Figure 3.22 Landscape of Historic Interest in Wales

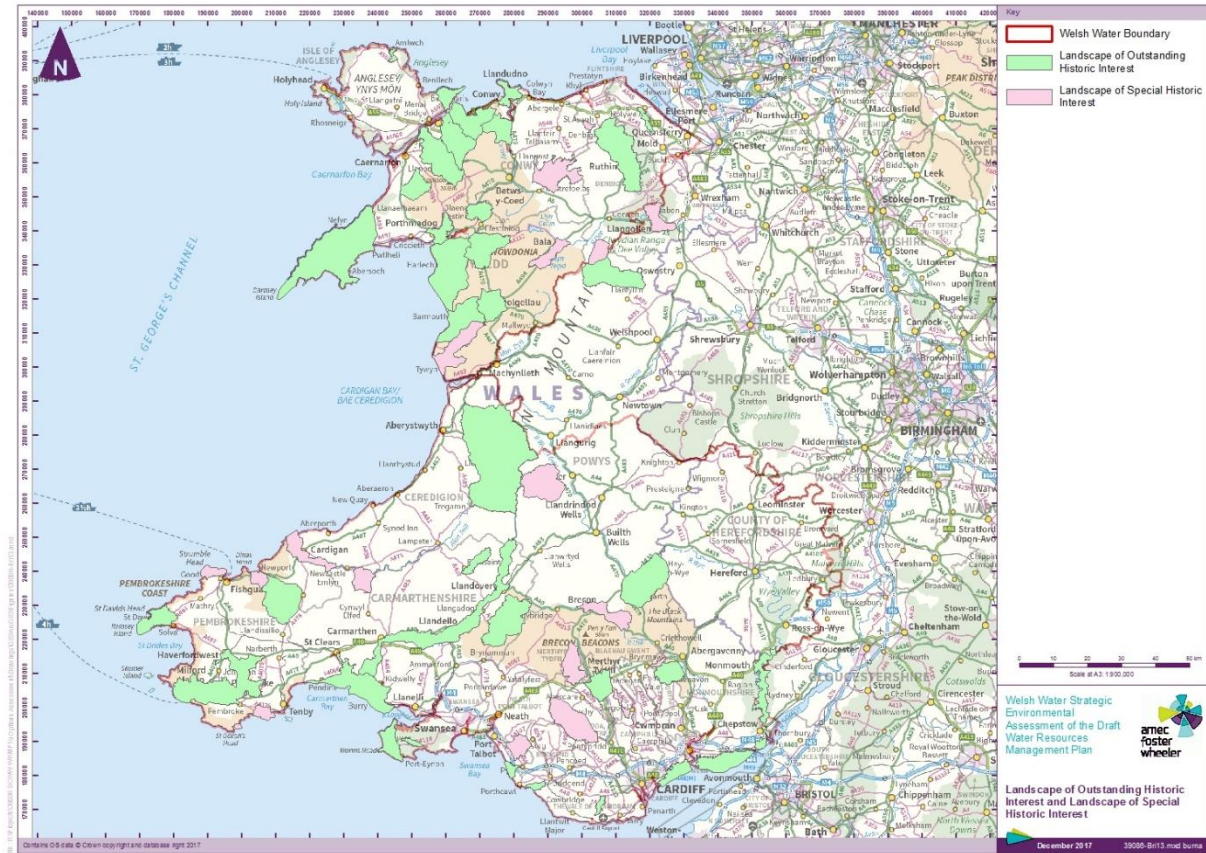
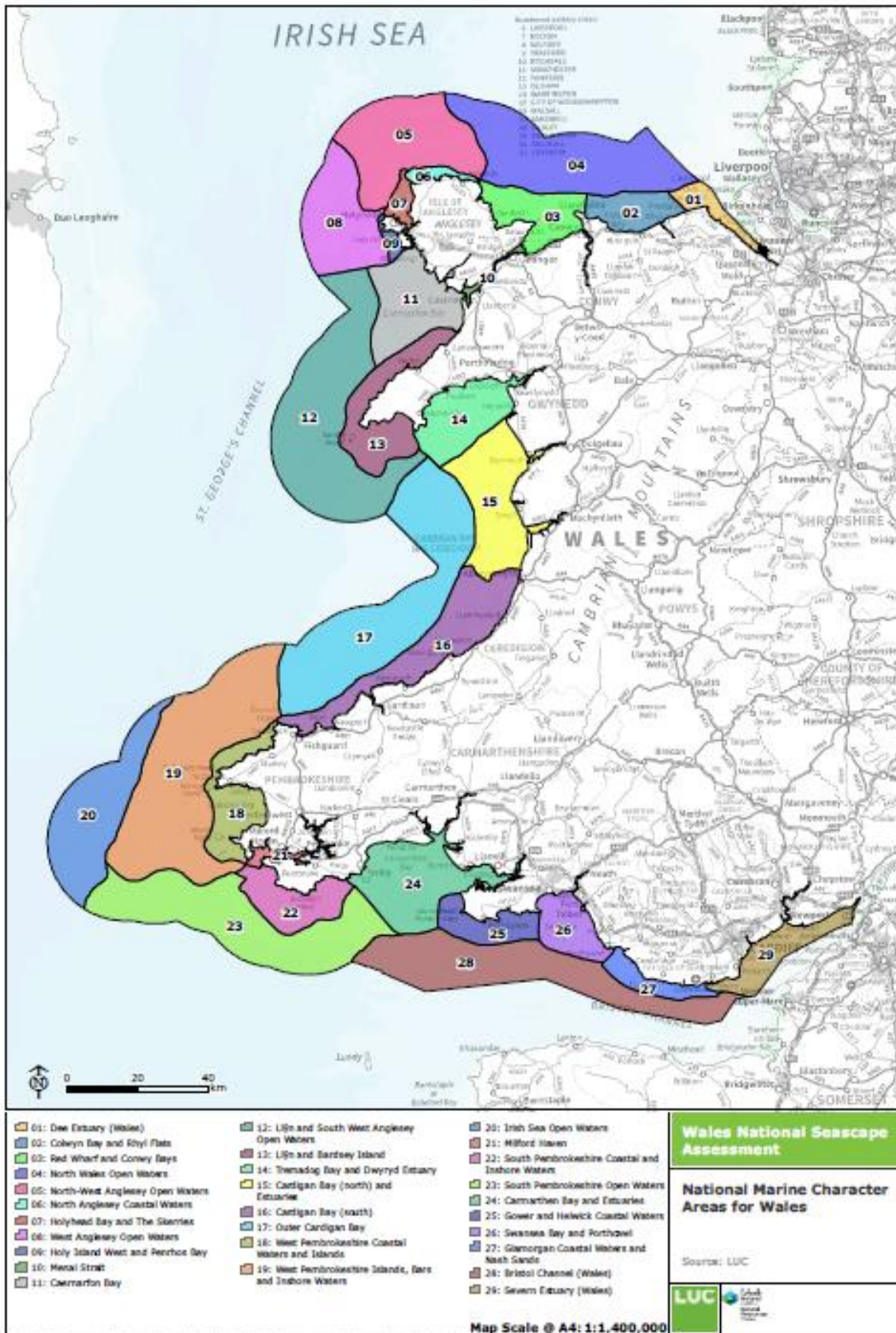
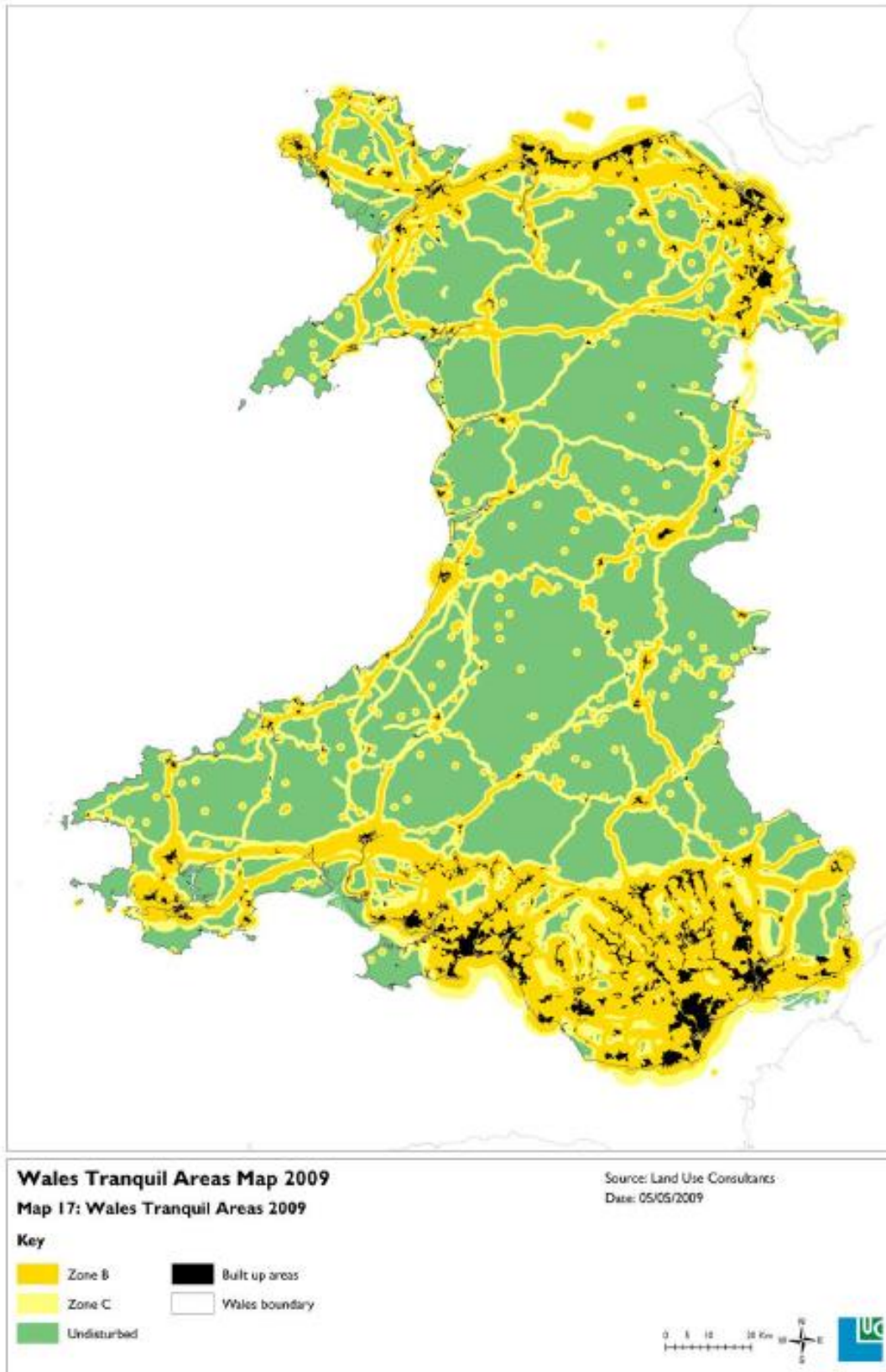


Figure 3.23 National Marine Character Areas for Wales



Source: Natural Resources Wales (2015) National Seascape Assessment for Wales. Available at: <https://naturalresources.wales/media/675208/mca-00-technical-report-summary-method-appendix.pdf> [Accessed October 2017]

Figure 3.24 2009 Wales Tranquil Areas Map



Source: Countryside Council for Wales (2009) Wales Tranquil Areas Map 2009. Available at: <https://a465gilwern2brynmawr.files.wordpress.com/2014/02/dd547-wales-tranquil-areas-map-2009-final-report.pdf> [Accessed February 2017].

Likely Evolution of the Baseline without the WRMP

Recent key factors determining landscape change are, in particular, the expansion of settlements, commercial and industrial development, road improvements, onshore windfarms and turbines and recreational related developments. Key changes in the natural environment affecting landscape character include the felling of conifers and replanting with broadleaves, woodland expansion, changing bracken cover, reduced habitat diversity in places and reduced bog. With specific regard to seascape, Wales’ Marine Evidence Report (2015) highlights that developments in the inshore planning area are increasingly likely to encroach on the seascape around the Welsh coastline, in particular renewable energy infrastructure. These factors are likely to continue to affect Wales’ landscape and seascape character.

The changing climate will also affect Wales’ distinctive landscapes and seascapes. Changes in weather patterns and soil conditions will alter the vegetation that is an important landscape feature whilst flooding and coastal erosion may affect landscape and seascape character. Responses to climate change such as the introduction of new crops and land uses may also have an impact on the visual appearance of the landscape whilst new flood defences could affect seascape.

Key Sustainability Issues Relevant to the WRMP

The key sustainability issues relevant to the WRMP arising from the analysis of the landscape and seascape baseline are:

- ▶ The need to conserve and enhance landscape and seascape character, taking into account the effects of climate change;
- ▶ The need to ensure the special qualities of designated landscapes are protected; and
- ▶ The need to minimise any adverse impacts upon landscape and seascape that may result from measures in the WRMP.

3.10 Summary of Key Sustainability Issues

From the analysis of the baseline presented in the preceding sections, a number of key sustainability issues have been identified. These issues are summarised in **Table 3.24**

Table 3.24 Summary of Key Issues

Topic Area	Key Economic, Social and Environmental Issues
Biodiversity	<ul style="list-style-type: none"> • The need to protect and enhance sites designated for nature conservation; • The need to protect and enhance non-designated sites; • The need to continue to increase and improve the condition of priority habitats and habitats of priority species, and restore populations of these species and other specially protected species; • The need to prevent the spread/introduction of invasive non-native species; • The need to maintain/enhance ecological connectivity; • The need to sustainably manage biodiversity assets, taking into account the effects of climate change; • The need to recognise the key role that green infrastructure plays in supporting (<i>inter alia</i>) biodiversity, landscape, wellbeing and climate change resilience; • The need to protect and enhance the green infrastructure network; • The need to continue monitoring biodiversity and ecological indicators; and • The need to work within environmental limits and capacities.
Geology Land use and Soils	<ul style="list-style-type: none"> • The need to protect, maintain and enhance geomorphological functions and services; • The need to influence how land is managed, promoting sustainable patterns of land use; • The need to conserve and enhance soil quality and function (including carbon sequestration); • The need to protect and avoid damage to Wales’ geodiversity and conserve and enhance sites designated for geological interest; and • The need to manage impacts on soil resources, including control of pollution and remediation of contaminated land.

Topic Area	Key Economic, Social and Environmental Issues
Water	<ul style="list-style-type: none"> • The need to maintain and improve water quality; • The need to maintain seasonal flows in groundwater and surface water; • The need to ensure that the continued risk of flooding is reduced or where this is not possible, mitigated effectively; • The need to restore sustainable and appropriate abstraction levels and water flow/levels in Wales' waters across the full range of regimes from low to high conditions; • The potential effects of climate change and the need to build climate change resilience into the water environment and water management; and • The need to prevent the deterioration of Water Framework Directive (WFD) waterbodies, achieve protected area objectives and achieve water body status objectives
Air quality and climate	<ul style="list-style-type: none"> • The need to minimise emissions of pollutant gases and particulates and enhance air quality; • The need to reduce the need to travel and promote sustainable modes of transport; • The need to reduce greenhouse gas emissions arising from implementation of the WRMP; • The need to take into account, and where possible adapt to, the potential effects of climate change; and • The need to increase environmental resilience to the effects of climate change.
Human Environment	<ul style="list-style-type: none"> • The need to ensure that water resource requirements of people and visitors can be met at all times, in a sustainable way; • The need to ensure that water resources remain affordable; • The need to ensure that the WRMP measures do not adversely affect the health and well-being of any member of the community; • The need to ensure that vulnerable people are not affected by implementation of the WRMP measures; • The need to ensure that the WRMP measures do not have an adverse economic impact; • The need to avoid disruption through effects on the transport network; and • The need to ensure resilience of water supply/treatment infrastructure against climate change effects.
Material Assets and Resource Use	<ul style="list-style-type: none"> • The need to promote water efficiency measures (including metering); • The need to ensure that leakage is managed at a sustainable economic level; • The need to maintain the balance between supply and demand for water; • The need to reduce energy consumption; • The need to ensure the sustainable and efficient use of resources such as construction materials; and • The need to minimise waste arisings, promote reuse, recovery and recycling and minimise the impact of wastes on the environment and communities.
Cultural Heritage	<ul style="list-style-type: none"> • The need to conserve and enhance the historic significance of buildings, monuments, features, sites, places, areas and landscapes of archaeological and cultural heritage interest, and their settings; • The need to promote access to Wales' cultural heritage sites within Welsh Water's ownership where possible and safe to do so; and • The need to avoid damage to important wetland areas with potential for paleoenvironmental deposits.
Landscape and Seascape	<ul style="list-style-type: none"> • The need to conserve and enhance landscape and seascape character, taking into account the effects of climate change; • The need to ensure the special qualities of designated landscapes are protected; and • The need to minimise any adverse impacts upon landscape and seascape that may result from measures in the WRMP.

3.11 Limitations of the Data and Assumptions Made

The following data limitations have been encountered in preparing this Environmental Report:

- ▶ The data collated and presented for the baseline builds upon work undertaken for the previous Environmental Report¹⁶⁶ for WRMP14 and has been updated where appropriate. However, in

¹⁶⁶ Welsh Water (2013) *Strategic Environmental Assessment of Draft Water Resources Management Plan: Environmental Report*, Amec Foster Wheeler.

some cases no updated information is available and the original datasets have been re-presented; and

- ▶ The information used has been sourced, so far as is possible, from the most recent datasets available utilising a wide range of authoritative and official sources. It is important to acknowledge that there are variable time lags between raw data collection and its publication. Consequently, at the time of this Environmental Report's publication, the baseline or predicted future trends may have varied from those described above.

4. Approach to the Assessment

4.1 Introduction

This section describes the approach to the assessment of the WRMP. It draws on the information contained in Sections 2 and 3, as well as the responses received to consultation on the Scoping Report, to define the scope of the assessment (in terms of the environmental and socio-economic issues considered) and sets out the SEA objectives and guide questions that comprise the assessment framework. The section then outlines how this assessment framework has been used to appraise the feasible options, preferred options and alternative plans before highlighting the difficulties encountered during the assessment process.

4.2 Scope of the Assessment

The aim of SEA is to identify, describe and evaluate the likely significant effects of implementing the WRMP on the environment. Annex I of the SEA Directive and Schedule 2 of the SEA regulations require that the assessment includes information on the “*likely significant effects on the environment, including on issues such as: biodiversity; population; human health; fauna; flora; soil; water; air; climatic factors; material assets; cultural heritage, including architectural and archaeological heritage; landscape; and the inter-relationship between the issues referred to*”.

The key policy objectives identified from the review of other plans and programmes relevant to the assessment of the WRMP (**Section 2.3**) and the economic, social and environmental issues arising from the analysis of the baseline (**Section 3.10**), together with the characteristics of the potential water management options, have been used to define the scope of the assessment. In **Table 4.1**, each of the 12 SEA topic areas are considered in turn.

Table 4.1 Basis for Scoping Out Topic Areas from the SEA

SEA Topic Area	Included in WRMP SEA?	Justification for scoping the topic out of the SEA
Biodiversity	Yes	Included within SEA framework.
Population	Yes	Included within SEA framework.
Human Health	Yes	Included within SEA framework.
Fauna	Yes	Included within SEA framework.
Flora	Yes	Included within SEA framework.
Soils	Yes	Included within SEA framework.
Water	Yes	Included within SEA framework.
Air	No	Some of the feasible options (predominantly the supply-side options) would involve the construction of new infrastructure which, during the construction phase, would result in an increase in vehicle movements and on-site construction plant operation and an associated effect on air quality from emissions, and potential effects on air quality from dust. For example, dam raising at existing impoundment reservoirs or development of new groundwater sources are expected to involve excavations and therefore in particular these options are likely to have an effect on air quality due to the HGV movements required to transport soil from/around the site and the likelihood of dust being generated due to the disturbance of the ground. However, these effects would be localised, intermittent and limited to the duration of the construction phase, as there would be no effects on air quality during the operational phase. There are also standard, best practice mitigation measures that it is assumed would be implemented to minimise any adverse air quality effects during construction.

SEA Topic Area	Included in WRMP SEA?	Justification for scoping the topic out of the SEA
		<p>The construction of a desalination plant would have similar construction related effects on air quality. There may also be very short term, limited effects resulting from the need to run the plant from a back up (assumed diesel) generator should there be a power outage. However, although the operation of a desalination plant is very energy intensive and would have an impact on carbon emissions, it would not result in significant adverse effects on local air quality.</p> <p>The majority of the demand side measures would not have any impact on air quality, with only limited, short term effects expected from mains/communication pipe replacement to reduce leakage – again due to an increase in vehicle movements and dust from excavation of the network to target specific leaks. At any one location excavations typically only last 1-2 days.</p> <p>For the reasons presented above, effects on air quality are not considered likely to be significant and therefore are not material to the SEA of the WRMP. The topic has therefore been scoped out of the assessment.</p>
Climatic factors	Yes	Included within SEA framework.
Material assets	Yes	Included within SEA framework.
Cultural Heritage	Yes	Included within SEA framework.
Landscape	Yes	Included within SEA framework.

SEA topic ‘Air’ was scoped out of the assessment. The primary reasons for this are that any air quality effects arising from the feasible and preferred options are likely to be as a result of the construction of new infrastructure or the replacement of the existing supply network and therefore will be localised, temporary, limited in duration. Further, it is anticipated that such effects can be effectively mitigated by implementing standard best practice measures at the project stage such that significant effects are not predicted.

4.3 Assessment Framework

Establishing appropriate SEA objectives and guide questions is central to assessing the effects of the WRMP on the environment. Each of the water management options that make up the proposed planning solution in the WRMP have been assessed against the SEA objectives to determine the scale and significance of the effect. By assessing each option against the objectives, it is more apparent where the WRMP will contribute to sustainability, where it might have a negative effect and where enhancements could be made. Guide questions focus the assessment on specific aspects of the objective that reflect issues identified from the review of baseline and contextual information relating to the Welsh Water area.

The SEA objectives and guide questions used in the assessment of the WRMP reflect the topics contained in Annex I of the SEA Directive and have been informed by:

- ▶ the SEA objectives and guide questions developed as part of the SEA of the 2015 WRMP;
- ▶ the review of relevant plans and programmes and the associated key policy objectives and messages (**Section 2** and **Appendix A**);
- ▶ the baseline information and key sustainability issues contained in **Section 3**; and
- ▶ responses received to consultation on the SEA Scoping Report (see **Appendix E**).

The final assessment framework is presented in **Table 4.2**. The well-being goals of the *Well-being of Future Generations (Wales) Act 2015* (see **Table 1.3**) are fully reflected in the framework to help ensure alignment with national policy and legislation on sustainability. Additionally, those objectives that are directly related to the objective for SMNR, established in the *Environment (Wales) Act 2016*, are highlighted.

Table 4.2 Assessment Framework for the WRMP

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
Biodiversity	1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity	<i>Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?</i>	A prosperous Wales A resilient Wales A healthier Wales A globally responsible Wales	Yes	Biodiversity, Flora and Fauna
		<i>Will the option protect and enhance non-designated sites and local biodiversity?</i>			
		<i>Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?</i>			
		<i>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</i>			
		<i>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</i>			
		<i>Will the option prevent the spread/introduction of invasive non-native species?</i>			
		<i>Will the option maintain and enhance the green infrastructure network and the biodiversity it supports?</i>			
		<i>Will the option contribute to the restoration of species that are currently not achieving management objectives?</i>			
		<i>Will the option maintain and enhance ecosystem resilience?</i>			
Geology and Soils	2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	<i>Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?</i>	A prosperous Wales A resilient Wales A globally responsible Wales	Yes	Soils, Material Assets
		<i>Will the option utilise previously developed land?</i>			
		<i>Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?</i>			
		<i>Will the option minimise the loss of best and most versatile agricultural land?</i>			
		<i>Will the option minimise conflict with existing land use patterns?</i>			
		<i>Will the option minimise land contamination?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
Water – Quantity	3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.	<i>Will the option minimise the demand for water resources?</i>	A prosperous Wales A resilient Wales A healthier Wales	Yes	Water, Biodiversity, Flora, Fauna
		<i>Will the option result in changes to river flows?</i>			
		<i>Will the option result in changes to groundwater levels?</i>			
		<i>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</i>			
Water – Quality	4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.	<i>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</i>	A prosperous Wales A resilient Wales A healthier Wales	Yes	Water, Biodiversity, Flora, Fauna
		<i>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</i>			
		<i>Will the option support the achievement of protected area objectives?</i>			
		<i>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</i>			
		<i>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</i>			
Water – Flood Risk	5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.	<i>Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?</i>	A prosperous Wales A resilient Wales A healthier Wales A Wales of cohesive communities A globally responsible Wales	Yes	Human health, Climatic Factors
		<i>Will the option have the potential to help alleviate flooding in the catchment area now or in the future?</i>			
		<i>Will the option be at risk of flooding now or in the future?</i>			
		<i>Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?</i>			
		<i>Will the option promote the use of sustainable drainage systems?</i>			
		<i>Will the option promote opportunities for collaborative working with other risk management authorities?</i>			
		<i>Will the option affect the risk of flooding to people and/or property?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<i>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</i>			
Climate Change	6. To limit the causes and potential consequences of climate change and to adapt to future changes.	<i>Will the option reduce or minimise greenhouse gas emissions?</i>	A prosperous Wales A resilient Wales A healthier Wales A Wales of cohesive communities A globally responsible Wales	Yes	Climatic Factors.
		<i>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</i>			
		<i>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</i>			
		<i>Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?</i>			
		<i>Will coastal erosion have consequences on the operation of this option now or in the future, taking account of expected climate change sea level rise?</i>			
Human Environment - Health	7. To ensure the protection and enhancement of human health.	<i>Will the option ensure the continuity of a safe and secure drinking water supply?</i>	A prosperous Wales A globally responsible Wales A resilient Wales A healthier Wales A more equal Wales	Yes	Population, Human Health.
		<i>Will the option impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation?</i>			
		<i>Will the option maintain surface water and bathing water quality within statutory standards?</i>			
		<i>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</i>			
		<i>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</i>			
Human Environment -Social and Economic Well-Being	8. To maintain and enhance the economic and social well-being of the local community.	<i>Will the option ensure sufficient infrastructure is in place for predicted population increases?</i>	A prosperous Wales A globally responsible Wales A resilient Wales	Yes	Population, Human Health, Material Assets.
		<i>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</i>			
		<i>Will the option help to meet the employment needs of local people?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<p><i>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</i></p> <p><i>Will the option improve access to local services and facilities (e.g. sport and recreation)?</i></p> <p><i>Will the option contribute to sustaining and growing the local and regional economy?</i></p> <p><i>Will the option avoid disruption through effects on the transport network?</i></p> <p><i>Will the option be resilient to future changes in resources (both financial and human)?</i></p> <p><i>Will the option improve opportunities for social interaction and community cohesion?</i></p>	<p>A healthier Wales</p> <p>A more equal Wales</p> <p>A Wales of cohesive communities</p> <p>A Wales of vibrant culture and thriving Welsh language</p>		
Material Assets and Resource Use - Water Resources	9. To ensure the sustainable and efficient use of water resources.	<i>Will the option lead to reduced leakage from the supply network?</i>	<p>A prosperous Wales</p> <p>A resilient Wales</p> <p>A globally responsible Wales</p>	Yes	Water, Material Assets.
		<i>Will the option improve efficiency in water consumption?</i>			
Material Assets and Resource Use – Waste and Resource Use	10. To promote the efficient use of resources.	<i>Will the option seek to minimise the demand for raw materials?</i>	<p>A prosperous Wales</p> <p>A resilient Wales</p> <p>A globally responsible Wales</p>	Yes	
		<i>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</i>			
		<i>Will the option encourage the use of sustainable design and materials?</i>			
		<i>Will the option reduce or minimise energy use?</i>			
Cultural Heritage	11. To conserve and enhance the cultural, historic and industrial heritage resource.	<i>Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings</i>	<p>A prosperous Wales</p> <p>A Wales of vibrant culture and thriving Welsh language</p>	Yes	Cultural Heritage
		<i>Will the option avoid or minimise damage to archaeologically important sites?</i>			
		<i>Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?</i>			
		<i>Will the option affect public access to, or enjoyment of, features of cultural heritage?</i>			

Topic Area	SEA Objective	Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<i>Will the option protect or enhance Welsh language and culture?</i>			
Landscape	12. To conserve and enhance landscape character.	<i>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</i>	A resilient Wales A Wales of cohesive communities A healthier Wales A prosperous Wales	Yes	Landscape
		<i>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</i>			
		<i>Will the option affect public access to existing landscape features?</i>			
		<i>Will the option minimise adverse visual impacts?</i>			

4.4 Assessment Methodology

The effects of the WRMP were assessed in two stages, complementary to the development of the plan itself. The first stage comprised a high level assessment of all feasible options (including supply-side, demand management and leakage reduction options) against the 12 SEA assessment objectives outlined in **Table 4.2** with the findings presented in a summary matrix. A more detailed assessment has then been undertaken of the preferred options that comprise Welsh Water’s planning solution contained in the Final WRMP including the Vowchurch resilience option. The potential effects (positive, negative or neutral) and the significance of the effects of each of the preferred options against each of the SEA objectives have been recorded, along with commentary setting out the reasons for the assessment results, any assumptions and uncertainties and, where appropriate, potential mitigation measures. Each stage is described in more detail below.

Feasible Options

Both the construction and operational effects of each feasible option have been assessed against all of the SEA objectives. This approach recognises that many of the options considered are likely to be very different in nature in their construction and operational phases. For example, whilst metering options will involve vehicle movements during the construction phase, construction activity will be limited. Conversely, supply-side options are likely to involve more substantial construction works potentially including new above ground infrastructure.

A matrix similar to that shown in **Table 4.3** has been used to capture the assessment of the feasible supply-side and leakage reduction options; a key to the meaning of the symbols is presented in **Table 4.4**. The completed assessment matrices are contained in **Appendix C** and a summary of the findings of the assessment is presented in **Section 5**. As the environmental effects of the demand management options are very similar and likely to be minor in magnitude (when compared to supply-side or leakage reduction option effects), in order to ensure a proportionate and appropriate assessment and to minimise unnecessary duplication of reporting, individual matrices have not been produced for these feasible options. Instead, the effects are summarised in tables for the Pembrokeshire and Tywyn Aberdyfi WRZs in **Section 5**.

Table 4.3 Feasible Options Assessment Matrix

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	Etc...
Option Name	Construction	--	-	0	-	0	--/?	
	Operation	--/?	0	0	-	0	--	
Construction <i>A description of the likely significant effects of the option on the SEA objectives during construction is included here.</i>								
Operation <i>A description of the likely significant effects of the option on the SEA objectives during operation is included here.</i>								

Table 4.4 Qualitative Scoring System

Score	Description	Symbol
Significant Positive Effect	Significant positive effect of the Water Resources Management Plan option on this objective	++
Minor Positive Effect	Positive effect of the Water Resources Management Plan option on this objective	+
Neutral	Overall neutral effect of the Water Resources Management Plan option on this objective	0
Minor Negative Effect	Negative effect of the Water Resources Management Plan option on this objective	-
Significant Negative Effect	Significant negative effect of the Water Resources Management Plan option on this objective	--
No Relationship	There is no clear relationship between the Water Resources Management Plan option and the achievement of the objective or the relationship is negligible.	~
Uncertain	The Water Resources Management Plan option has an uncertain relationship to the objective or the relationship is dependent on the way in which the aspect is managed. In addition, insufficient information may be available to enable an assessment to be made.	?
Mixed Effect	Mixed positive and negative effect of the Water Resources Management Plan option on this objective	+/-

The feasible options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Where relevant, other information and assessments including the HRA and WFD Assessment have been referenced as appropriate.

To ensure a consistent approach to interpreting the significance of effects and to help the reader understand the decisions made by the assessment, a series of quantitative and semi-quantitative 'thresholds' have been defined (shown in **Appendix B**) to provide direction on what constitutes a significant effect.

Preferred Options

The feasible options assessments enabled Welsh Water to make an informed choice on which options to take forward as the preferred option(s) that comprise the Final WRMP. The preferred options and the resilience option were then subject to more detailed appraisal with the results recorded in a matrix similar to that shown in **Table 4.5**.

Table 4.5 Preferred Options Assessment Matrix

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
<p>1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity.</p>	<ul style="list-style-type: none"> Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater / river water quality and/or quantity? Will the option protect, and enhance where appropriate, coastal and marine habitats and species? Will the option prevent the spread / introduction of invasive non-native species? Will the option maintain and enhance the green infrastructure network and the biodiversity it supports? Will the option contribute to the restoration of species that are currently not achieving management objectives? Will the option maintain and enhance ecosystem resilience? 	-	0	<p>Effects of Construction <i>A description of the likely significant effects of the option on the SEA objective during construction has been included here.</i></p> <p>Effects of Operation <i>A description of the likely significant effects of the option on the SEA objective during operation has been included here.</i></p> <p>Mitigation <i>Mitigation and enhancement measures have been outlined here.</i></p> <p>Assumptions <i>Any assumptions made in undertaking the assessment have been listed here.</i></p> <p>Uncertainties <i>Any uncertainties encountered during the assessment have been listed here.</i></p>

The commentary section of the matrices provides justification for how the assessment was reached and includes consideration of the following:

- ▶ the nature of the potential effect (what is expected to happen);
- ▶ the timing and duration of the potential effect (e.g. short, medium or long term);
- ▶ the geographic scale of the potential effect (e.g. local, regional, national);

- ▶ the location of the potential effect (e.g. whether it affects rural or urban communities, or those in particular parts of the supply area);
- ▶ the potential effect on vulnerable communities or sensitive habitats;
- ▶ the reasons for whether the effect is considered significant;
- ▶ the reasons for any uncertainty, where this is identified; and
- ▶ the potential to avoid, minimise, reduce, mitigate or compensate for the identified effect(s) with evidence (where available).

The commentary section also includes details of any assumptions made during the assessment, uncertainties encountered and further measures that could mitigate adverse effects and enhance positive effects.

The completed assessment matrices are contained in **Appendix D. Sections 6.2 and 6.3** provide a summary of the findings of the assessment.

It should be noted that the receipt of further information from Welsh Water in respect of the preferred options means that in some cases, there are differences in scoring between options at the feasible and preferred options stages, as uncertainties have been reduced and/or precautionary scores have been revised to reflect greater understanding of the option and its likely effects.

4.5 Assessment of Secondary, Cumulative and Synergistic Effects

The SEA Directive and implementing regulations require that the cumulative effects of the WRMP are assessed. This includes the cumulative effects of the individual preferred options and the effects of the WRMP in-combination with other plans and programmes.

The cumulative effects of the individual preferred options have been appraised through an assessment of the Welsh Water's proposed planning solution. The cumulative effects of the WRMP in-combination with other plans and programmes, meanwhile, has considered:

- ▶ growth proposals and associated population change in the Welsh Water region;
- ▶ National Policy Statements (NPS) and Nationally Significant Infrastructure Projects (NSIPs);
- ▶ Welsh Water's Drought Plan 2015; and
- ▶ other water company WRMPs.

It should be noted that the cumulative effects of the WRMP are difficult to accurately assess given the inherent uncertainties concerning (inter alia): future changes to baseline environmental conditions; future population and economic growth; the deliverability of some NSIPs (and the potential for new NSIPs to be brought forward); and the proposals of emerging water company WRMPs.

The assessment of cumulative effects of the WRMP is presented in **Section 6.4**.

4.6 Contribution of the Final WRMP to Wales' Well-being Goals and the Objective for the Sustainable Management of Natural Resources

Informed by the assessment of the preferred options against the SEA objectives, a judgement has been made regarding whether, and the extent to which, the Final WRMP will support or detract from the achievement of each of the well-being goals for Wales and the objective for SMNR. A matrix has been used to record this assessment and the results are presented in **Section 6.5**.

4.7 Difficulties Encountered

The SEA Directive and implementing regulations requires the identification of any difficulties (such as technical deficiencies or lack of knowledge) encountered during the assessment process. The difficulties encountered in undertaking the SEA of the WRMP are summarised below:

- ▶ Due to the scope of the WRMP, and its nature in combining site-specific options into a plan for the whole of Welsh Water's region, a balance needed to be struck between the information provided as an overview of the whole area and the detail of a specific location. Throughout the whole process, it was necessary to balance the need for enough information to undertake a robust assessment, while retaining its strategic focus.
- ▶ In undertaking the assessments of feasible and preferred options it has been necessary to make some assumptions. An example of this is the use of carbon estimates as a proxy for the amount of construction materials used in each option. Any assumptions made have been captured in the detailed preferred option assessments.
- ▶ Reflecting the strategic nature of the WRMP and SEA, for many supply-side options exact site locations and pipeline routes are approximated at this stage whilst the final design of new infrastructure is unknown. However, the assessments of feasible and preferred options have been based on the best available information provided by Welsh Water and any assumptions used in the assessment (e.g. in respect of pipeline routes) have been highlighted where appropriate. For some option types (e.g. leakage reduction options), the location of works are not known at this stage and would (if taken forward) be subject to more detailed analysis during the implementation of the WRMP. In consequence, effects on some objectives such as biodiversity are uncertain for these options. Where this is the case, the assessment has reflected this uncertainty.
- ▶ Whilst the assessment of the cumulative effects of the implementation of the WRMP and other plans and programmes has been based on the most up to date information available at the time of writing, in many cases there is a lack of detailed information at this stage to make robust conclusions. This is a typical issue encountered during the assessment of WRMPs.

5. Assessment of Feasible Options

5.1 Introduction

This section presents the findings of the assessment of the feasible options identified for the WRMP following the process of options identification and appraisal (as described in **Section 1**). The types of feasible options considered in the assessment can be broadly categorised as follows:

- ▶ supply-side measures (e.g. increasing capacity at an existing groundwater source);
- ▶ demand management measures (e.g. water metering or household visits to install water efficiency measures); and
- ▶ leakage reduction and network metering measures (e.g. repairing pipes)

As set out in **Section 1.5**, Welsh Water has identified 63 feasible options across both the Pembrokeshire and Tywyn Aberdyfi WRZs comprising of 13 feasible supply-side options, 41 demand management options and nine leakage reduction options. All of the feasible options were assessed using the framework and approach set out in **Section 4** to identify the likely environmental effects. Each feasible option was assessed against the SEA objectives to identify its potential effects in both the short term (during construction) and medium/long term (during operation). The feasible options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Where quantified information was available for the feasible option from Welsh Water, the assessment was also informed by reference to threshold values set out in the definitions of significance (see **Appendix B**).

The findings of the assessment are presented by option type in the sections that follow.

5.2 Assessment of Supply-Side Options

Pembrokeshire Resource Zone

A total of nine feasible supply-side options have been identified for the Pembrokeshire WRZ; these are listed in **Table 5.1**. A summary of the assessment of these options is presented in **Table 5.2** with commentary on the likely significant construction and operational effects provided below (assessment matrices are contained in **Appendix C**).

Table 5.1 Supply-side Feasible Options: Pembrokeshire Resource Zone

Ref	Option	Deployable Output (MI/d)*	Description
PEM001	Re-instate Milton source for industrial customers (non-potable)	0.02	This option would reinstate the existing Milton borehole, currently used as an emergency source during periods of high demand to supplement the potable supply from Bolton Hill WTW. Water would be abstracted from the borehole and softened and blended with existing supplies to deliver water to the South Pembrokeshire Industrial Supplies. This would allow other water that is currently abstracted from the Eastern Cleddau to be used over the wider WRZ. The option would include the following works: new borehole pumps; installation of an upgraded power supply and new mains cable connector; and a new 0.5km raw water main (200mm diameter) from boreholes would be required to connect the Milton supply to the existing raw water main. The Milton borehole is currently licence exempt, however a licence will be required for future abstractions.

Ref	Option	Deployable Output (MI/d)*	Description
PEM002b	Upgrade zonal infrastructure from Bolton Hill WTW to make use of spare capacity (South Route): across the Cleddau bridge	2.46	This option would involve an increase in production at Bolton Hill WTW and transfer to the Tenby area to address the predicted deficit. An additional 5 MI/d of resource can be provided to Bolton Hill from various sources and to realise this a treatment works extension must be undertaken to increase capacity, and various sections of infrastructure would need to be upgraded. Specifically, additional pipework on the Cleddau Bridge (diameter 250mm, 870m) would be required. For the DO gain of 2.46MI/d to be realised it needs to be combined with a supply option.
PEM003	Dam raising of Llys-y-Fran	0.66	Llys-y-Fran reservoir was originally constructed in 1971. In 1992 the reservoir top water level was raised from 94.48m to 96.17m. The reservoir was designed so that if required, a second phase of raising could be undertaken that would potentially take the top water level to 106.68m. This option does not currently address additional pumping and treatment at Presili or elsewhere (Llys-y-Fran is a river regulating reservoir and controls release of water into the river for abstraction elsewhere), which would be required in order to significantly increase DO gain.
PEM012	Desalination plant for non-potable supplies to Milford Haven	0.66	This option is for a new desalination plant to supplement industrial users in Pembroke. This option would involve the construction of a seawater desalination plant with new seawater intake/outfall and a new treated water pumping station on the coast to the west of the Pembroke Power Station. Treated water would be transferred (via a new 2km pipeline to an existing reservoir, Greenhill), for blending with alternative supplies. It is assumed that the plant would not run continuously, only at times to meet demands that cannot be met by other resources. A new abstraction licence and discharge consent would be required.
PEM014	Abstraction from Afon Taf	0.03	This option involves a new intake and pumping station at Whitland, a new pipeline (13.5 km) to Canaston Bridge and then onward transfer to Bolton Hill WTW via existing infrastructure. A new abstraction licence is required. This option does not include upgrades to zonal infrastructure, which would be required to achieve a higher DO gain.
PEM016a	East West Transfer Felindre to Pembrokeshire - existing assets	3.67	The option would allow transfer of surplus capacity at Felindre WTW to partially address the forecast deficit in the Pembrokeshire WRZ through additional transfers. The transfer would require 4km new main from Brondini SRV to Capel Dewi WTW, and the reinforcement of 38km existing infrastructure west of Capel Dewi WTW to allow the onwards transfer to Brandy Hill SRV. Additional and upgraded pumps would also be required. For the option existing points of storage would be used.
PEM016b	East West Transfer Felindre to Pembrokeshire	4.93	The option would allow transfer of surplus capacity at Felindre WTW to partially address the forecast deficit in the Pembrokeshire WRZ through additional transfers via Brondini WPS and Brondini SRV to Penlanffos SRV. From here the additional capacity would be moved west via Brandy Hill SRV from where it can be transferred in to the Pembrokeshire zone. The option would use a new dedicated 38km main (400mm main (possibly 450mm)) for transfer from Brondini SRV for Brandy Hill SRV. For the option existing points of storage would be used.
PEM024a	Canaston Bridge - High-Lift VSDs	0.66	This option involves asset upgrades at Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau, and hence reduce unnecessary over-release of compensation flows from Llys y Fran reservoir. The abstraction licence requires that compensation releases from Llys y Fran reservoir match the maximum rate of abstraction, meaning that water is typically wasted due to the difference between the maximum rate of abstraction and the daily total abstraction. The option requires a low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d, and for option a,

Ref	Option	Deployable Output (MI/d)*	Description
			replacement of the fixed speed high-lift pumps with variable speed pumps.
PEM024b	Canaston Bridge – Upgrade Pumping Station	0.66	This option involves asset upgrades at Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau, and hence reduce unnecessary over-release of compensation flows from Llys y Fran reservoir. The abstraction licence requires that compensation releases from Llys y Fran reservoir match the maximum rate of abstraction, meaning that water is typically wasted due to the difference between the maximum rate of abstraction and the daily total abstraction. The option requires a low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d, and for option b, an increase in available bankside storage. This may be supplemented with additional raw water storage with a capacity of 30,000m ³ .

*DO is taken from the engineering pro forma prepared for each option.

Table 5.2 Supply-side Feasible Option Assessment Summary: Pembrokeshire Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
PEM001	Re-instate Milton source for industrial customers (non-potable)	C	-/?	0	0	0	-	0	0	0	0	-	0	-
		O	?	0	-	0	0	-	0	0	0	-	0	0
PEM002b	Upgrade zonal infrastructure from Bolton Hill WTW to make use of spare capacity (South Route): across the Cleddau bridge	C	0	0	0	0	0	-	0	+/-	0	-	0	0
		O	0	0	0	0	0	-	+	+	0	-	0	0
PEM003	Dam raising of Llys-y-Fran	C	--/?	-	0	-	-	--	-	++/-	0	--	0	-
		O	-/?	0	?	-	+	0	0	0	0	0	0	-
PEM012	Desalination plant for non-potable supplies to Milford Haven	C	--	-	0	-	0	--/?	0	++	0	--	0	-
		O	--/?	0	0	-	0	--	0	0	0	--	0	-
PEM014	Abstraction from Afon Taf	C	--	-	0	0	-	--	0	+/-	0	--	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0/-	0	0	0	-	-	0	0	0	-	0	-
PEM016a	East West Transfer Felindre to Pembrokeshire - existing assets	C	--/?	0	0	0	-	--	-	++/-	0	--	--	0
		O	0	0	0	0	0	-	+	+	+	-	0	0
PEM016b	East West Transfer Felindre to Pembrokeshire	C	--/?	0	0	0	-	--	-	++/-	0	--	--	0
		O	0	0	0	0	0	-	+	+	+	-	0	0
PEM024a	Canaston Bridge - High-Lift VSDs	C	0	0	0	0	-	-	0	+	0	-	0	0
		O	0	0	0	0	-	+/-	0	0	+	-	0	0
PEM024b	Canaston Bridge – Upgrade Pumping Station	C	-	-	0	0	--	-	0	++	0	-	0	-
		O	0	0	0/+	0	-	+/-	0	0	+	-	0	0

Construction Effects

With the exception of one feasible supply-side option (PEM001), all of the identified feasible options for the Pembrokeshire WRZ have been assessed as having a positive effect on economic and social well-being (SEA Objective 8) during the construction phase. This reflects the potential for capital investment to generate supply chain benefits and employment opportunities as well as increased spend in the local economy by contractors and construction workers. The anticipated scale of investment associated with five options (PEM003, PEM012, PEM016a, PEM016b and PEM024b) is such that significant positive effects have been identified in respect of this SEA objective. However, HGV movements and large scale pipeline works associated with several of the options are considered to have the potential to cause traffic disruption, generating a (mixed) minor negative effect on this objective.

No further significant positive effects have been identified during the assessment.

The majority of the feasible options have been assessed as having a negative effect on biodiversity (SEA Objective 1) during the construction phase. This reflects the potential for construction works to result in the loss of/disturbance to habitats and species as a result of, for example, land take, emissions to air and noise. In the case of five options (PEM003, PEM012, PEM014, PEM016a and PEM016b), effects on this objective have been assessed as significant due to the potential for works to affect internationally and/or nationally designated conservation sites, although it may be possible to avoid or mitigate impacts on these sites and in consequence, some uncertainty remains.

Given the scale of construction activity associated with the implementation of the feasible options, most have been assessed as having a negative effect on climate change (SEA Objective 6). This reflects the anticipated emissions of greenhouse gases from HGV movements, construction plant and the embodied carbon in raw materials. Material use, energy requirements and waste generation would also have a negative effect on waste and resources (SEA Objective 10). Given the scale of development and associated emissions associated with their construction, five options (PEM003, PEM012, PEM014, PEM016a and PEM016b) have been assessed as having significant negative effects on these objectives.

One feasible option (PEM024b) involves construction work located within Flood Zone 3 (high risk of flooding, with 1 per cent or greater annual probability of flooding), which has been assessed as a significant negative effect with respect to flood risk. Two feasible options (PEM016a and PEM016b) have been assessed as having a significant negative effect on cultural heritage (SEA Objective 11). This is due to the potential for direct impacts on a designated heritage asset (Bryn Helyg Round Barrow Scheduled Monument) associated with pipeline works.

No further significant negative effects have been identified during the assessment.

Several of the feasible options have been assessed as having minor negative effects in respect of geology and soils (SEA Objective 2), due to the loss of greenfield land (PEM003, PEM012, PEM014 and PEM024b), water quality (SEA Objective 4), due to the potential for construction activities to affect waterbodies (PEM003 and PEM012), and flooding (SEA Objective 5), given the location of some development sites and pipeline works within Flood Zones 2 and 3 (PEM001, PEM003, PEM014, PEM016a, PEM016b and PEM024a). Emissions to air from HGV movements and construction plant together with noise/vibration associated with the implementation of a small number of options may also have adverse impacts on human health (SEA Objective 7). Five options (PEM001, PEM003, PEM012, PEM014 and PEM024b), meanwhile, have been assessed as having a negative effect on landscape (SEA Objective 12) given the potential for works to affect landscape character and/or visual amenity.

Operational Effects

Several of the feasible supply-side options have been assessed as having a positive effect on health (SEA Objective 7) and economic and social well-being (SEA Objective 8) as they will help to ensure the continuity of a safe and secure drinking water supply which may in-turn support economic and population growth.

No further significant positive operational effects have been identified during the assessment.

One feasible option has been assessed as having significant negative effects on several of the SEA objectives, namely PEM012. This option would involve the construction and operation of a desalination plant

to the west of Pembroke Power Station. Operation of the desalination plant would result in the discharge of brine which may have localised effects on some features within Pembrokeshire Marine Special Area of Conservation (SAC) depending on dilution profiles. Fish entrainment is also possible. The HRA also identifies that whilst Cleddau Rivers SAC is not linked to the site by a direct impact pathway, some mobile interest features may be vulnerable to the effects of the scheme (indirectly via possible effects on the fish species of Pembrokeshire Marine SAC). This has been identified as a significant negative effect on biodiversity (SEA Objective 1), although some uncertainty remains. Reflecting anticipated energy requirements and greenhouse gas emissions associated with the operation of the plant, significant negative effects have also been identified in respect of climate change (SEA Objective 6) and waste and resource use (SEA Objective 10).

No further significant negative effects associated with the operation of the feasible options have been identified during the assessment.

Tywyn Aberdyfi Resource Zone

Four feasible supply-side options have been identified for the Tywyn Aberdyfi WRZ; these are listed in **Table 5.3**. A summary of the assessment of these options is presented in **Table 5.4** with commentary on the likely significant construction and operational effects provided below (assessment matrices are contained in **Appendix C**).

Table 5.3 Supply-side Feasible Options: Tywyn Aberdyfi Resource Zone

Ref	Option	Deployable Output (MI/d)*	Description
TYA001	Abstraction from Afon Dysynni and transfer to Afon Fathew	0.38	The option would allow transfer of 0.6 MI/d abstracted water to the Afon Fathew at a point upstream of Pen y Bont WTW and thereby allow an increased abstraction at the WTW. The option requires: a new intake and pumping station at the Afon Dysynni, 3.8km of new pipeline main, a new break pressure tank upstream of the outfall to Afon Fathew and new outfall to Afon Fathew. A new abstraction licence would also be required.
TYA004	New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW)	0.44	This option allows Pen y Bont WTW to receive abstracted water from the Afon Dysynni directly via a new raw water transfer main. Due to topography the supply will need to be pumped from source. It requires the construction of a pumping station at Pont y Garth, the laying of approximately 6km of pipeline running alongside a road to the WTW at Pen y Bont. A new abstraction licence would also be required. This option may also be supplemented with additional raw water storage as described in option TYA009a.
TYA009a	Pen-y-Bont WTW Bankside Storage (8MI)	0.44	This option would involve the construction of a non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of Pen-y-Bont under dry weather/peak demand conditions when run-of-river abstraction may not supply sufficient inflow to the WTW. The reservoir would be sized at 8 MI to provide short-term buffer, and would require an increase in licensed abstraction volumes.
TYA009b	Pen-y-Bont WTW Bankside Storage (35MI)	0.44	This option would involve the construction of a non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of Pen-y-Bont under dry weather/peak demand conditions when run-of-river abstraction may not supply sufficient inflow to the WTW. The reservoir would be sized at 35 MI to provide longer-term dry period buffer, and would require an increase in licensed abstraction volumes.

**DO is taken from the engineering pro forma prepared for each option.

Table 5.4 Supply-side Feasible Option Assessment Summary: Tywyn Aberdyfi Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
TYA001	Abstraction from Afon Dysynni and transfer to Afon Fathew	C	-/?	-	0	-	-	-	-	-	0	-	0	--
		O	0/?	0	-	0	0	-	0	0	0	-	0	0
TYA004	New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW)	C	-	-	0	-	--	-	-	-	0	-	0	--
		O	0/?	0	-	0	--	-	0	0	0	-	0	-
TYA009a	Pen-y-Bont WTW Bankside Storage (8MI)	C	-	-	0	0	0	-	-	0	0	-	0	--
		O	0/?	0	+	+	0	-	0	0	0	-	0	--
TYA009b	Pen-y-Bont WTW Bankside Storage (35MI)	C	-	-	0	0	0	-	-	0	0	-	0	--
		O	0/?	0	+	+	0	-	0	0	0	-	0	--

Construction Effects

No significant positive or minor positive effects have been identified during the assessment of the feasible options identified for the Tywyn Aberdyfi WRZ. This principally reflects the fact that the scale of capital investment associated with these options is small such that any economic impacts during construction (for example, supply chain benefits and the creation of employment opportunities) would be negligible.

All four feasible options have been assessed as having a significant negative effect on landscape (SEA Objective 12). This reflects the location of the options within Snowdonia National Park and the potential for construction activity to have (albeit temporary) adverse impacts on this designated landscape. In addition, TYA004 gives rise to a significant negative effect with respect to flood risk due to the construction of infrastructure in in Flood Zone 3.

No further significant negative effects associated with the operation of the feasible options have been identified during the assessment.

As per the assessment of feasible options for the Pembrokeshire WRZ, all the feasible options have been assessed as having a negative effect on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), climate change (SEA Objective 6), human health (SEA Objective 7) and waste and resource use (SEA Objective 10). Options TYA001 and TYA004 have also been assessed as having minor negative effects on water quality (SEA Objective 4), economic and social well-being (SEA Objective 8), and for TYA001, flood risk (SEA Objective 5).

Operational Effects

No significant positive effects have been identified with respect to the operation of the feasible supply-side options. This principally reflects the fact that the deployable outputs associated with the options identified for this WRZ are small such that effects on health (SEA Objective 7) and economic and social well-being (SEA Objective 8) are likely to be negligible, when considered against the definitions of significance (**Appendix B**). Options TYA009a and TYA009b, meanwhile, have been assessed as having a minor positive effect on water quantity (SEA Objective 3) and water quality (SEA Objective 4). These options would involve the construction and operation of a non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of Pen-y-Bont under dry weather/peak demand conditions when run-of-river abstraction may not supply sufficient inflow to the WTW and which could reduce reliance on the Afon Dysynni at times of low flow.

Options TYA009a and TYA009b have been assessed as having a significant negative effect on landscape (SEA Objective 12). Under these options, the new non-impounding raw water reservoir would be developed within Snowdonia National Park and in consequence, there is the potential for significant adverse effects on this designated landscape. The presence of the reservoir may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme and its proximity to an existing WTW, no significant impacts in this regard are predicted. Effects associated with the remaining two options on this SEA objective have been assessed as either neutral or minor negative.

TYA004 has been assessed as having a significant negative effect with respect to flood risk due to the operation of a pumping station in an area at high risk of flooding.

No further significant negative effects associated with the operation of the feasible options have been identified during the assessment.

5.3 Assessment of Demand Management Options

A total of 21 demand management measures have been identified; these are listed in **Table 5.5** together with the estimated total water saving when each measure is applied as a feasible option across the Pembrokeshire and Tywyn Aberdyfi WRZs (41 options in total). A summary of the assessment of these

options is presented in **Tables 5.6 and 5.7** by WRZ with commentary on the likely significant construction and operational effects identified provided below.¹⁶⁷

Table 5.5 Demand Management Options (All Zones)

Ref	Measure	Description	Estimated Total Saving (Ml/d)*	
			Pembroke-shire	Tywyn/Aberdyfi
WE001	Hippo - Solicited	These options would involve the provision of Hippo displacement devices to reduce water volume in toilet cisterns. Devices would be distributed by post for householders to fit themselves either on request (solicited) or by general allocation (unsolicited).	0.2	0.01
WE002	Hippo - Unsolicited		0.2	0.01
WE003	Ecobeta – Solicited	These options would involve the provision of Ecobeta variable flush systems to convert standard single-flush siphon valves into water saving dual-flush units. Devices would be distributed by post for householders to fit themselves either on request (solicited) or by general allocation (unsolicited).	0.1	0.01
WE004	Ecobeta – Unsolicited		0.1	0.01
WE005	Push Tap Installation – Solicited	Under these options, Welsh Water fitters would supply and fit push taps onto existing standard tap bodies in order to reduce household water consumption either on request (solicited) or by general allocation (unsolicited).	0.2	0.01
WE006	Push Tap Installation – Unsolicited		0.2	0.01
WE007	Save A Flush – Solicited	These options would involve the provision of ‘Save-A-Flush’ devices to reduce waste flush water. Devices would be distributed by post for householders to fit themselves either on request (solicited) or by general allocation (unsolicited).	0.1	0.003
WE008	Save A Flush – Unsolicited		0.1	0.003
WE009	Tap Inserts – Solicited	Under these options, water efficient tap inserts (aerators, flow restrictors, and/or in-line regulators) would be posted to householders to fit themselves either on request (solicited) or by general allocation (unsolicited).	0.1	0.004
WE010	Tap Inserts – Unsolicited		0.1	0.004
WE011	Aerated Showerhead - Solicited	These options would involve the provision of aerated showerheads in order to reduce water consumption. Devices would be distributed by post for householders to fit themselves either on request (solicited) or by general allocation (unsolicited).	0.2	0.008
WE012	Aerated Showerhead - Unsolicited		0.2	0.008
WE013	Shower Timers – Solicited	These options would involve the provision of shower timers to reduce water consumption. Devices would be distributed by post for householders to fit themselves either on request (solicited) or by general allocation (unsolicited).	0.03	0.001
WE014	Shower Timers – Unsolicited		0.03	0.001
WE015	Hose Trigger Gun – Solicited	These options would involve the provision of trigger heads for hosepipes to reduce water waste. Devices would be posted to	0.01	0.001

¹⁶⁷ It should be noted that the SEA assessment is based on each leakage reduction measure being implemented across all District Metered Areas (DMAs) within a WRZ. The DMAs to be targeted are subject to further investigation by Welsh Water and each leakage reduction measure may be implemented in some DMAs but not others. In consequence, there remains some uncertainty with regard to the exact scale (e.g. the length of pipeline to be renewed or repaired) of each option and the resulting magnitude of effects recorded in the assessment.

Ref	Measure	Description	Estimated Total Saving (Ml/d)*	
			Pembroke-shire	Tywyn/Aberdyfi
WE016	Hose Trigger Gun – Unsolicited	householders either on request (solicited) or by general allocation (unsolicited).	0.01	0.001
WE017	Garden Crystals – Solicited	These options would involve the provision of garden crystals to reduce water consumption through decreasing watering frequency. Crystals would be posted to householders either on request (solicited) or by general allocation (unsolicited).	0.001	0.00002
WE018	Garden Crystals – Unsolicited		0.001	0.00002
WE019	Non-Domestic Audits	This option would comprise a mail shot and subsequent visit from Welsh Water staff to assess water consumption in non-domestic properties and advise on how water consumption could be reduced.	0.5	0.02
WE020	Domestic Audit	This option would comprise a mail short and subsequent visit from Welsh Water staff to assess household water consumption and advise on how water consumption could be reduced.	0.1	0.01
N/A	Smart Metering	This option would involve the installation and maintenance of SMART Meters within the premises of domestic and commercial customers in order to increase consumer awareness regarding water usage, and subsequently, reduce demand as well as leakage.	4.2	No option identified for this WRZ.

*Based on measures being implemented in all DMAs within the WRZ.

Table 5.6 Assessment of Demand Management Feasible Options: Pembrokeshire Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WE001	Hippo – Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE002	Hippo – Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE003	Ecobeta - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE004	Ecobeta - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE005	Push Tap Installation - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE006	Push Tap Installation - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE007	Save A Flush - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE008	Save A Flush - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE009	Tap Inserts - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE010	Tap Inserts - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE011	Aerated Showerhead - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE012	Aerated Showerhead - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE013	Shower Timers - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE014	Shower Timers - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE015	Hose Trigger Gun - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE016	Hose Trigger Gun – Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE017	Garden Crystals – Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE018	Garden Crystals – Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE019	Non-Domestic Audits	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE020	Domestic Audits	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	?	0	0	+	?	0	0
N/A	SMART Metering (Pembrokeshire WRZ only)	C	0	0	0	0	0	-/?	0	++/?	0	-/?	0	0
		O	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0

Table 5.7 Assessment of Demand Management Feasible Options: Tywyn Aberdyfi Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
WE001	Hippo – Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE002	Hippo – Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE003	Ecobeta - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE004	Ecobeta - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE005	Push Tap Installation - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE006	Push Tap Installation - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE007	Save A Flush - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE008	Save A Flush - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE009	Tap Inserts - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE010	Tap Inserts - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE011	Aerated Showerhead - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE012	Aerated Showerhead - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE013	Shower Timers - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE014	Shower Timers - Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE015	Hose Trigger Gun - Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE016	Hose Trigger Gun – Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE017	Garden Crystals – Solicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE018	Garden Crystals – Unsolicited	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE019	Non-Domestic Audits	C	0	0	0	0	0	?	0	0	0	?	0	0
		O	0	0	+	0	0	?	0	0	+	?	0	0
WE020	Domestic Audits	C	0	0	0	0	0	?	0	0	0	?	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		0	0	0	+	0	0	?	0	0	+	?	0	0

Construction Effects

In general, environmental effects associated with the construction phase of the feasible demand management options are likely to be very similar. The implementation of water efficiency devices and activities and the installation of SMART Meters would all take place within or just beyond the curtilages of domestic and commercial properties and in consequence, none would be expected to have noticeable effects on biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quantity (SEA Objective 3), water quality (SEA Objective 4), flood risk (SEA Objective 5), human health (SEA Objective 7), water resources (SEA Objective 9), cultural heritage (SEA Objective 11) or landscape (SEA Objective 12).

Expenditure related to SMART Metering in the Pembrokeshire WRZ could be of a scale that may generate a significant positive effect on economic and social well-being, depending on the number of customers ultimately targeted. Capital expenditure associated with the implementation of the remainder of the demand management options would be relatively small in comparison, and would therefore be unlikely to have a substantive impact in terms of supply chain benefits. It is also more likely that any additional work would be accommodated in existing employees' or contractors'/partners' workloads such that any employment opportunities are likely to be very limited. In consequence, effects of the feasible options on economic and social well-being (SEA Objective 8) have largely been assessed as neutral.

No further significant positive effects have been identified during the assessment.

All of the demand management options would require different amounts of raw materials, energy and carbon depending on the need for manufacturing and means of distribution. Those elements which are customer-fitted can be sent out by post and be distributed along with the other mail, reducing the need for a specific trip to deliver a particular item but those which need engineers to fit or audit will require an individual journey with higher carbon emissions. Carbon emissions associated with products used in the water efficiency options are currently unknown and in consequence, effects on climate change (SEA Objective 6) and waste and resource use (SEA Objective 10) have been assessed as uncertain at this stage; however, it is considered very unlikely that any adverse effects would be significant. The installation of SMART Meters in the Pembrokeshire WRZ could, however, generate a larger volume of emissions (including vehicle emissions and the embodied carbon in devices), depending on the number of SMART Meters ultimately installed. In consequence, this option has been assessed as having a significant negative effect on SEA Objectives 6 and 10, although some uncertainty remains.

No further significant negative effects have been identified during the assessment.

Operational Effects

Demand reductions through the operation of water efficient devices and demand/leakage reductions associated with metering would have positive effects in respect of water quantity (SEA Objective 3) and water resources (SEA Objective 9).

Demand/leakage reductions may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. As a result, SMART Metering in the Pembrokeshire WRZ is expected to result in minor positive effects on climate change (SEA Objective 6) and waste and resource use (SEA Objective 10). Potential emission reductions generated by the remaining water efficiency options are unknown at this stage and in consequence, effects on climate change and waste and resource use have been assessed as uncertain, although it is considered that any benefits would be minor.

SMART Metering in the Pembrokeshire WRZ also has the potential for positive effects on health (SEA Objective 7) and economic and social well-being (SEA Objective 8) as the option would help to ensure the continuity of a safe and secure drinking water supply, which may in-turn support economic and population growth. The deployable outputs associated with the remaining demand management options are small, such that effects on health and economic and social well-being are likely to be negligible.

No further significant positive effects have been identified during the assessment.

Once installed, the feasible demand management options are considered unlikely to have any adverse environmental effects and no significant or minor negative effects have been identified during the assessment.

5.4 Assessment of Leakage Reduction Options

A total of nine leakage reduction measures have been identified; these are listed in **Table 5.8** together with the estimated total water saving when each measure is applied as a feasible option across the Pembrokeshire and Tywyn Aberdyfi WRZs (15 feasible options in total). A summary of the assessment, by WRZ, is presented in **Tables 5.9 and 5.10** with commentary on the likely significant construction and operational effects provided below.¹⁶⁸ Assessment matrices are contained in **Appendix C**.

Table 5.8 Leakage Reduction Options

Ref	Option Name	Description	Estimated Total Saving (MI/d)*	
			Pembrokeshire	Tywyn/Aberdyfi
N/A	All Mains Schemes	This option would involve the replacement and renewal of trunk mains, communication pipes (running from the trunk main to a property boundary), and Customer Supply Pipes (CSP) (from the property boundary to inside the property).	5.3	0.02
N/A	Comms and CSP Schemes	This option would involve the replacement and renewal of communication pipes (running from the trunk main to a property boundary) and CSPs (from the property boundary to inside the property). The option excludes the replacement of trunk mains, and typically involves smaller scale works than mains replacements.	2.9	0.02
N/A	Mains and Comms Schemes	This option would involve the replacement and renewal of trunk mains and communication pipes (running from the trunk main to a property boundary). Trunk mains replacement would involve larger scale works than communication pipes. This option excludes replacement of CSPs (from the property boundary to inside the property).	4.1	No option identified for this WRZ.
N/A	Trunk Main Renewal	This option involves the identification and replacement of leaking sections of trunk mains.	0.1	0.04
N/A	Trunk Main Repair	This option involves leak detection to identify leaks on trunk mains and the repair of leaks where they are found. The option does not involve the replacement of pipelines.	0.1	0.03
N/A	ALC Leakage Reduction Options	This option involves a leakage detection and repair scheme which would utilise various investigation techniques in order to reduce and maintain leakage at a defined level.	3.7	0.004
N/A	Policy Minimum Leakage Detection	This option involves a leakage detection and repair scheme which would utilise various investigation techniques in order to reduce leakage level to the policy minimum.	2.4	0.01
N/A	Leakage Automation	This option would involve the below ground installation of acoustic loggers within the DMA water network which would, following a period of calibration, detect and pinpoint any	0.06	No option identified for this WRZ

¹⁶⁸ It should be noted that the SEA assessment is based on each leakage reduction measure being implemented across all District Metered Areas (DMAs) within a WRZ. The DMAs to be targeted are subject to further investigation by Welsh Water and each leakage reduction measure may be implemented in some DMAs but not others. In consequence, there remains some uncertainty with regard to the exact scale (e.g. the length of pipeline to be renewed or repaired) of each option and the resulting magnitude of effects recorded in the assessment.

Ref	Option Name	Description	Estimated Total Saving (MI/d)*	
			<i>Pembroke-shire</i>	<i>Tywyn/Aberdyfi</i>
		emerging leakages within the network in order to reduce detection costs, leak run times and safety hazards for personnel.		
N/A	Pressure Management Schemes	This option would involve the implementation of pressure management schemes within the pressure management areas (PMAs) characterised as having daily high pressure variance. This would regulate and/or reduce high pressure variations across the area in order to reduce the risk of leakage, and furthermore, reduce water breakout should leakage occur within the network.	1.7	No option identified for this WRZ

*Based on measures being implemented in all DMAs within the WRZ.

Table 5.9 Assessment of Leakage Reduction Feasible Options: Pembrokeshire Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
N/A	All Mains Schemes	C	-/?	0	0	0	0	--/?	-	++/- /?	0	--/?	0	-
		O	0	0	+	0	0	+/?	+/?	+/?	++/?	+/?	0	0
N/A	Comms and CSP Schemes	C	0	0	0	0	0	--/?	-	++/- /?	0	--/?	0	0
		O	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0
N/A	Mains and Comms Schemes	C	-/?	0	0	0	0	--/?	-	++/- /?	0	--/?	0	-
		O	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0
N/A	Trunk Main Renewal	C	-/?	0	0	0	0	--/?	-	++/- /?	0	--/?	0	-

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	0	0	0	+	0	0	0
N/A	Trunk Main Repair	C	0/?	0	0	0	0	0	0	0	0	-	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0
N/A	ALC Leakage Reduction Options	C	0/?	0	0	0	0	-/?	-/?	++/- /?	0	-/?	0	0
		O	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0
N/A	Policy Minimum Leakage Detection	C	0/?	0	0	0	0	-/?	0	0	0	-/?	0	0
		O	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0
N/A	Leakage Automation	C	0	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
N/A	Pressure Management Schemes	C	0	0	0	0	0	-/?	0	0	0	-/?	0	0
		O	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0

Table 5.10 Assessment of Leakage Reduction Feasible Options: Tywyn Aberdyfi Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
N/A	All Mains Schemes	C	0/?	0	0	0	0	-/?	0	+/?	0	-/?	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0
N/A	Comms and CSP Schemes	C	0	0	0	0	0	-/?	0	0	0	-/?	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0
N/A	Trunk Main Renewal	C	0/?	0	0	0	0	-/?	0	++/?	0	-/?	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0
N/A	Trunk Main Repair	C	0/?	0	0	0	0	0	0	0	0	0	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0
N/A	ALC Leakage Reduction Options	C	0/?	0	0	0	0	0	0	0	0	-	0	0

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		O	0	0	+	0	0	0	0	0	+	0	0	0
N/A	Policy Minimum Leakage Detection	C	0/?	0	0	0	0	0	0	0	0	-	0	0
		O	0	0	+	0	0	0	0	0	+	0	0	0

Construction Effects

Employment opportunities and supply chain benefits may be generated during the implementation of leakage reduction options. The assessment has highlighted that the scale of investment generated by six options involving larger scale pipeline renewal/repair could potentially be substantial and for these options, effects on economic and social well-being (SEA Objective 8) have been assessed as significant, although some uncertainty remains. However, HGV movements and large scale pipeline works may cause traffic disruption, generating a (mixed) minor negative effect on SEA Objective 8.

No further significant positive effects have been identified during the assessment.

There would be additional resource use and carbon emissions as a result of the implementation of leakage reduction schemes. For those options that could involve the replacement/repair of large lengths of pipeline, resource use and emissions may be substantial and in this regard, a total of five options have been assessed as having a significant negative effect on SEA Objectives 6 and 10, although some uncertainty remains.

No further significant negative effects have been identified during the assessment.

Construction activity associated with the repair of leaks or replacement of pipeline may impact on biodiversity, priority habitats and/or protected species if existing pipelines pass through ecologically sensitive areas. If this is the case, these areas would be previously disturbed but may be subject to extensive excavation and disruption. Those options involving potentially larger scale pipeline works in the Pembrokeshire WRZ in particular have therefore been assessed as having a negative effect on biodiversity (SEA Objective 1) (options in the Tywyn Aberdyfi WRZ have been assessed as having a neutral effect on this objective, reflecting the relatively small scale of pipeline works that could take place in this zone). For those options involving larger scale pipeline works, negative effects have also been identified in respect of health (SEA Objective 7), due to the potential for vehicle movements and the operation of plant to affect local air quality and generate noise/vibration disturbance, and landscape (SEA Objective 12), given the potential for works to have a temporary impact on landscape character and visual amenity.

Environmental effects associated with the construction phase of the feasible leakage reduction options on geology and soils (SEA Objective 2), water quantity (SEA Objective 3), water quality (SEA Objective 4), flood risk (SEA Objective 5) and cultural heritage (SEA Objective 11) are expected to be negligible. This reflects the nature of works under these options and the likelihood that any potential adverse effects would be managed.

Operational Effects

The operation of leakage reduction options would result in less water being lost due to leakage and therefore lower demand for water abstraction. This would benefit the water environment and all of the options have therefore been assessed as having a positive effect with respect to water quantity (SEA Objective 3) and water resources (SEA Objective 9). The potential levels of leakage reduction associated with one option in the Pembrokeshire WRZ is of a magnitude (i.e. above 5 Ml/d) such that effects on SEA Objective 9 could be significant.

Six options in the Pembrokeshire WRZ have been assessed as having a minor positive effect on human health (SEA Objective 7) and economic and social well-being (SEA Objective 8) given the potential for water savings to help ensure continuity of water supply and support population and economic growth. Reflecting the relatively small level of likely leakage reduction activity in the Tywyn Aberdyfi WRZ, options in this zone have been assessed as having a neutral effect on SEA Objectives 7 and 8.

Lower levels of leakage may reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water. For six options in the Pembrokeshire WRZ, the potential scale of emissions reductions has been assessed as having a positive effect on climate change (SEA Objective 6) and waste and resource use (SEA Objective 10), although some uncertainty remains. Again, commensurate with the likely scale of leakage reduction activity in the Tywyn Aberdyfi WRZ, options in this zone have been assessed as having a neutral effect on these objectives.

No further significant positive effects have been identified during the assessment.

Once works have been completed, the feasible leakage reduction options are considered unlikely to have any adverse environmental effects and no significant or minor negative effects have been identified during the assessment.

5.5 Summary

Significant Positive Effects

The majority of the feasible supply-side options in the Pembrokeshire WRZ have been assessed as having a positive effect on economic and social well-being (SEA Objective 8) during construction. This reflects the potential for capital investment to generate supply chain benefits and employment opportunities as well as increased spend in the local economy by contractors and construction workers. The anticipated scale of investment associated with a number of the options is such that significant positive effects have been identified in respect of this SEA objective. Investment generated by SMART Metering in the Pembrokeshire WRZ could also be of a scale that may generate significant positive effects on this objective, depending on the number of customers ultimately targeted. The scale of investment related to the leakage reduction options would be greater and, subject to the confirmed extent of works, options involving pipeline renewal/repair could generate a significant positive effect on economic and social well-being.

Three feasible supply-side options have been assessed as having a positive effect on economic and social well-being as well as on human health (SEA Objective 7) during the operational phase as they would help to ensure the continuity of a safe and secure drinking water supply which may in-turn support economic and population growth. Several of the leakage reduction options in the Pembrokeshire WRZ have additionally been assessed as having a positive effect on health and economic and social well-being during operation given the potential for water savings to also help ensure continuity of water supply and support population and economic growth.

Once operational, the feasible demand management and leakage reduction options would help to reduce overall water use in the Welsh Water supply area and minimise water loss from the network which is expected to have a positive effect on the water quantity (SEA Objective 3) and water resources (SEA Objective 9). The assessment has identified that the potential scale of water savings associated with one leakage reduction option in the Pembrokeshire WRZ could be significant.

Demand and leakage reductions may in-turn reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home. For SMART Metering and several leakage reduction options in the Pembrokeshire WRZ, this has been identified as having positive effects on climate change (SEA Objective 6) and waste and resource use (SEA Objective 10).

Significant Negative Effects

The assessment has found that the feasible supply-side options identified for the WRMP would be likely to have the most significant effects during construction across the SEA objectives. Where significant negative effects on the SEA objectives have been identified, this principally reflects the scale of construction activity and the sensitivity of the receiving environment. In contrast, the feasible demand management and leakage reduction options are, overall, likely to be more limited in range and smaller in magnitude when compared to the supply-side options. This reflects the fact that construction activity would be smaller in scale and, in the case of water efficiency options, undertaken predominantly within properties such that few environmental effects are anticipated.

Several of the supply-side feasible options have been assessed as having a significant negative effect on climate change (SEA Objective 6), related to associated greenhouse gas emissions, and waste and resource use (SEA Objective 10), given their anticipated high energy and raw material requirements, during construction with further negative effects on climate change and resource use expected during operation related to the pumping and treatment of water. In addition, all of the demand management and leakage reduction options would result in resource/energy use and carbon emissions and for those options that could involve the replacement/repair of large lengths of pipeline in particular, resource use and emissions could be

substantial. In this regard, a total of five leakage reduction options have been assessed as having a significant negative effect on these objectives.

A total of five feasible supply-side options have been assessed as having potentially significant negative effects on biodiversity (SEA Objective 1) during construction, due to the potential for works to affect internationally and/or nationally designated conservation sites (although it may be possible to avoid or mitigate impacts on these sites and in consequence, some uncertainty remains), whilst one option (Option PEM012) has been assessed as having a significant negative effect on this objective during operation. Leakage reduction options involving potentially larger scale pipeline works in the Pembrokeshire WRZ may also have negative effects on biodiversity.

Two supply-side options have been assessed as having significant negative effects on cultural heritage (SEA Objective 11), due to the potential for direct impacts on designated heritage assets during construction, and four options were assessed as having significant negative effects on landscape (SEA Objective 12), due to their location within Snowdonia National Park. Additionally, three leakage reduction options may have negative effects on landscape where they involve larger scale works. Those options involving potentially larger scale works in the Pembrokeshire WRZ may also have negative effects on human health (SEA Objective 7) during the construction phase due to impacts on air quality.

6. Assessment of the Final WRMP

6.1 Introduction

This section of the Environmental Report summarises the findings of the detailed assessment of the preferred options identified for each WRZ forecast to be in deficit over the planning horizon of WRMP19; this assessment has been undertaken in accordance with the methodology described in **Section 4** (detailed assessment matrices are contained in **Appendix D**). The cumulative, synergistic and secondary effects of the Final WRMP are then considered in **Section 6.4** and commentary is provided on the performance of the Final WRMP against the well-being goals of the *Well-being of Future Generations (Wales) Act 2015* and the objective for the sustainable management of natural resources (SMNR) established in the *Environment (Wales) Act 2016* in **Section 6.5**. An overview of the mitigation and enhancement measures identified during the assessment is set out in **Section 6.6**. Finally, this section concludes by identifying the reasons for selection of the preferred options and for the rejection of the reasonable alternative considered in preparing the Final WRMP (**Section 6.7**).

6.2 Pembrokeshire Resource Zone

Overview

The preferred option to resolve the forecast deficit in the Pembrokeshire WRZ is Option PEM024b: Canaston Bridge - Bankside Attenuation (DO gain 0.66 MI/d). This option involves asset upgrades at Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau and in-turn enable water to be conserved within the Llys y Fran reservoir by matching compensation releases to actual abstraction. The option would require a low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d and a new reservoir with a capacity of 30,000m³.

A summary of the assessment of this option is presented in **Table 6.1** with commentary on the likely significant construction and operational effects identified provided below.

Table 6.1 Preferred Option Assessment Summary: Pembrokeshire Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
PEM024b	Canaston Bridge – Upgrade Pumping Station	C	-	-	0	0	--	-	0	++	0	-	0	-
		O	0	0	0/+	0	-	+/-	0	0	+	-	0	0

Construction Effects

The construction of Option PEM024b would involve a significant capital spend. This is likely to generate a number of employment opportunities and supply chain benefits (for example, associated with the supply of raw materials and appointment of contractors to undertake the works). Whilst the degree to which this would benefit the local labour market and local businesses would depend on skills within the local labour market and the procurement policies of both Welsh Water and any subcontractors, the level of spend suggests that effects may be substantial. Overall, Option PEM024b has been assessed as having a significant positive effect on economic and social well-being (SEA Objective 8).

No further significant positive or minor positive effects have been identified during the assessment of this option.

The proposed reservoir site is located within Flood Zone 3 (an area at high risk of flooding, with 1 per cent or greater annual probability of flooding), while the low-lift pumps would be situated within Flood Zone 2 (risk of flooding is up to 0.1 per cent in any given year). In consequence, construction activity may be vulnerable to flooding (depending on the timing of works). Overall, the option has been assessed as having a significant negative effect on flood risk (SEA Objective 5) at this stage, although project level mitigation, informed by a Flood Consequences Assessment (FCA), would be likely to manage adverse effects in this regard.

No further significant negative effects have been identified during the assessment of this option.

Minor negative effects have been identified in respect of biodiversity (SEA Objective 1). This principally reflects the loss of a relatively small area of greenfield land to the south of Canaston Bridge which may cause some localised loss of and/or disturbance to habitats and species. The loss of land associated with the bankside storage has also been assessed as having a minor negative effect on geology and soils (SEA Objective 2).

Construction of the scheme would result in the emission of 379 tonnes of carbon dioxide equivalent (tCO₂e) associated with the use of fossil fuels by construction plant and vehicle movements as well as the embodied carbon in construction materials. This has been assessed as having a minor negative effect on climate change (SEA Objective 6). The use of raw materials and energy associated with the replacement of pumps and the construction of the reservoir, in addition to waste generated during construction, would also have a minor negative effect with respect to waste and resource use (SEA Objective 10).

Canaston Bridge is located within the Pembrokeshire Coast National Park. However, the works associated with this option would be temporary and would take place within and adjacent to an existing and remote site. Taking into account the presence of existing screening (trees) and intervening vegetation (which should restrict long distance views to the development site), landscape and visual impacts are not expected to be significant and a minor negative effect has therefore been identified in respect of SEA Objective 12.

Neutral effects have been identified in respect of water quantity (SEA Objective 3), water quality (SEA Objective 4), human health (SEA Objective 7), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

Operational Effects

Once operational, the scheme would use a new bankside storage reservoir to attenuate the impact of the high-lift pump abstraction rate, such that the low lift pumps can pump at a constant rate equivalent to the total abstraction. This would allow water to be conserved within Llys y Fran reservoir by matching compensation releases to actual abstraction. No changes to the abstraction licence would be required.

No significant positive effects have been identified during the assessment of Option PEM024b which reflects the relatively small DO of 0.66 MI/d. It is anticipated that the new reservoir would reduce the pressure on the need for abstraction during times of low flows in the river, which would have a minor positive effect on water quantity (SEA Objective 3) at these times. Minor positive effects have also been identified in respect of water resources (SEA Objective 9), as operation of the option would be expected to minimise wastage.

Welsh Water has identified that minimising the unnecessary release of compensation flows would improve the storage position in Llys y Fran reservoir at the end of a drought, which has the potential to reduce vulnerability to the effects of climate change. However, operation of the option would require ongoing energy

use with associated carbon emissions due to the pumping of water (the operational energy demand for this scheme has been estimated to result in carbon emissions of 113 tonnes of CO_{2e}). On balance, the option has been assessed as having a mixed minor positive and minor negative effect on climate change (SEA Objective 6).

No significant negative effects have been identified during the assessment of this option. A minor negative effect has been identified in respect of flood risk (SEA Objective 5), as the new pumps and reservoir would be located within Flood Zones 2/3, and waste and resource use (SEA Objective 10), reflecting the requirement for ongoing energy usage.

Operation would result in 'less' water passing down the Afon Cleddau as the compensation releases match the actual abstraction more closely; however, as the operation would be within the terms of the existing abstraction licence, effects on biodiversity (SEA Objective 1) and water quality (SEA Objective 4) are not anticipated. Neutral effects have also been identified with respect to geology and soils (SEA Objective 2), human health (SEA Objective 7), economic and social well-being (SEA Objective 8), cultural heritage (SEA Objective 11) and landscape (SEA Objective 12).

6.3 Tywyn Aberdyfi Resource Zone

The preferred options to resolve the forecast deficit in the Tywyn Aberdyfi WRZ are:

- ▶ Option TYA004: New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW) (DO gain 0.44 MI/d); and
- ▶ Option TYA009a: Pen-y-Bont WTW Bankside Storage (8MI) (DO gain 0.44 MI/d).

A summary of the assessment of these options is presented in **Table 6.2** with commentary on the likely significant construction and operational effects identified provided below by each option in-turn.

Table 6.2 Preferred Option Assessment Summary: Tywyn Aberdyfi Resource Zone

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
TYA004	New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW)	C	-	-	0	-	--	-	-	-	0	-	0	--
		O	0/?	0	-	0	--	-	0	0	0	-	0	-
TYA009a	Pen-y-Bont WTW Bankside Storage (8MI)	C	-	-	0	0	0	-	-	0	0	-	0	--
		O	0	0	0	0	0	-	0	0	0	-	0	-

Option TYA004: New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW)

Overview

This option allows Pen y Bont WTW to receive abstracted water from the Afon Dysynni directly via a new raw water transfer main. Due to topography, the supply would need to be pumped from source. The option requires the construction of an intake and pumping station at Pont y Garth and the laying of approximately 6km of pipeline running alongside a road to the WTW at Pen y Bont. This option may also be supplemented with additional raw water storage as described in Option TYA009a.

Construction Effects

No significant or minor positive effects have been identified during the assessment of Option TYA004.

All of the proposed works would be located within Snowdonia National Park and the local area has notable landscape features including stone walls, clusters of Scots Pine and the Craig yr Aderyn (Bird's Rock). Construction associated with this option may therefore cause adverse landscape and visual impacts which could affect the special qualities of the National Park as well as the visual amenity of proximate residential and recreational receptors along the pipeline route. Whilst some sections of the pipeline route are screened by high hedges on both sides, the remainder of the route, as well as the intake/pumping station site, have a more open landscape. Overall, Option TYA004 has been assessed as having a significant negative effect on landscape (SEA Objective 12), although it is likely that effects in this regard could be managed at the project level through the implementation of appropriate mitigation such as screening.

As the proposed pipeline would cross extensive areas of Flood Zone 3 (1 per cent or greater annual probability of flooding) and the new pumping station and intake would also be located in Flood Zone 3, construction has been identified as having a significant negative effect with respect to flood risk (SEA Objective 5) at this stage, although project level mitigation, informed by a FCA, would be likely to manage adverse effects in this regard.

No further significant negative effects have been identified during the assessment of this option.

Option TYA004 has been assessed as having a minor negative effect on biodiversity (SEA Objective 1), due to the potential for construction of the pipeline, new intake and pumping station to result in the localised loss of/disturbance to habitats and species, and geology and soils (SEA Objective 2), due to the loss of greenfield land. Minor negative effects have also been identified in respect of water quality (SEA Objective 4) due to required trenching across watercourses, risk of spillage or leakage of chemicals, potential disturbance of contaminated sediments and the disconnection of flow, although any effects are expected to be localised and of short duration.

Construction of the scheme would result in the emission of an estimated 716 tonnes of CO_{2e} associated with the use of fossil fuels by construction plant and vehicle movements as well as the embodied carbon in construction materials. This has been assessed as having a minor negative effect on climate change (SEA Objective 6). The use of raw materials and energy, in addition to waste generated during construction, would also have a minor negative effect with respect to waste and resource use (SEA Objective 10).

The proposed route of the pipeline is near to a number of scattered houses and farms as well as residential dwellings in the village of Brynchrug. In consequence, there may be limited and short-term noise and dust impacts experienced at these receptors during construction (associated with the use of plant and HGV movements) which has been assessed as having a minor negative effect on human health (SEA Objective 7).

Capital expenditure associated with the scheme is considered unlikely to generate sustained benefits in terms of the supply chain and local employment creation. The route of the proposed pipeline includes part of National Cycle Network Route 82 and as a result, there may be disruption and diversions to cyclists (and other recreational users such as horse riders etc.). During construction there may also be highways disruption where pipeline works take place within roads, particularly as the narrow width of the local road

network would make passing difficult whilst works take place. Overall, Option TYA004 has been assessed as having a minor negative effect with respect to economic and social well-being (SEA Objective 8).

Neutral effects have been identified with respect to water quantity (SEA Objective 3), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

Operational Effects

No significant or minor positive effects have been identified during the assessment of Option TYA004 which reflects the relatively small DO of 0.44 MI/d.

As noted above, the new pumping station would be located within Flood Zone 3 (1 per cent or greater annual probability of flooding) and therefore this infrastructure could be at risk of flooding during its operation. This has been assessed as having a significant negative effect on flood risk (SEA Objective 5) at this stage, although project level mitigation, informed by a FCA, would be likely to manage adverse effects in this regard.

No further significant negative effects have been identified during the assessment of this option.

A minor negative effect on water quantity (SEA Objective 3) is expected during the operation of Option TYA004. The WFD Assessment has highlighted that the abstraction of up to 3.2 MI/d is likely to have an impact on the hydrological regime of the Afon Dysynni (especially in respect of the frequency and duration of low flows) and has the potential to result in the deterioration of all WFD biological quality elements. However, as the Meirionnydd Catchment Abstraction Management Strategy (2015) states that there is water available in this catchment, and taking into account the requirement for a new licence controlling abstractions from causing damage, any impact on water quantity is likely to be minor.

Minor negative effects have also been identified in respect of climate change (SEA Objective 6), as operation of the option would result in a small increase in greenhouse gas emissions, and waste and resources (SEA Objective 10), due to ongoing energy usage associated with the pumping of water.

Above ground infrastructure including a new pumping station and intake would be located within Snowdonia National Park. However, the scale of the development would be relatively small such that significant effects on landscape (SEA Objective 12) are not predicted.

Neutral effects have been identified with respect to biodiversity (SEA Objective 1) (with some uncertainty), geology and soils (SEA Objective 2), water quality (SEA Objective 4), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

Option TYA009a: Pen-y-Bont WTW Bankside Storage (8 MI)

Overview

This option would involve the construction of an 8 MI non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of the Tywyn Aberdyfi system. The reservoir would be filled from the existing Afon Fathew source in winter (under existing licence volumes) and would be used to supply Pen y Bont WTW during periods of poor raw water conditions in other stream sources.

Construction Effects

No significant or minor positive effects have been identified during the assessment of Option TYA009a.

The proposed reservoir site would occupy an estimated 0.3ha and is within Snowdonia National Park and therefore construction could have a temporary but adverse effect on this designated landscape. Whilst the works would be partially screened from the road by hedgerows, they would remain visible from areas of higher surrounding land and in consequence, Option TYA009a has been assessed as having a significant negative effect on landscape (SEA Objective 9), although it is likely that effects in this regard could be managed at the project level through the implementation of appropriate mitigation such as screening.

No further significant negative effects have been identified during the assessment of this option.

The option has been assessed as having a minor negative effect on biodiversity (SEA Objective 1), due to the potential for construction of the reservoir to result in the localised loss of/disturbance to habitats and species, and geology and soils (SEA Objective 3), due to the loss of greenfield land.

Construction of the scheme would result in the emission of 187 tCO₂e associated with the use of fossil fuels by construction plant and vehicle movements as well as the embodied carbon in construction materials. This has been assessed as having a minor negative effect on climate change (SEA Objective 6). The use of raw materials and energy associated with the construction of the reservoir, in addition to waste generated during construction, would also have a minor negative effect with respect to waste and resource use (SEA Objective 10). A further minor negative effect has been identified in respect of human health (SEA Objective 7) due to the potential for noise and air quality impacts associated with construction activity and HGV movements to affect local residents and tourists.

Neutral effects have been identified in respect of water quantity (SEA Objective 3), water quality (SEA Objective 4), flood risk (SEA Objective 5), economic and social well-being (SEA Objective 8), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

Operational Effects

No significant positive effects have been identified during the assessment of Option TYA009a which reflects the relatively small DO of 0.44 MI/d.

No significant negative effects have been identified during the assessment of this option. The option has, however, been assessed as having minor negative effects on climate change (SEA Objective 6), as operation of the option would result in a small increase in greenhouse gas emissions, and waste and resources (SEA Objective 10), due to ongoing energy usage associated with the pumping of water.

As noted above, the proposed reservoir site is within Snowdonia National Park and in consequence, there is the potential for adverse effects on this designated landscape. The presence of the reservoir may also affect the visual amenity of proximate recreational and residential receptors. However, the reservoir would not constitute substantial new above ground infrastructure and would be adjacent to an existing WTW such that effects once operational are not considered likely to be significant. Nonetheless, the option would result in minor changes to the designated landscape, which has been assessed as having a minor negative effect on SEA Objective 12.

While the operation of the scheme would help secure water available for potable supply, the gain associated with this option (0.44 MI/d) would be very minor and effects on human health (SEA Objective 7) and economic and social well-being (SEA Objective 8) have therefore been assessed as neutral. Neutral effects have also been identified with respect to biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quantity (SEA Objective 3), water quality (SEA Objective 4), flood risk (SEA Objective 5), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

6.4 Vowchurch Resource Zone

Overview

Welsh Water has assessed the susceptibility of the Vowchurch WRZ to severe droughts and identified that the River Dore and associated gravel aquifer may not provide the required yield to meet customer demands during a 1 in every 200 years drought event. To address this resilience risk, this option involves the laying of a main between the Hereford and Vowchurch WRZs to allow some of the Vowchurch demand to be met from Broomy Hill water treatment works (WTW) when needed.

This option would require the installation of a circa 12km main between Broomy Hill WTW and Kingstone service reservoir (SR) together with an upgrade to Broomy Hill water pumping station (WPS) to supply 2.5 MI/d to Kingstone SR. A total of 0.5 MI/d would be supplied from Aconbury SR using an existing main.

A summary of the assessment of this option is presented in **Table 6.3** with commentary on the likely significant construction and operational effects identified provided below.

Table 6.3 Preferred Option Assessment Summary: Vowchurch

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
Option 2a	Transfer from Hereford WRZ	C	-	0	0	0	0	-	-	+/-	0	-	0	-
		O	+	0	+	+	0	+	+	+	0	0	0	0

Construction Effects

The construction of Option 2a 'Transfer from Hereford WRZ' was assessed as having no significant effects.

Minor negative effects have been identified in respect of biodiversity (SEA Objective 1). This principally reflects the proposed pipeline route which would cross greenfield land and that works may therefore result in some localised loss of/disturbance to habitats and species. The route of the proposed pipeline between Broomy Hill WTW and Kingstone SR does cross the River Wye SAC/SSSI and in consequence, there is the potential for adverse effects on the habitats and species associated with the Wye (for example, white-clawed crayfish, lamprey and Atlantic salmon) due to disturbance arising from pipeline works and the release of pollutants into the watercourse. However, it is understood that the pipeline would be directed under the Wye and it is anticipated that standard best practice construction measures would be implemented to manage any potential impacts such that adverse effects on the SAC/SSSI are likely to be avoided. In this regard, the HRA concludes that the option would not have adverse effects (alone or in combination) on the River Wye SAC. Welsh Water have confirmed that through detailed planning and design, the route will avoid any other designated conservation sites.

During the construction phase, the use of plant on-site and transportation of materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This has been assessed as having a negative effect on climate change (SEA Objective 6). The use of raw materials and energy associated with the replacement of pumps and the construction of the pipeline, in addition to waste generated during construction, would also have a minor negative effect with respect to waste and resource use (SEA Objective 10).

Construction activity associated with the pipeline works including HGV movements has the potential to result in noise and air quality impacts which may affect residential and other sensitive receptors along the pipeline route. However, any impacts in this regard would be short term and temporary. Pipeline works may also temporarily affect some walking routes (for example, walking routes in the vicinity of Cage Brook). Overall, this option has been assessed as having a minor negative effect on health (SEA Objective 7).

Construction of the option would involve a moderate capital spend. This is likely to generate some employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). There is also the potential for localised disruption to traffic on a temporary basis during the construction period; associated HGV movements may also result in localised congestion. Overall, this option has been assessed as having a mixed minor positive and minor negative effect in respect of economic and social wellbeing (SEA Objective 8).

Pipeline works would largely follow existing linear features (roads), although works would temporarily affect greenfield land and there is the potential for construction activity to cause some short term impacts on the visual amenity of residential and recreational receptors along the proposed route. Overall, this option has been assessed as having a minor negative effect on landscape (SEA Objective 12).

Neutral effects have been identified in respect of geology and soils (SEA Objective 2), water quantity (SEA Objective 3), water quality (SEA Objective 4), flood risk (SEA Objective 5), water resources (SEA Objective 9) and cultural heritage (SEA Objective 11).

Operational Effects

Once operational, the option would permit the some of the Vowchurch demand to be met from Broomy Hill WTW when needed during drought events.

No significant effects were identified as a consequence of the operation of the option.

This option would not involve the abstraction of additional water beyond current licence limits (the Broomy Hill abstraction has been confirmed as being environmentally sustainable at full licence volume) and all transferred water would be treated. In consequence, no adverse effects on biodiversity associated with the operation of the option are predicted. The operation of the scheme will enable Welsh Water to reduce abstraction significantly from the Vowchurch boreholes and improve baseflow in the River Dore during periods of dry weather; this is likely to generate positive effects on the ecology supported by these sources. Overall, a positive effect on biodiversity (SEA Objective 1) during operation has been identified.

Reduction of the abstraction from the Vowchurch boreholes and the improvement in the baseflow in the River Dore is also assessed as having positive effects on water quantity (SEA Objective 3) and water quality (SEA Objective 4).

This option would help to address the risk of severe drought in the Vowchurch WRZ through the transfer of water from the Hereford WRZ. This has the potential to reduce vulnerability to the effects of climate change and has been assessed as having a positive effect on climate change (SEA Objective 6).

This option would enhance the resilience of supply to Welsh Water customers in the Vowchurch WRZ during periods of dry weather through the transfer of water (up to 3 Ml/d) from the Hereford WRZ. This will help to ensure the continuity of a safe and secure drinking water supply and help protect vulnerable customers. The option has therefore been assessed as having a positive effect on health (SEA Objective 7) and economic and social well-being (SEA Objective 8).

Neutral effects have also been identified with respect to geology and soils (SEA Objective 2), flood risk (SEA Objective 5), water resources (SEA Objective 9), waste and resource use (SEA Objective 10), cultural heritage (SEA Objective 11) and landscape (SEA Objective 12).

6.5 Secondary, Cumulative and Synergistic Effects

In determining the significance of effects of a plan or programme, the SEA Directive and implementing regulations require that consideration is given to the cumulative nature of the effects. This section considers the potential cumulative effects of the implementation of the individual preferred options that comprise the Final WRMP and the effects of the Final WRMP in combination with other plans and programmes.

Cumulative Effects of the Preferred Options

The likely significant construction and operational effects of the Final WRMP, taking into account the findings of the assessment of the preferred options, are summarised in **Table 6.4**.

Table 6.4 Cumulative Effects of Options within the Final WRMP

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
PEM024b	Canaston Bridge – Upgrade Pumping Station	C	-	-	0	0	--	-	0	++	0	-	0	-
		O	0	0	0/+	0	-	+/-	0	0	+	-	0	0
TYA004	New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW)	C	-	-	0	-	--	-	-	-	0	-	0	--
		O	0/?	0	-	0	--	-	0	0	0	-	0	-
TYA009a	Pen-y-Bont WTW Bankside Storage (8MI)	C	-	-	0	0	0	-	-	0	0	-	0	--
		O	0	0	0	0	0	-	0	0	0	-	0	-
Option 2a	Transfer from Hereford WRZ	C	-	0	0	0	0	-	-	+/-	0	-	0	-
		O	+	0	+	+	0	+	+	+	0	0	0	0
Cumulative Effects of the Preferred Options		C	-	-	0	-	--	--	-	++/-	0	--	0	--

Ref	Option	Construction (C) or Operation (O)	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Human Health	8. Economic and Social Wellbeing	9. Water Resources	10. Waste and Resource Use	11. Cultural Heritage	12. Landscape
		0	0/?	0	+/-	0	-	+/-	+	+	+	-	0	-

Construction Effects

Capital investment associated with the Final WRMP would generate supply chain benefits, employment opportunities and increased spend in the local economy by contractors and construction workers. The local economies in Pembrokeshire and Tywyn Aberdyfi are both expected to experience benefits, with significant expenditure associated with Option PEM024b anticipated; however, the plan options are not likely to generate significant in combination effects in this regard due to the distance between the two WRZs and the relatively low spend associated with Options TYA004 and TYA009a. Overall, a significant positive effect has been identified in respect of economic and social well-being (SEA Objective 8), albeit with a mixed minor negative effect expected due to highways disruption and diversions to recreational users on the National Cycle Network associated with the implementation of Option TYA004 and the disruption arising from the construction of the pipeline for Option 2a Pipeline.

No further significant or minor positive effects have been identified during the assessment of the Final WRMP.

Significant negative effects have been identified in respect of flood risk (SEA Objective 5), as construction activity associated with Options PEM024b and TYA004 would take place within Flood Zones 2 and 3. However, project level mitigation, informed by a FCA, would be likely to manage adverse effects in this regard.

The Final WRMP would give rise to the emission of greenhouse gases resulting from embodied carbon (in, for example, construction materials) in addition to plant operation and vehicle movements. Together, the construction of the preferred options would generate a total of at least 1,282 tCO₂e which has been assessed as having a significant negative effect on climate change (SEA Objective 6). Using the scale of carbon emissions as a proxy for resource use, a significant negative effect would also be expected on waste and resources (SEA Objective 10).

Construction associated with the preferred options may cause adverse landscape and visual impacts (SEA Objective 12) which could affect the special qualities of Snowdonia National Park and Pembrokeshire Coast National Park as well as local landscape character and the visual amenity of proximate residential and recreational receptors. For Options TYA004 and TYA009, these effects have been assessed as significant and, additionally, in combination landscape effects may arise if the construction of these options takes place at the same time (due to the close proximity of the schemes to one another). However, it is likely that effects in this regard could be managed at the project level through the implementation of appropriate mitigation such as screening informed by appropriate landscape and visual assessment.

No further significant negative effects have been identified during the assessment of the Final WRMP.

Minor negative effects have been identified in respect of biodiversity (SEA Objective 1), geology and soils (SEA Objective 2), water quality (SEA Objective 4), human health (SEA Objective 7) and economic and social well-being (SEA Objective 8). This reflects construction-related impacts including disturbance, land take, and vehicle emissions.

Operational Effects

No significant positive effects have been identified during the assessment of the Final WRMP. Implementation of the plan would help to ensure the continuity of potable water supplies and increasing WRZ resilience, supporting population and economic growth. In combination, this would give rise to positive effects on human health (SEA Objective 7) and economic and social well-being (SEA Objective 8). The operation of option PEM024b is also expected to minimise wastage, with a positive effect identified for water resources (SEA Objective 9). Reflecting the combined DO gain associated with the preferred options (1.54 MI/d) effects on these objectives are, however, unlikely to be significant.

Mixed minor positive and negative effects have been identified in respect of water quantity (SEA Objective 3). This reflects the expectation that operation of Option PEM024b would reduce the pressure on abstraction from the Afon Cleddau during times of low flows but also the potential for abstraction associated with Option TYA004 to have an adverse impact on the hydrological regime of the Afon Dysynni. It should be noted that Options TYA004 and TYA009a will both affect the Afon Dysynni and in-combination effects on SEA Objective 3 are therefore possible. However, the two options would not operate concurrently and the

2015 Meirionnydd Catchment Abstraction Management Strategy (CAMS) states that water is available for abstraction without restrictions within the Afon Dysynni. Operation of Option 2a would lead to a reduction of the abstraction from the Vowchurch boreholes and the improvement in the baseflow in the River Dore is also assessed as having positive effects on water quantity (SEA Objective 3) and water quality (SEA Objective 4).

Mixed minor positive and negative effects have also been identified in respect of climate change (SEA Objective 6). The improved storage position in Llys y Fran reservoir associated with Option PEM024b and Option 2a have the potential to reduce vulnerability to the effects of climate change (drought), generating a positive effect on this objective. However, the release of greenhouse gases associated with all of the preferred options (at least 741 tCO₂e) has been assessed as having an overall minor negative effect on climate change.

A significant negative effect has been identified with respect to flood risk (SEA Objective 5). This is because new above ground infrastructure would be sited in Flood Zones 2 and 3 under Options PEM024b and TYA004. However, project level mitigation, informed by a FCA, would be likely to manage adverse effects in this regard.

Further minor negative effects have been identified in respect of waste and resources (SEA Objective 10) due to combined energy use across the options. Additionally, implementation of the Final WRMP may give rise to minor negative effects on landscape (SEA Objective 12) as Options TYA004 and TYA009a would result in the development of new aboveground infrastructure in Snowdonia National Park (SEA Objective 12) (although as the new infrastructure for these options would be situated approximately 4km apart, significant in combination landscape effects are not anticipated).

Cumulative Effects of the Final WRMP In-combination with Other Plans and Programmes

The following subsections consider the cumulative effects of the Final WRMP in combination with other plans and programmes including:

- ▶ growth proposals and associated population change in the Welsh Water area;
- ▶ National Policy Statements (NPS) and Nationally Significant Infrastructure Projects (NSIPs);
- ▶ Welsh Water's Final Statutory Drought Plan 2015; and
- ▶ other water company WRMPs.

The cumulative effects of the Final WRMP are difficult to accurately assess given the inherent uncertainties concerning (*inter alia*): future changes to baseline environmental conditions; future population and economic growth; the deliverability of some NSIPs (and the potential for new NSIPs to be brought forward); and the proposals of emerging water company WRMPs. As such, it will be necessary to keep under review these factors as the WRMP is implemented (e.g. in Environmental Impact Assessments (EIA) and HRAs) to ensure that the latest and most up to date information is taken into account.

Population Change and Economic Growth

Population change in the Welsh Water region has already been explicitly considered in the Final WRMP along with the potential for further changes in demographics throughout the plan period. The population forecasts have also taken into account potential economic growth in the Welsh Water region. This means that 'in combination' water-resource effects with growth promoted by other plans or projects are considered and accounted for during the WRMP development process and its deficit calculations.

Potential 'in combination' effects in respect of water-resource demands due to other plans or projects are unlikely since these demands are explicitly modelled when determining deficit zones and hence developing the preferred options. As a result (in respect of water resources), the WRMP is not likely to make non-significant effects in other plans significant (indeed, other plans are arguably the 'source' of any potential effects in respect of water demand, with the WRMP having to manage potential effects that are not generated by the WRMP itself).

Whilst an increasing population and number of household properties would result in a higher forecast of household customer consumption, a combination of changes in water use behaviour and design standards,

metering and economic conditions mean that a commensurate increase in overall demand for water may not necessarily occur.

The WRMP safeguards against uncertainty in option yield and timing through 'Target Headroom'; this is an allowance provided in the planning process (i.e. designed-in spare capacity) that ensures that any supply-demand deficit will still be met if there is an underperforming demand side measure or growth exceeds predicted levels. It is therefore extremely unlikely that additional demand or a poorly-performing option would result in a deficit that might result in significant in combination effects. Additionally, the WRMP is prepared on a five-yearly cycle, which allows any changes in demand forecasts to be accounted for, and for timely intervention should a measure not be performing as expected. It is also informally reviewed on an annual basis.

It is therefore considered that the preferred options will not have significant 'in combination' effects with population change and economic growth.

National Policy Statements and Nationally Significant Infrastructure Projects

The Planning Act 2008 introduced a procedure to streamline the decision-making process for NSIPs. Under the Act, a developer wishing to construct a NSIP must first apply to the Secretary of State for development consent. NPSs establish the need for specific types of infrastructure and provide planning guidance for promoters of NSIPs, and the basis for the examination by the Examining Authority and decisions by the Secretary of State on development consent order applications. A number of NPSs have been published which set out the definition, and in some cases the location, of NSIPs. The current status of NPSs is set out in **Table 6.5**.

Table 6.5 Current Status of National Policy Statements

National Policy Statement (NPS)	Status	Are Potential Locations of NSIPs included in the NPS?
Overarching Energy EN-1	Designated July 2011	No
Fossil Fuel Electricity Generating Infrastructure EN-2	Designated July 2011	No
Renewable Energy Infrastructure EN-3	Designated July 2011	No
Gas Supply Infrastructure and Oil and Gas Pipelines EN-4	Designated July 2011	No
Electricity Networks Infrastructure EN-5	Designated July 2011	No
Nuclear Power Generation EN-6	Designated July 2011	Yes
Ports	Designated January 2012	No
Waste Water Infrastructure	Designated March 2012	Yes
Hazardous Waste Infrastructure	Designated June 2013	No
National Networks	Designated January 2015	No

National Policy Statement (NPS)	Status	Are Potential Locations of NSIPs included in the NPS?
Airports NPS: new runway capacity and infrastructure at airports in the South East of England	Designated June 2018	Yes
Water Resources Infrastructure	Draft published November 2018	No
Geological Disposal Infrastructure	Draft published January 2018	No

The Final WRMP is not expected to have any adverse cumulative effects in-combination with the NPSs listed above. This is because the NPS are either not site specific or because specific NSIP proposals are unlikely to affect, or be affected by, the measures that comprise the Final WRMP.

The Nuclear Power NPS (EN-6) sets out eight potentially suitable sites for the deployment of new nuclear power stations in England and Wales. Of these sites, one (Wylfa) is located within the Welsh Water supply area. Proposals for the Wylfa Newydd new nuclear build are currently at the examination stage. The Wylfa site is located on the Isle of Anglesey, and is not within either the Pembrokeshire or Tywyn Aberdyfi WRZs. Given the distance of the preferred options from the proposed NSIP, no significant cumulative effects in-combination with the implementation of the Final WRMP are predicted.

Two NSIPs are set out in the Waste Water Treatment NPS; however, both of these are located in London and are not expected to have any effect on water demand in the Welsh Water region. Similarly, the Airports NPS concerns runway capacity in the South East of England only.

Defra is currently preparing a NPS for water resources. This will set out the need for NSIPs related to water resources, and the Government's policies to deliver them. Whilst this NPS will not be site specific, implementation of the Final WRMP is likely to support the objectives of the NPS for improving water supply resilience which is likely to generate cumulative positive effects in respect of, in particular, climate change, human health and economic and social well-being.

No proposed NSIPs within the Pembrokeshire or Tywyn Aberdyfi WRZs are currently listed on the Planning Inspectorate website as being at the pre-application stage¹⁶⁹.

Welsh Water Drought Plan 2015

Welsh Water's Final Drought Plan was published in July 2015 following consultation in late 2014. The Drought Plan outlines Welsh Water's strategy for managing operations through prolonged dry periods that could result in significant shortages in water resource. The Plan details how a drought will be defined and the triggers for action.

The Plan includes a range of drought management actions that can be broadly categorised as:

- ▶ demand side actions (water efficiency products; customer engagement; temporary use bans; non-essential use bans for commercial customers through drought orders);
- ▶ leakage reduction and water treatment works loss reduction;
- ▶ supply-side actions (reinstatement of mothballed sources; permits to amend abstraction license conditions; the reduction of reservoir compensation arrangements; and drought orders to abstract water at new sites); and

¹⁶⁹ See <https://infrastructure.planninginspectorate.gov.uk/projects/> [Accessed November 2017].

- ▶ communication actions.

The key proposed drought actions in the Pembrokeshire and Tywyn Aberdyfi WRZs are summarised in **Table 6.6** and **Table 6.7** respectively (the actions are in addition to increased awareness raising, water efficiency devices and leakage management).

Table 6.6 Pembrokeshire Drought Actions

Type of Action	Drought Action	Max. Water Saving / Yield
Supply	Standby source of Milton Boreholes brought back into supply (when summer demands increase to the point where Service Reservoir Levels are difficult to maintain)	Unknown
Supply	Tankering to support lower resource and/or from neighbouring zone	Unknown
Demand	Introduction of Temporary Use Bans (TUBs)	1.82 MI/d
Demand	Introduction of Non Essential Usage Bans (NEUBs)	3.64 MI/d
Demand	Implementation of Emergency Drought Orders	6.19 MI/d
Supply	Reduce the required prescribed flow below the Crowhill Abstraction	3 MI/d
Supply	Reduce the Compensation release from Preseli Reservoir by 50%	0.9 MI/d
Supply	Increase the direct abstraction from Llys y Fran Reservoir	2 MI/d
Supply	Reduce the prescribed flow required at the Pont Hywel abstraction	2 MI/d
Supply	Abstraction from the Afon Taf	5 to 10 MI/d
Supply	Reduction in the statutory compensation release from Llys y Fran Reservoir to the Afon Syfynwy of 7.64 MI/d from 13.64 MI/d to 6 MI/d	7.64 MI/d

Table 6.7 Tywyn Aberdyfi Drought Actions

Type of Action	Drought Action	Max. Water Saving / Yield
Demand	Introduction of Temporary Use Bans (TUBs)	0.07 MI/d
Supply	Possible tankering from adjoining South Meirionnydd WRZ	Unknown
Demand	Introduction of Non Essential Usage Bans (NEUBs)	0.02 MI/d
Demand	Implementation of Emergency Drought Orders	0.13 MI/d

Type of Action	Drought Action	Max. Water Saving / Yield
Supply	New abstraction (tankering) from Afon Dysynni at Pont y Garth (to Pen y Bont WTW)	0.3 MI/d
Supply	Relaxation of annual licences on the Afon Fathew and the Nant Braich Y Rhiw	0 MI/d (Drought Permit will allow continued abstraction)

It should be recognised that the Final WRMP complements the Drought Plan which itself has been subject to SEA and HRA. The Final WRMP schemes selected for Tywyn Aberdyfi and Pembrokeshire will increase the drought resilience of supplies in these zones and Welsh Water is currently revising its Drought Plan which will reflect the proposed changes. The revised Drought Plan will be subject to SEA and HRA and further consideration will be given as to whether there are any 'in-combination' effects with the Final WRMP.

Other Water Company WRMPs

There is potential for Welsh Water's WRMP to have cumulative effects with the WRMPs of adjacent water companies. A review of the proposals in current published neighbouring water company areas (Severn Trent Water/Dee Valley Water, United Utilities, Bristol Water and Thames Water) is included in **Appendix A**. None of the current WRMPs have included options to draw water supplies from resources in the Welsh Water region and in consequence, no cumulative effects are expected to occur with the currently published plans.

In addition, the draft WRMPs for the respective companies have been reviewed:

- ▶ Severn Trent's Draft WRMP was published for consultation in February 2018. It identified measures to address deficits in four WRZs (Nottinghamshire, Forest and Stroud, North Staffordshire and the Strategic Grid). None were identified as having any in-combination effects with Welsh Water's WRMP.
- ▶ United Utilities' Draft WRMP was published for consultation in March 2018. Taking into account feedback and views received from the consultation process, United Utilities has submitted its Revised Draft WRMP to the Secretary of State. In it, United Utilities forecast a very small baseline deficit (circa 3 megalitres per day (MI/d) in the Strategic Resource Zone at the end of the planning horizon which it has proposed to resolve with enhanced leakage and improved levels of service. None of the proposed measures were identified as having any in-combination effects with Welsh Water's WRMP.
- ▶ Bristol Water's Draft WRMP was published for consultation in March 2018. Taking into account feedback and views received from the consultation process, Bristol Water has submitted its Revised Draft WRMP to the Secretary of State. In it, Bristol Water forecast a deficit in its zone, requiring a number of options to provide a combined yield of between 21.9 MI/d and 23.5 MI/d. The preferred options combined a reduction of a bulk transfer agreement with Wessex Water and enhanced and active leakage management. None of the proposed measures were identified as having any in-combination effects with Welsh Water's WRMP.
- ▶ Thames Water published its Draft WRMP for consultation in February 2018 followed by a Revised Draft WRMP that was consulted on between October and November 2018. The Revised Draft WRMP identifies supply demand deficits in each of its six WRZs. A mix of supply, bulk water transfers and demand management measures are proposed. None of the proposed preferred measures were identified as having any in-combination effects with Welsh Water's WRMP, although it should be noted that Thames Water is committed to exploring longer term bulk transfers with Welsh Water (though no preferred options in this regard have been identified to-date).

The information used to carry out this review is considered to be the most up to date information available at the time of writing. It should be noted that all water company WRMPs may be subject to review and as a

result, ‘in combination’ effects with the new WRMPs cannot be fully assessed until after the plans are adopted. However, it is clear that the locations of the Welsh Water preferred options (west Wales) will make ‘in combination’ effects with the options of other WRMPs extremely unlikely.

6.6 Contribution of the Final WRMP to Wales’ Well-being Goals and the Objective for SMNR

As set out in **Section 1.9**, the *Well-being of Future Generations (Wales) Act 2015* places a duty on public bodies including Welsh Water to carry out sustainable development, aimed at achieving the seven well-being goals for Wales. The well-being goals established by the Act are as follows:

- ▶ A prosperous Wales;
- ▶ A resilient Wales;
- ▶ A healthier Wales;
- ▶ A more equal Wales;
- ▶ A Wales of cohesive communities;
- ▶ A Wales of vibrant culture and thriving Welsh language; and
- ▶ A globally responsible Wales.

The *Environment (Wales) Act 2016*, meanwhile, has established an objective for the sustainable management of natural resources (SMNR) “*to maintain and enhance the resilience of ecosystems and the benefits they provide and, in so doing—*

(a) meet the needs of present generations of people without compromising the ability of future generations to meet their needs, and

(b) contribute to the achievement of the well-being goals in section 4 of the Well-being of Future Generations (Wales) Act 2015”.

The well-being goals and SMNR objective have been mapped to the SEA objectives that comprise the SEA assessment framework (see **Section 4.2**). Through the assessment of the preferred options identified for WRMP19 against the SEA objectives, it is therefore possible to assess the contribution that the implementation of the Final WRMP would make to the achievement of the goals and objective.

A matrix has been used to record this assessment and is presented in **Table 6.8** below. Informed by the assessment of the preferred options against the SEA objectives, as well as the cumulative effects of the Final WRMP (as summarised in the preceding sections), a judgement has been made regarding whether, and the extent to which, the Final WRMP would support or detract from the achievement of each well-being goal (and by extension, the SMNR objective) in-turn with commentary provided to justify the conclusions reached.

Table 6.8 Assessment of the Contribution of the Final WRMP to the Well-being Goals for Wales

Well-being Goals	Related SEA Objective	Contribution to the Well-being Goal	Commentary
<p>A prosperous Wales: An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work.</p>	<p>SA Objectives 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12</p>	<p style="text-align: center;">↕</p>	<p>The assessment of the preferred options has identified that capital expenditure associated with the construction of the preferred options will generate benefits in respect of the supply chain and local employment creation, which has been assessed as supporting the achievement of the well-being goal 'a prosperous Wales'. The operation of the preferred options will also help to ensure the continuity of a safe and secure drinking water supply over the planning horizon of WRMP19 which may in-turn support economic and population growth and improve resilience to the effects of climate change.</p> <p>The assessment of the preferred options against the SEA objectives has also, however, highlighted the potential for direct and indirect adverse environmental effects which has been assessed as not supporting the achievement of this well-being goal. These effects would be most significant during construction and would include resource use and the emissions of greenhouse gases. However, it should be recognised that through the implementation of the preferred options, the Final WRMP seeks to ensure that future demand for water is met sustainably. This will help protect and enhance the environment and ensure the efficient use of water resources.</p>
<p>A resilient Wales: A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).</p>	<p>SA Objectives 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12</p>	<p style="text-align: center;">↕</p>	<p>Overall, the Final WRMP seeks to ensure that future demand for water is met sustainably. This will help protect and enhance the environment and ensure the efficient use of water resources, supporting the achievement of the well-being goal 'a resilient Wales'. The assessment of the preferred options has identified that the operation of Option PEM024b in particular will reduce pressure on the need for abstraction during times of low flows, which is likely to benefit the water environment and water resources.</p> <p>The assessment of the preferred options against the SEA objectives has identified the potential for direct and indirect adverse environmental effects which has been assessed as not supporting the achievement of this well-being goal. These effects would be particularly felt during construction and could include impacts on (inter alia) biodiversity, soils, water quality and landscapes which contribute to the resilience of Wales' ecosystems. However, these effects would be largely minor, localised and temporary and it is likely that adverse impacts would be mitigated where possible at the project level.</p>
<p>A healthier Wales: A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.</p>	<p>SEA Objectives 1, 3, 4, 5, 6, 7, 8, 12</p>	<p style="text-align: center;">↕</p>	<p>It is expected that the Final WRMP will help to ensure the continuity of water supply to Welsh Water customers over the horizon of WRMP19 and which has been assessed as supporting the achievement of the well-being goal 'a healthier Wales'.</p> <p>Emissions to air, alongside noise and vibration disturbance, during construction of the preferred options may have minor adverse effects on human health which has been assessed as not supporting the achievement of this well-being goal. However, any adverse impacts in this regard would be temporary and localised and, further, are likely to be managed through the implementation of best practice construction methods.</p>
<p>A more equal Wales: A society that enables people to fulfil their potential no matter</p>	<p>SEA Objectives 7, 8</p>	<p style="text-align: center;">↑</p>	<p>As noted above, the assessment of the preferred options has identified that capital expenditure associated with the construction of the preferred options may generate benefits in respect of local employment creation. The operation of the preferred options will</p>

Well-being Goals	Related SEA Objective	Contribution to the Well-being Goal	Commentary
what their background or circumstances (including their socio economic background and circumstances).			also help to ensure the continuity of a safe and secure drinking water supply over the planning horizon of WRMP19 which may in-turn support economic and population growth. This has been assessed as supporting the achievement of the well-being goal 'a more equal Wales'.
<p>A Wales of cohesive communities: Attractive, viable, safe and well-connected communities.</p>	SEA Objective 5, 6, 8, 12	↕	<p>The operation of the preferred options will help to ensure the continuity of a safe and secure drinking water supply over the planning horizon of WRMP19 which may in-turn support economic and population growth. Employment generation, population growth and the maintenance of water supplies could help to ensure that communities remain viable. Collectively, these factors have been assessed as supporting the achievement of the well-being goal 'a Wales of cohesive communities'.</p> <p>Emissions to air, alongside noise and vibration disturbance, during construction of the preferred options may have minor adverse effects on host communities which has been assessed as being not supportive of this well-being goal. However, any adverse impacts in this regard would be temporary and localised and, further, are likely to be managed through the implementation of best practice construction methods. Further, the preferred options are relatively remote with development likely to be distant from main settlements.</p> <p>The assessment of the preferred options has highlighted that new development would be located in Flood Zones 2 and 3. However, the construction and operation of this development would be unlikely to result in increased flood risk elsewhere (i.e. offsite) and in consequence, communities are unlikely to be affected by increased flood risk as a result of the implementation of the Final WRMP.</p>
<p>A Wales of vibrant culture and thriving Welsh language: A society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.</p>	SEA Objectives 8, 11	↔	<p>Capital expenditure associated with the construction of the preferred options and benefits in respect of ensuring the continuity of water supply may in-turn support economic and population growth. This could make a small contribution towards retaining local, Welsh speakers.</p> <p>The assessment of the preferred options against the SEA objectives has not identified adverse effects in respect of cultural heritage during the construction or operational phases of the proposed schemes.</p> <p>Collectively, these factors have been assessed as meaning the Final WRMP will not make a contribution to the achievement of the well-being goal, 'a Wales of vibrant culture and thriving Welsh language'.</p>
<p>A globally responsible Wales: A nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.</p>	SEA Objectives 1, 2, 5, 6, 7, 8, 9, 10	↔	<p>Taking into account the nature and scale of the preferred options contained in the Final WRMP and that effects associated with their construction and operation would be predominantly felt at a local/sub-regional level, it is not expected that the Final WRMP would make a contribution to this well-being goal.</p> <p>It is recognised that the construction and operation of the preferred options would result in resource use and greenhouse gas emissions; however, in the context of national (Wales) and global emissions, any impact in this regard would be negligible.</p> <p>Collectively these factors have been assessed as meaning the Final WRMP will not make a contribution to achievement of the well-being goal, 'a globally responsible Wales'.</p>

Key

Symbol	Effect
↑	The Final WRMP supports the achievement of the well-being goal.
↔	The Final WRMP will not make a contribution to the achievement of the well-being goal.
↓	The Final WRMP does not support the achievement of the well-being goal.

Table 6.8 demonstrates that the Final WRMP is likely to support the achievement of the well-being goals for Wales and in particular ‘a prosperous Wales’, ‘a resilient Wales’ and ‘a more equal Wales’. This reflects the potential for capital expenditure associated with the construction of the preferred options to generate benefits in respect of the supply chain and local employment creation and for the operation of the preferred options to help to ensure the continuity of a safe and secure drinking water supply over the planning horizon of WRMP19. Investment and security of water supply may also generate minor benefits across several other well-being goals.

New development associated with the preferred options will unavoidably require the use of natural resources and generate greenhouse gas emissions and construction activity in particular could also result in some adverse environmental effects. However, it should be recognised that through the implementation of the preferred options, the Final WRMP will help to ensure that future demand for water is met sustainably. This will help protect and enhance the environment and promote the efficient use of water resources, making a long term contribution to the well-being goals for Wales and the objective for SMNR.

6.7 Mitigation and Enhancement

The potential effects of the preferred options are set out in the sections above. In some cases, there is an opportunity to reduce some of the potential negative impacts. The detail of this mitigation needs to be considered during the planning phases of each of the individual component schemes within the preferred options. Potential mitigation measures are included within each of the preferred option assessment matrices in **Appendix D** although these should be considered as a starting point for more detailed consideration as options are planned and developed.

Specific mitigation measures in the preferred options assessment matrices include:

- ▶ Construction measures that need to be incorporated into scheme design and or planning to avoid or mitigate potential effects; for example, to allow ecological investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with NRW; or to avoid effects on the setting of nearby listed buildings through scheme siting and design;
- ▶ Minimising the visual effects of erecting new buildings in National Parks by designing the buildings to be in-keeping with the local landscape (e.g. housing in a field barn) or through screening (e.g. tree or hedge planting);
- ▶ Flood attenuation measures such as designing pumping stations and other essential infrastructure which are at risk of flooding with removable electric parts, wiring above possible water levels, flood proof barriers to doors;
- ▶ The avoidance of road closures during periods of peak tourist influx in summer months;
- ▶ Measures to reduce greenhouse gas emissions/energy usage during construction including, for example, the use of low emission/low energy plant;
- ▶ Opportunities to utilise reused/recycled materials during construction (including excavated spoil and topsoil) where appropriate;

- ▶ A detailed project level HRA/EIA would be required to consider these in more detail but at the very least a detailed Construction Environmental Management Plan would be required setting out detailed method statements as to how risks would be minimised.

Species Specific Measures and Biodiversity

Most species-specific avoidance or mitigation measures can only be determined at the scheme level, following scheme-specific surveys, and 'best-practice' mitigation for a species will vary according to a range of factors that cannot be determined at this level. In addition, some general 'best-practice' measures may not be relevant or appropriate to the interest features of the European sites concerned (for example, clearing vegetation over winter is usually advocated to avoid impacts on nesting birds; however, this is unlikely to be necessary to avoid effects on some SPA species (such as overwintering estuarine birds) and the winter removal of vegetation might actually have a negative effect on these species through disturbance).

However, the following general measures should be followed to minimise the potential for impacts on species that are European site interest features unless project-level environmental studies or HRA indicate that they are not required or not appropriate, or that alternative or additional measures are more appropriate / necessary:

- ▶ Scheme design will aim to minimise the environmental effects by 'designing to avoid' potential habitat features that may be used by species that are European site interest features when outside the site boundary (e.g. linear features such as hedges or stream corridors; large areas of scrub or woodland; mature trees; etc.) through scheme-specific routing studies;
- ▶ The works programme and requirements for each Option will be determined at the earliest opportunity to allow investigation schemes, surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with NRW;
- ▶ Night-time working, or working around dusk / dawn, should be avoided to reduce the likelihood of negative effects on nocturnal species;
- ▶ Any lighting required (either temporary or permanent) will be designed with an ecologist to ensure that potential 'displacement' effects on nocturnal animals, particularly SAC bat species, are avoided;
- ▶ All compounds / pipe stores etc. will be sited, fenced or otherwise arranged to prevent vulnerable SAC species from accessing them;
- ▶ All materials will be stored away from commuting routes / foraging areas that may be used by species that are European site interest features;
- ▶ All excavations will have ramps or battered ends to prevent species becoming trapped; and
- ▶ Pipe-caps must be installed overnight to prevent species entering and becoming trapped in any laid pipe-work.

Welsh Water is required to hold an abstraction licence for all the supply options that abstract water from surface or ground water bodies. In some cases this will be under an existing abstraction licence while in other cases a new licence will be required. In developing the options, Welsh Water has considered whether it would be able to successfully apply for a licence, provided that any potential adverse effects on biodiversity could be mitigated. This has necessitated a more proactive and integrated approach to the development of mitigating measures within the development of the schemes. For some sites where there is a particular risk to designated sites, it may be necessary to undertake an Appropriate Assessment or other formal environmental assessment, which may also set out further measures to mitigate any risks of adverse effects. For all schemes, appropriate advice should be sought and measures taken to minimise negative effects of construction and operation on wildlife and habitats and where possible, seek to positively enhance biodiversity in the area.

Scheme Design and Planning

The preferred options will be subject to project-level environmental assessment¹⁷⁰ as they are brought forward, which will include assessments of their potential to affect European sites during their construction or operation. These assessments will consider or identify (*inter alia*):

- ▶ opportunities for avoiding potential effects on European sites through design (e.g. alternative pipeline routes; micro-siting; etc);
- ▶ construction measures that need to be incorporated into scheme design and or planning to avoid or mitigate potential effects – for example, ensuring that sufficient space is available for pollution prevention measures to be installed, such as sediment traps; and
- ▶ operational regimes required to ensure no adverse effects occur (e.g. compensation releases – although note that these measures can only be identified through detailed investigation schemes).

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through construction-site derived pollutants, rather than through direct encroachment. There is a substantial body of general construction good-practice which is applicable to all of the proposed options and can be relied on (at this level) to prevent significant or adverse effects on a European site occurring as a result of construction site-derived pollutants. The following guidance documents detail the current industry best-practices in construction that are relevant to the proposed schemes:

- ▶ NRW, SEPA & NIEA, Guidance for Pollution Prevention (GPPs) (which are replacing the previous Pollution Prevention Guidelines (PPGs) when published) [online]. Available at: <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>
 - PPG1: Understanding Your Environmental Responsibilities - Good Environmental Practices (July 2013; under review);
 - GPP5: Works and maintenance in or near water (January 2017);
 - PPG6: Working at construction and demolition sites (March 2012; under review);
 - GPP21: Pollution incident response planning (July 2017); and
 - PPG22: Incident response - dealing with spills (April 2011; under review).
- ▶ Venables R. et al. (2000) Environmental Handbook for Building and Civil Engineering Projects. 2nd Edition. Construction Industry Research and Information Association (CIRIA), London.

The best-practice procedures and measures detailed in these documents will be followed for all construction works derived from the draft WRMP¹⁷¹ as a minimum standard, unless scheme-specific investigations identify additional measures and / or more appropriate non-standard approaches for dealing with potential site-derived pollutants.

Effects on Human Health and Social and Economic Well-being

Construction activities should be undertaken so as to minimise short term adverse effects on recreational areas, such as footpaths, and on landscape and biodiversity. Noise, traffic disruption and visual impacts should also be considered. Welsh Water and its contractors are enrolled in the Considerate Constructors Scheme, a voluntary scheme which commits those contractors in the Scheme to be considerate and good neighbours, as well as clean, respectful, safe, environmentally conscious, responsible and accountable. Care should also be taken during construction regarding the potential for contaminants such as silt, concrete

¹⁷⁰ These will be undertaken as part of the detailed 'investigation schemes' which are funded through inclusion in the WRMP.

¹⁷¹ Both preferred and feasible options, if these are used.

or fuel oil to pollute water courses via surface run off. This can be mitigated by undertaking all construction activities in accordance with relevant best practice pollution prevention guidance.

To maximise economic benefits in the Welsh Water area it is recommended that, where possible, work is carried out by local firms and contractors or by those with a policy for training and skills development that could help contribute to the local economy and meet employment needs.

Effects on Flood Risk, Climate Change and Resource Use

To mitigate the potential effects of flooding on a scheme, infrastructure should, where possible, be located outside the 1 in 100 year indicative flood plain. Where this is not possible due to operational requirements the infrastructure should be designed such that it can continue to operate under flood conditions and not increase flood risk elsewhere.

Schemes which have operational energy requirements could mitigate effects on climate change through the use of on-site energy generation or renewable energy sources where feasible. The use of low emission plant could also be used where feasible.

Where significant raw materials are required for options this can be mitigated by utilising recycled and locally sourced materials. Construction and operational wastes should also be reused/recycled where appropriate.

Effects on Cultural Heritage and Landscape

Effects on landscape character and visual amenity should be considered at an early stage in the design process. Many of the options, particularly supply-side options, could have a negative effect on the landscape if new buildings or structures are required that cannot be located on previously developed land, are prominent and the landscape is recognised for its importance and special qualities (whether designated as National park or an AONB). In order to minimise this effect, potential mitigation includes the adoption of high quality design principles (e.g. new structures utilising local building styles) and incorporate landscaping schemes (e.g. tree/ hedge planting). In addition, it is also expected that a landscape and visual impact assessment would be undertaken at the project stage as part of any EIA.

The potential for adverse impacts of the settings of cultural heritage assets should also be considered early in the design process and as part of the EIA and any adverse effects minimised for example through micro-siting/alternative pipeline routes to avoid designated sites.

6.8 Conclusions and Reasons for the Selection of the Preferred Options

Reasons for the Selection of the Preferred Option

To obtain a preferred set of solutions that resolves the supply demand imbalances in the Tywyn Aberdyfi and Pembrokeshire zones, Welsh Water followed a robust process that is compliant with regulatory guidance and best practice, is thorough in its appraisal of possible options, and takes full account of external and internal engagement. The key principles of Welsh Water's decision making process have been:

- ▶ conduct detailed customer and stakeholder engagement to understand their views and preferences for the proposed options;
- ▶ undertake a detailed options appraisal process, including SEA/HRA and WFD assessment, to generate a set of costed, feasible supply side and demand side options;
- ▶ utilise the UKWIR Industry Standard "Economics of Balancing Supply and Demand" (EBSD) methodology to generate the 'least cost' plan;
- ▶ review against Welsh Government objectives as set out in the Environment (Wales) Act 2016, Water Strategy for Wales and Future Generations Act 2015;
- ▶ ensure options are aligned with Welsh Water's PR19 priorities, the 2050 vision and Biodiversity Plan.

Reasons for the Selection of the Preferred Option

The following text has been provided by Welsh Water and considers the final option for each WRZ in turn.

Tywyn Aberdyfi

The initial least cost assessment identified the new abstraction from the Afon Dysynni as the most cost beneficial scheme that resolves the forecast deficit in Tywyn Aberdyfi. No demand side measures could fully resolve the imbalance given the already low level of leakage. To confirm that this solution is the best value Welsh Water has tested it further against other measures, such as drought risk, climate change and environmental impact; the results of which show:

- ▶ it is resilient to climate change;
- ▶ it is resilient to more extreme droughts than have experienced been historically;
- ▶ it is resilient to potential uncertainties such as future rates of population growth; and
- ▶ it has a minimal impact upon the environment.

Pembrokeshire

The initial least cost assessment identified the Canaston Bridge pumping station upgrade as the most cost beneficial scheme that resolves the forecast deficit in Pembrokeshire. No demand side measures could fully resolve the imbalance, though as part of Welsh Water's overall strategy for Pembrokeshire, water efficiency activity in the zone will be increased and the company will look to pilot further smart metering trials. To confirm that this solution is the best value Welsh Water has tested it further against other measures, such as drought risk, climate change and environmental impact; the results of which show

- ▶ it is resilient to climate change;
- ▶ it is resilient to more extreme droughts than have been experienced historically;
- ▶ it is resilient to potential uncertainties such as catchment hydrology and growth; and
- ▶ it does not impact the environment.

Vowchurch Resilience Option

There are limited options to resolve the issue of resilience for the Vowchurch WRZ. Demand management effort such as leakage reduction would not on its own resolve the situation. The Vowchurch boreholes site was subject to a Restoring Sustainable Abstraction (RSA) study in 2010/11 as required by the Environment Agency through the NEP for AMP 5. To inform the cost benefit element of the study, options appraisal work was completed which investigated alternative sources of supply to the Vowchurch boreholes. The only feasible option identified was to provide a potable supply of water from the neighbouring Hereford WRZ.

Given the water supply risks related to poor raw water quality and resilience to drought, Welsh Water will lay a new potable water main between our Hereford and Vowchurch zones, capable of meeting the whole Vowchurch demand from Broomy Hill WTW when needed.

Broomy Hill is fed by abstraction from the River Wye and is licensed for a maximum rate of 52 Ml/d. The initial resilience assessment of this river source suggests there is no plausible drought severe enough to deplete flows in the River Wye to such an extent that they would be unable to provide 52 Ml/d for abstraction at Broomy Hill. Welsh Water are therefore confident that this new supply of water to Vowchurch is fully drought resilient.

7. Next Steps and Proposals for Monitoring

7.1 Next Steps

This Final Environmental Report has been completed to assess the Final WRMP that was published by Welsh Water in March 2019. Alongside this document, Welsh Water has also issued a Post Adoption Statement which is the final output of the SEA process. This summarises:

- ▶ how environmental considerations have been integrated into the Final WRMP;
- ▶ how the Environmental Report has been taken into account;
- ▶ how opinions expressed in response to consultation have been taken into account;
- ▶ the reasons for choosing the Final WRMP as adopted, in the light of the other reasonable alternatives dealt with; and
- ▶ the measures that are to be taken to monitor the significant environmental effects of the implementation of the plan or programme.

As the WRMP is implemented, Welsh Water will monitor its effects on the environment through their existing processes, helping to ensure that the potential impacts identified in the SEA are considered in practice.

7.2 How Environmental Effects will be Considered During Plan Implementation

The preferred options for managing water supply and demand contained in the Final WRMP, along with the resilience option, will need to be implemented through specific projects. As part of this process, each project may be subject to further assessment to understand and manage its potential environmental and social impacts. These assessments, which may include HRA and EIA, will take account of the issues discussed in this report but will also be informed by the greater detail available as the work progresses about construction techniques, building materials, and agreed locations and routes.

The projects will also need to be licensed by NRW where they involve abstraction from surface waters or groundwaters. In considering whether to grant or extend a licence, NRW considers any potential impacts on the status of the water bodies (for example their chemical and biological quality, the volumes and flows of water, and the impacts on the structure of the water bodies) and on wildlife that might be affected by construction or operation.

7.3 Monitoring the Effects of the Final WRMP

As the Final WRMP is implemented, with its component projects in place, its effects on the environment and people will need to be taken into account. Welsh Water expects to monitor the effects of the WRMP alongside the other impacts of its operations, and as such, is likely to rely on existing sources of information that are collected either by Welsh Water or by other relevant organisations such as the NRW. For example, Welsh Water already collects information for its Annual Performance Report that allows customers and stakeholders to review its performance, some of which is presented in a robust Risk and Compliance Statement that is submitted to the Office of Water Services (Ofwat). Welsh Water updates their WRMP and Drought Plan every five and three years respectively and there are a number of statutory controls which

must be monitored. A substantial amount of relevant information is also collated by the Welsh Government¹⁷², NRW¹⁷³, and via the Welsh Government StatsWales website¹⁷⁴.

Monitoring Requirements

It is a requirement of the SEA Directive to establish how the significant effects of the WRMP will be monitored. Monitoring the sustainability effects of the WRMP can help to answer questions such as:

- ▶ Were the SEA predictions of effects accurate?
- ▶ Is the WRMP contributing to the achievement of the SEA objectives?
- ▶ Are mitigation measures performing as well as expected?
- ▶ Are there any adverse effects? Are these within acceptable limits, or is remedial action desirable?

It is not necessary to monitor everything or monitor an effect indefinitely. Instead monitoring should be focussed on:

- ▶ significant effects that may give rise to irreversible damage, with a view to identifying trends before such damage is caused; and
- ▶ significant effects where there was uncertainty in the SEA and where monitoring would enable preventative or mitigation measures to be undertaken.

Welsh Water will need to take a broad view of the findings of their ongoing monitoring processes to identify whether the WRMP has any significant unforeseen effects. Where these are identified, Welsh Water may be required to put in place specific monitoring arrangements and will consider how best to mitigate or avoid the adverse consequences.

Table 7.1 sets out the monitoring framework for the Final WRMP; further information on monitoring proposals are contained in the Post Adoption Statement.

Table 7.1 Indicators for Monitoring Effects

Objective	Indicator	Source of Information	Commentary
1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity	Condition of specific protected sites (e.g. SACs, SPAs and Ramsar)	Natural Resources Wales (NRW)	Open communication between NRW and Welsh Water will support the provision of up-to-date information and identification of any potential issues.
	Condition of SSSIs on water industry land holdings	NRW, Welsh Water	Condition assessment of designated land on Welsh Water's landholdings, both area and condition may change.
	Biological monitoring (macroinvertebrates, macrophytes, fisheries, bird surveys)	NRW, Welsh Water, Angling clubs.	Using data sets and comparing them against other monitored information such as levels and flows will assist in identifying whether there are any adverse effects and if mitigation measures are

¹⁷² Welsh Government (2017) *Statistics & Research*. Available online at: <http://gov.wales/statistics-and-research/?lang=en>

¹⁷³ Natural Resources Wales (2017) *Evidence and Data*. Available online at: <https://naturalresources.wales/evidence-and-data/?lang=en>

¹⁷⁴ Welsh Government (2017) *StatsWales: Environment and Countryside*. Available online at: <https://statswales.gov.wales/Catalogue/Environment-and-Countryside>

Objective	Indicator	Source of Information	Commentary
			performing as well as expected.
	Number and area of new or restored habitats	Welsh Water	Welsh Water will consider recording the number of locations and area of habitats created or restored.
2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	Number/ developed area of water infrastructure built on previously developed land	Welsh Water	Welsh Water will consider recording the number and developed area of new buildings that are built on previously developed land.
	Condition of sites designated for geological interest (e.g. geological SSSIs) on water industry land holdings	Welsh Water	Condition assessment of designated land on Welsh Waters landholdings, both area and condition may change.
3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.	River flow and level characteristics	Welsh Water, NRW	Monitoring can be compared to historic records. Source information will include Environmental Assessment Reports (EARs) and Environmental Monitoring Plans (EMPs) for DCWWs Drought Plan options and information from NRW from RBMPs.
	River flows, river levels, lake and reservoir levels.	Welsh Water, NRW	At sensitive sites, previous studies will be used to inform monitoring and assessment. For example Review of Consents (RoC) documentation and any Drought Plan option EARs and associated EMPs.
	Groundwater levels, recharge characteristics	Welsh Water, NRW	At sensitive sites, previous studies will be used to inform monitoring and assessment. For example, RoC documentation and any Drought Plan option EARs and associated EMPs.
4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.	Water quality of surface, groundwater, estuarine and coastal waters	Welsh Water, NRW	Monitoring can be compared to historic records. Source information will include Environmental Assessment Reports (EARs) and Environmental Monitoring Plans (EMPs) for DCWWs Drought Plan options and information from NRW from RBMPs. For coastal waters, source information would include the Wales Marine Planning Portal.
5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.	Number of properties that experience internal flooding from public sewers.	Welsh Water, NRW	Welsh Water report these data to Ofwat as part of the statutory returns process and which is published in the Annual Performance Report (MOS D3 KPI).

Objective	Indicator	Source of Information	Commentary
	Installation of sustainable drainage systems and green infrastructure.	Welsh Water	Welsh Water will consider recording the number of sustainable drainage systems and green infrastructure installed.
6. To limit the causes and potential consequences of climate change and to adapt to future changes.	Quantity of greenhouse gas emissions per megalitre of water supplied.	Welsh Water	Welsh Water energy managers can use company data, and guidance from the UKWIR greenhouse gas workbook and BEIS (Department for Business, Energy & Industrial Strategy) conversion factors to derive this information.
	Energy use in the operational phase of water treatment and supply.	Welsh Water	Welsh Water hold and record energy consumption data e.g. via accounts / invoices.
	Renewable energy generated; renewable energy purchased.	Welsh Water	Welsh Water report these data to Ofwat as part of the statutory returns process and which is published in the Annual Performance Report (MOS C2 KPI). Welsh Water hold and record energy consumption data e.g. via accounts / invoices..
7. To ensure the protection and enhancement of human health.	Compliance with drinking water standards at customers' taps (%).	Welsh Water – drinking water quality report	Welsh Water reports these data to Ofwat as part of the statutory returns process (Annual Performance Report) and to the Drinking Water Inspectorate.
	Compliance with water quality standards under the EC Bathing Waters Directive.	NRW	NRW monitors the compliance of bathing waters and reports this annually.
	Number of Welsh Water sites with public access which provide sporting, recreational and leisure resources and number of visits per year.	Welsh Water	Welsh Water holds information on the number of annual visitors to sites where specific visitor facilities are provided (e.g. Llyn Brenig)
	The percentage of critical assets that are resilient against key risks covering: <ul style="list-style-type: none"> • Security and Emergency Measures Directive (SEMD) risk; • Flood Risk; • Coastal Erosion Risk; • Loss of Power Risk; • Loss of Remote Control ability • Loss of any part of the treatment process; • Loss of water or wastewater supply capacity; or • Loss of access to the asset. 	Welsh Water	Welsh Water report these data to Ofwat as part of the statutory returns process and which is published in the Annual Performance Report (MOS F3 KPI).
8. To maintain and enhance the economic and social well-being of the local community.	Population and projected population change over time (per WRZ)	Welsh Water	Welsh Water reports these data to Ofwat as part of the statutory returns process and as part of the Strategic Business Plan.

Objective	Indicator	Source of Information	Commentary
	The number of customers benefitting from social tariffs (The measure embraces all social tariffs and means of assistance and includes HelpU, WaterSure Wales, Water Direct, and the Customer Assistance Fund (but not Water Collect))	Welsh Water	Welsh Water report these data to Ofwat as part of the statutory returns process and which is published in the Annual Performance Report (MOS E2 KPI).
9. To ensure the sustainable and efficient use of water resources.	Leakage	Welsh Water	Welsh Water report these data to Ofwat as part of the statutory returns process and which is published in the Annual Performance Report (MOS F2 KPI).
	Water saved through demand management / water efficiency measures	Welsh Water	Welsh Water will consider reporting these data.
	Trends in overall per capita consumption.	Welsh Water	Welsh Water report these data to Ofwat as part of the statutory returns process and which is published in the Annual Performance Report (additional non-financial information).
10. To promote the efficient use of resources.	Amount of recycled / reused materials used	Welsh Water (contractors/consultants)	Information on the use of recycled / reused materials will be held by construction managers and accounts (contractors / consultants accounts, waste or procurement records).
	Proportion of waste sent to landfill	Welsh Water (services data)	Information on waste disposal to landfill will be held by Welsh Water.
	Chemicals used in water supply	Welsh Water	Information (quantities, composition) on chemical use will be held in accounts.
11. To conserve and enhance the cultural, historic and industrial heritage resource.	Loss / damage or discovery / protection of cultural, historic and industrial heritage features. Including loss of landscapes of historic interest and natural heritage features (including for example field systems, field boundaries) that contribute to the cultural and historic distinctiveness of Wales	Welsh Water, Cadw	Cadw's regional field monument wardens monitor the condition of all statutorily protected monuments on a five-year programme.
12. To conserve and enhance landscape character.	Loss or damage to Special Qualities of Designated Landscapes (DL) arising from new water resource infrastructure, implemented as result of Welsh Water's WRMP19.	Welsh Water	Welsh Water will consider recording the number and developed area of new buildings above ground infrastructure that are built within designated landscape sites.

Appendix A

Review of Plans and Programmes

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
The Bonn Convention (or CMS) 1975 <i>The Convention on the Conservation of Migratory Species of Wild Animals</i>	
<p>The Convention on the Conservation of Migratory Species of Wild Animals (also known as the Bonn Convention or CMS) is an intergovernmental treaty under the United Nations Environment Programme. The convention was signed in 1979 ratified in the UK in 1985.</p> <p>The convention aims to ensure contracting parties work together to conserve terrestrial, marine and avian migratory species and their habitats (on a global scale) by providing strict protection for endangered migratory species.</p> <p>Overarching objectives set for the Parties are:</p> <ul style="list-style-type: none"> - Should promote, co-operate in and support research relating to migratory species; - Shall endeavour to provide immediate protection for migratory species; - Shall endeavour to conclude Agreements covering the conservation and management of migratory species included in Appendix II. <p>Setting targets is the responsibility of member states.</p>	<p>The WRMP should take into account the habitats and species that have been identified under this directive, and should include provision for their protection, preservation and improvement.</p> <p>The SEA assessment framework should include biodiversity, incorporating the importance of conserving migratory species.</p>
The Bern Convention 1979	
<p>The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) was adopted in Bern, Switzerland in 1979, and came into force in 1982.</p> <p>The principal objectives are:</p> <ul style="list-style-type: none"> - To conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co-operation of several States; - To promote such co-operation. Particular emphasis is given to endangered and vulnerable species, including endangered and vulnerable migratory species; - In order to achieve this the Convention imposes legal obligations on contracting parties, protecting over 500 wild plant species and more than 1000 wild animal species. <p>Targets for Contracting Parties are:</p> <ul style="list-style-type: none"> - Promoting national policies for the conservation of wild flora, wild fauna and natural habitats, with particular attention to endangered and vulnerable species, especially endemic ones, and endangered habitats, in accordance with the provisions of this Convention; - Undertaking in its planning and development policies, and in its measures against pollution, to have regard to the conservation of wild flora and fauna; - Promoting education and disseminating general information on the need to conserve species of wild flora and fauna and their habitats. 	<p>The WRMP should take into account the habitats and species that have been identified under the Convention, and should include provision for the preservation, protection and improvement of the quality of the environment as appropriate.</p> <p>The SEA assessment framework should incorporate the conservation provisions of the Convention particularly the protection of wild flora, fauna and natural habitats.</p>
UNESCO (1971) <i>The Ramsar Convention on Wetlands</i>	
<p>The Convention on Wetlands of International Importance was signed in Ramsar, Iran in 1971. It is an intergovernmental treaty which provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources, as a means to achieving sustainable development throughout the world.</p> <p>The original emphasis was on the conservation and wise use of wetlands primarily to provide habitat for waterbirds, however over the years the Convention has broadened its scope to incorporate all aspects of wetland conservation and wise use, recognising wetlands as ecosystems that are extremely important for biodiversity conservation and for the well-being of human communities.</p> <p><i>'The Convention's mission is the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world'</i> (Ramsar COP8, 2002).</p> <p>A Strategic Plan 2009-2015 has been adopted to provide guidance on how efforts for implementing the Convention on Wetlands should be focussed. The strategy has 5 goals:</p> <ul style="list-style-type: none"> - Wise use: The wise use of all wetlands being achieved in all Parties, including more participative management of wetlands, and conservation decisions being made with an awareness of the importance of the ecosystem services provided by wetlands; 	<p>The WRMP should ensure the protection and wise use of wetlands.</p> <p>The SEA assessment framework should incorporate the protection of wetland sites listed under the Ramsar convention.</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<ul style="list-style-type: none"> - Wetlands of International Importance: Parties designating and managing Ramsar sites within their territories with a view to supporting an international network of Wetlands of International Importance, fully implementing their reporting commitments under Articles 3 and 8.2, and using the Montreux Record as part of the Convention's governance process, as appropriate; - International cooperation: Parties developing their coherent national approaches to the implementation of the Ramsar Convention in such a way as to benefit from developing effective partnerships with related conventions and international agencies and with other Parties to the Convention on Wetlands; - Institutional capacity and effectiveness: Increasing success of the Convention in achieving the conservation and wise use of wetlands, as measured by agreed effectiveness indicators, and increased recognition of the Convention's achievements by other sectors of governments and civil society; - Membership: All countries eligible for accession to have joined the Ramsar Convention by 2015. <p>A number of strategic key results are set out in the strategy against each of the 5 goals, e.g. by 2015 global wetland distribution and status data and information should be available through Webportal mechanisms, Ramsar guidance on the maintenance of ecological character to be have been applied with a priority upon recognized internationally important wetlands not yet designated as Ramsar sites.</p>	
UNESCO World Heritage Convention (1972)	
<p>The Convention defines the kind of natural or cultural sites which can be considered for inscription on the World Heritage List. In addition to this, countries are required to:</p> <ul style="list-style-type: none"> • Ensure that measures are taken for the protection, conservation and presentation of cultural and natural heritage • Adopt a general policy that gives cultural and natural heritage a function in the life of the community • Integrate the protection of heritage into comprehensive planning programmes 	<p>The assessment framework should include an objective on heritage and archaeological issues.</p>
The Kyoto Protocol 1997	
<p>The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. It is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for industrialized countries for reducing greenhouse gas (GHG) emissions. These amounted to an average of five per cent against 1990 levels in the first commitment period (2008 to 2012). The Protocol is planned to be extended to 2020 (the Kyoto second commitment period), pending ratification of the Doha Agreement.</p>	<p>The WRMP should aim to reduce greenhouse gas emissions.</p> <p>The SEA assessment framework should include objectives/guide questions related to reducing greenhouse gas emissions.</p>
The Aarhus Convention 1998	
<p>To contribute to the protection of present and future generations to live in an environment adequate to his or her health and well-being. This will be achieved through each Party subject to the convention guaranteeing the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention.</p> <p>To establish and maintain a clear, transparent and consistent framework to implement the provisions of this Convention. This will be achieved through each Party taking the necessary legislative, regulatory and other measures, including measures to achieve compatibility between the provisions implementing the information, public participation and access-to-justice provisions in this Convention, as well as proper enforcement measures.</p> <p>Responsibility for implementation is deferred to the member states.</p>	<p>The development of the WRMP needs to be a transparent process.</p> <p>SEA should show a strong sense of safeguarding the lives of future generations and ensure that enough time is provided for consultation on the SEA documents in line with the Aarhus convention of establishing and maintaining a transparent clear framework.</p>
The Convention for the Protection of the Architectural Heritage of Europe (Granada Convention, 1987)	
<p>The main purpose of the convention is to reinforce and promote policies for the conservation and enhancement of Europe's heritage and to foster closer European co-operation in defence of heritage. Recognition that conservation of heritage is a cultural purpose and integrated conservation of heritage is an important factor in the improvement of quality of life.</p>	<p>The SEA assessment framework should include an objective on the conservation and enhancement of heritage and decision making criteria on architectural heritage.</p>
The European Convention on the Protection of Archaeological Heritage (Valetta Convention)	
<p>Agreement that the conservation and enhancement of an archaeological heritage is one of the goals of urban and regional planning policy. It is concerned in particular with the need for co-</p>	<p>The SA Framework should include an objective on the conservation and enhancement of heritage and</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
operation between archaeologists and planners to ensure optimum conservation of archaeological heritage.	decision making criteria on archaeological heritage.
World Commission on Environment and Development (1987) <i>Our Common Future (The Brundtland Report)</i>	
<p>The Brundtland Report is concerned with the world's economy and its environment. The objective is to provide an expanding and sustainable economy while protecting a sustainable environment. The Report was a call by the United Nations:</p> <ul style="list-style-type: none"> to propose long-term environmental strategies for achieving sustainable development by the year 2000 and beyond; to strengthen co-operation among developing countries and between countries at different stages of economic and social development to achieve common and mutually supportive objectives which take account of the interrelationships between people, resources, environment and development; to consider ways and means by which the international community can deal more effectively with environment concerns; and to help define shared perceptions of long-term environmental issues and the appropriate efforts needed to deal successfully with the problems of protecting and enhancing the environment, a long term agenda for action during the coming decades, and aspirational goals for the world community. 	The SEA and WRMP should seek to contribute to sustainable development.
The World Summit on Sustainable Development, Johannesburg (September 2002)	
<p>The World Summit resulted in the Johannesburg Declaration on Sustainable Development and a Plan of Implementation. The declaration reaffirms principles already agreed upon at the Rio Earth Summit UNCED in 1992 and the UN Millennium Summit in 1999. It recognises that poverty eradication is a key condition for sustainable development and addresses issues such as cultural diversity, patterns of production and consumption, health issues, armed conflicts, the new dimension created by globalisation, gender issues and financing for development.</p> <p>The implementation plan sets out actions to achieve sustainable development such as poverty eradication, changing unsustainable patterns of consumption and production, protecting and managing the natural resource base of economic and social development, sustainable development in a globalizing world and health and sustainable development.</p> <p>Sustainable development in England is delivered through the sustainable development strategy, Securing the Future, and in Wales through One Wales: One Planet, The Sustainable Development Scheme of the Welsh Government.</p>	<p>The WRMP should promote sustainable development.</p> <p>The SEA should help to deliver sustainable development through the balanced assessment of the WRMP.</p>
United Nations Convention on Biodiversity (the Rio Convention, 1992)	
<p>The Convention on Biodiversity called for the development and enforcement of national strategies and associated action plans to identify, conserve and protect existing biological diversity, and to enhance it wherever possible. In the UK, the UK Biodiversity Action Plan was then established to conserve and enhance biodiversity in the UK through the use of Habitats and Species Action Plans to help the most threatened species and habitats to recover and to contribute to the conservation of global biodiversity.</p>	The assessment framework should include protection and enhancement of biodiversity.
European Landscape Convention 2000 (became binding March 2007)	
<p>The European Landscape Convention was adopted on 20 October 2000 in Florence and came into force on 1 March 2004 (Council of Europe Treaty Series no. 176). It is open for signature by member states of the Council of Europe and for accession by the European Community and European non-member states. The UK Government signed the European Landscape Convention in 2006 and it became binding from March 2007.</p> <p>The aims of the Convention are to promote landscape protection, management and planning, and to organise European co-operation on landscape issues.</p> <p>Responsibility for implementation has been deferred to the signatories. Articles 5 (general measures) and 6 (specific measures) set out measures that the signatories will undertake, e.g. integrating landscape into policies with possible direct or indirect impact on landscape and to introduce instruments aimed at protecting, managing and/or planning the landscape.</p>	<p>The WRMP should take landscape into account.</p> <p>The SEA assessment framework should include landscape.</p>
The Paris Agreement 2015	
<p>The Paris Agreement was adopted at the 2015 UN Climate Change Conference, which aims to limit global temperature rises to 2 degrees Celsius, and to pursue efforts to limit the temperature increase even further to 1.5 degrees. It was adopted by 195 countries at the Conference, and came into force in November 2016, following ratification by sufficient parties.</p>	<p>The WRMP should aim to reduce greenhouse gas emissions.</p> <p>The SEA assessment framework should include greenhouse gas emissions.</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
European Commission (2006) <i>Thematic Strategy for Soil Protection</i>	
<p>The <i>Thematic Strategy for Soil Protection</i> consists of a Communication from the Commission to the other European Institutions, a proposal for a framework Directive (a European law), and an Impact Assessment.</p> <p>It sets out an EU strategy for soil protection with an overall objective of the protection and sustainable use of soil, based on the following guiding principles:</p> <p>(1) Preventing further soil degradation and preserving its functions:</p> <ul style="list-style-type: none"> - when soil is used and its functions are exploited, action has to be taken on soil use and management patterns; and - when soil acts as a sink/receptor of the effects of human activities or environmental phenomena, action has to be taken at source. <p>(2) Restoring degraded soils to a level of functionality consistent at least with current and intended use, thus also considering the cost implications of the restoration of soil.</p> <p>The strategy proposes introducing a framework Directive setting out common principles for protecting soils across the EU, with Member States deciding how best to protect soil and how use it in a sustainable way on their own territory.</p>	<p>The WRMP should take potential effects on soil into account.</p> <p>The SEA assessment framework should include soils.</p>
European Commission (EC) (2011) <i>A Resource- Efficient Europe- Flagship Initiative Under the Europe 2020 Strategy, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (COM 2011/21)</i>	
<p>This flagship initiative aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy which will help to:</p> <ul style="list-style-type: none"> • Boost economic performance while reducing resource use; • Identify and create new opportunities for economic growth and greater innovation and boost the EU's competitiveness; • Ensure security of supply of essential resources; and • Fight against climate change and limit the environmental impacts of resource use. 	<p>The WRMP provides an opportunity to ensure reductions in resource use and to ensure security of supply of water.</p> <p>The SEA framework should include objectives relating to resource use.</p>
European Commission (2011) <i>A Roadmap for Moving to a Competitive Low Carbon Economy in 2050</i>	
<p>The EU already has short term targets in place to reduce its emissions to 20% below 1990 levels by 2020; to increase the share of renewable energy to 20%; and to make a 20% improvement in energy efficiency. The 2050 roadmap looks beyond 2020 at longer term objectives.</p> <p>The roadmap suggests that by 2050, the EU should cut its emissions to 80% below 1990 levels through domestic reductions alone. It sets out milestones which form a cost-effective pathway to this goal - reductions of 40% by 2030 and 60% by 2040. It also shows how the main sectors responsible for Europe's emissions - power generation, industry, transport, buildings and construction, as well as agriculture - can make the transition to a low-carbon economy most cost-effectively.</p>	<p>The assessment framework should recognise that certain development proposals require an EIA to be undertaken, resulting in the identification of any likely significant environmental effects and associated mitigation measures.</p>
European Commission (2013) <i>Strategy on Adaptation to Climate Change</i>	
<p>The EU strategy aims to make Europe more climate-resilient by adapting to the changing climate. It aims to provide a coherent approach to enhance preparedness and capacity to respond to the impacts of climate change. The three key objectives of the strategy are:</p> <ul style="list-style-type: none"> • Promoting action by Member States – encouraging Member States to adopt adaptation strategies and provide funding to boost capacity; • 'Climate-proofing' action at EU level – promoting adaptation in vulnerable sectors such as agriculture and fisheries; and • Better informed decision-making – addressing gaps in knowledge and improving the European information sharing platform, Climate-ADAPT. 	<p>The assessment framework should include criteria relating to climate resilience.</p>
European Commission (2014) <i>A Policy Framework for Climate and Energy in the Period from 2020 to 2030</i>	

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>The 2030 climate and energy framework was adopted in 2014 and builds on the 2020 targets. It sets three key targets for 2030:</p> <ul style="list-style-type: none"> at least 40% cuts in greenhouse gas emissions (from 1990 levels); at least 27% share for renewable energy; and at least 27% improvement in energy efficiency. <p>The greenhouse gas emissions and renewable energy targets are binding, while the energy efficiency target will be reviewed in 2020.</p>	<p>The WRMP should support longer term targets for reducing greenhouse gas emissions, increasing renewable energy and energy efficiency.</p> <p>The SEA assessment framework should include the consideration of energy and greenhouse gas emissions.</p>
European Commission (2015) 'Closing the loop - An EU Action Plan for the Circular Economy' policy package	
<p>This document sets out actions to implement the European Commission's long term vision of significantly reducing waste landfilling and increasing recycling.</p>	<p>The SEA should consider opportunities for the WRMP to contribute/enable the circular economy.</p>
European Union (1991) The Nitrates Directive (91/676/EEC)	
<p>The Nitrates Directive is designed to reduce water pollution caused by nitrate from agriculture. The directive requires Defra and the Welsh Government to identify surface or groundwaters that are, or could be high in nitrate from agricultural sources.</p> <p>Once a water body is identified as being high in nitrate all land draining to that water is designated a Nitrate Vulnerable Zone. Within these zones, farmers must observe an action programme of measures which include restricting the timing and application of fertilisers and manure, and keeping accurate records.</p>	<p>The WRMP should be consistent with the aim to reduce water pollution caused by nitrate from agriculture.</p> <p>The SEA assessment framework should include water quality.</p>
European Union (1991) 91/271/EEC for Urban Waste-water Treatment	
<p>The aim of the Urban Waste Water Directive is to protect the environment from the adverse effects of waste water discharges. It sets out guidelines and legislation for the collection, treatment and discharge of urban waste water. The Directive was adopted by member states in May 1991 and is transposed into law in England and Wales by The Urban Waste Water Treatment (England & Wales) Regulations 1994 (as amended*). The Regulations require that all significant discharges are treated to at least secondary treatment. They also set standards and deadlines for the provision of sewage systems, the treatment of sewage according to the size of the community served by the sewage treatment works and the sensitivity of receiving waters to their discharges.</p> <p>* The Regulations were amended in 2003 by The Urban Waste Water Treatment (England & Wales) (Amendment) Regulations 2003.</p> <p>Responsibility for Implementation is deferred to member states.</p>	<p>The WRMP needs to consider the implication of the Directive.</p> <p>The SEA assessment framework should include water quality.</p>
European Union (1992) The Habitats Directive 92/43/EEC	
<p>The Habitats Directive seeks to conserve natural habitats. Conservation of natural habitats requires member states to identify special areas of conservation and to maintain where necessary landscape features of importance to wildlife and flora.</p> <p>It is required that each Member State propose a list of sites indicating which natural habitat types and which species the sites host. The information would include a map of the site, its name, location and its extent. The Commission will then establish, in agreement with each Member State, a draft list of sites of Community importance drawn from the Member States' lists identifying those which host one or more priority natural habitat types or priority species.</p>	<p>The WRMP should take into account the habitats and species that have been identified under this Directive, and include provision for the preservation, protection and improvement of the quality of the environment as appropriate.</p> <p>The SEA assessment framework should incorporate sites protected for their nature conservation importance.</p>
European Union (1998) Drinking Water Directive (98/83/EC)	
<p>The Drinking Water Directive (DWD) concerns the quality of water intended for human consumption. The objective of the DWD is to protect the health of the consumers in the EU and to make sure the water is wholesome and clean. To do this, the DWD sets standards for 48 (microbiological and chemical) parameters that can be found in drinking water. The parameters must be monitored and tested regularly. In principle WHO guidelines for drinking water are used as a basis for the standards in the DWD. While translating the DWD into their own national legislation (transposition of the DWD), the Member States of the European Union can include additional requirements e.g. regulate additional substances that are relevant within their territory or set higher standards. However, Member States are not allowed to set lower standards as the level of protection of human health should be the same within the whole EU. Member States have to monitor the quality of the drinking water supplied to their citizens and of the water used in the food</p>	<p>The WRMP should contain objectives for drinking water quality to ensure that limits are not exceeded.</p> <p>The SEA assessment framework should include drinking water quality.</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>production industry. Member States report at three yearly intervals the monitoring results to the European Commission.</p> <p>Standards constitute legal limits. Sets limits for microbiological and chemical parameters in drinking water. Also gives indicator parameters.</p>	
European Union (1999) <i>Directive on the Landfill of Waste (99/31/EC)</i>	
<p>The Directive aims at reducing the amount of waste landfilled; promoting recycling and recovery; establishing high standards of landfill practice across the EU, and preventing the shipping of waste from one Country to another.</p> <p>The objective of the Directive is to prevent or reduce as far as possible negative effects on the environment (in particular on surface water, groundwater, soil, air and human health) from the landfilling of waste, by introducing stringent technical requirements for waste and landfills.</p> <p>The Directive requires the reduction of the amount of biodegradable municipal waste sent to landfill to 75% of the total generated in 1995 by 2006, 50% by 2009 and 35% by 2016.</p>	<p>The WRMP should take the effects on waste to landfill into account.</p> <p>The SEA assessment should consider the effects on water, soil, air, human health and waste</p>
European Union (2000) <i>EU Water Framework Directive (2000/60/EC)</i>	
<p>The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. The framework aims to:</p> <ul style="list-style-type: none"> - Protect any further deterioration and enhance the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems; - Promote sustainable water use based on a long-term protection of available water resources; - Enhance protection and improvement of the aquatic environment, <i>inter alia</i>, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances; - Ensure the progressive reduction of pollution of groundwater and prevent its further pollution; - Contribute to mitigating the effects of floods and droughts. <p>Key targets and indicators relevant to the WRMP and SEA are:</p> <ul style="list-style-type: none"> - Achievement of good ecological status and good surface water chemical status by 2015; - Achievement of good ecological potential and good surface water chemical status for heavily modified water bodies and artificial water bodies; - Prevention of deterioration from one status class to another; - Achievement of water-related objectives and standards for protected areas; - Achievement of good groundwater quantitative and chemical status by 2015; - Prevention of deterioration from one status class to another; - Reversal of any significant and sustained upward trends in pollutant concentrations and prevent or limit input of pollutants to groundwater; - Achievement of water related objectives and standards for protected areas. 	<p>The WRMP needs to consider the implication of the Directive in terms of sustainable water use, protection and improvement of the aquatic environment, reducing and preventing pollution and mitigating the effects of droughts.</p> <p>The SEA assessment framework should include water quality, water resources, sustainable water use, and biodiversity.</p>
European Union (2001) <i>Directive on the Assessment of the Effects of Certain Plans and Programmes on the Environment (SEA Directive) (2001/42/EC)</i>	
<p>The objective of the SEA Directive is “to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view of contributing towards sustainable development”.</p> <p>Throughout the course of the development of the plan, policy or programme, the aim of SEA is to identify the potential impact of options proposed in the plan in terms of their environmental, economic and social effects. If any adverse effects are identified, these options can then be avoided or proposals modified to manage or mitigate adverse effects.</p>	<p>Driver for SEA. Need to ensure all topics identified in the SEA Directive are considered within the scope of the assessment. Need to ensure that the subsequent Environmental Report meets the requirements of Annex I of the SEA Directive.</p>
European Union (2001) <i>National Emissions Ceiling Directive 2001/81/EC</i>	
<p>The Directive sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia). The UK 2010 ceilings for each of these pollutants were 585 kilotonnes, 1,167 kilotonnes, 1,200 kilotonnes and 297 kilotonnes, respectively.</p> <p>This is being revised through the Thematic Strategy on Air Pollution and emissions ceilings for the four compounds and particulate matter (PM2.5) up to 2020 are anticipated.</p>	<p>Consider the need for air quality to be included in the SEA framework.</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
European Union (2002) <i>The Environment Noise Directive (Directive 2002/49/EC)</i>	
<p>The END aims to “define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to the exposure to environmental noise”. For that purpose, several actions are to be progressively implemented. It furthermore aims at providing a basis the harmful effects, including annoyance, due to the exposure to environmental noise”. For that purpose, several actions are to be progressively implemented. It furthermore aims at providing a basis for developing EU measures to reduce noise emitted by major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.</p> <p>The underlying principles of the Directive are similar to those underpinning other overarching environment policies (such as air or waste), i.e.:</p> <ul style="list-style-type: none"> - Monitoring the environmental problem; by requiring competent authorities in Member States to draw up "strategic noise maps" for major roads, railways, airports and agglomerations, using harmonised noise indicators Lden (day-evening-night equivalent level) and Lnight (night equivalent level). These maps will be used to assess the number of people annoyed and sleep-disturbed respectively throughout Europe. - Informing and consulting the public about noise exposure, its effects, and the measures considered to address noise, in line with the principles of the Aarhus Convention. - Addressing local noise issues by requiring competent authorities to draw up action plans to reduce noise where necessary and maintain environmental noise quality where it is good. The directive does not set any limit value, nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities. - Developing a long-term EU strategy, which includes objectives to reduce the number of people affected by noise in the longer term, and provides a framework for developing existing Community policy on noise reduction from source. With this respect, the Commission has made a declaration concerning the provisions laid down in article 1.2 with regard to the preparation of legislation relating to sources of noise. <p>It is important to note, however, that the present Directive does not set binding limit values, nor does it prescribe the measures to be included in the action plans thus leaving those issues at the discretion of the competent authorities.</p> <p>The long-term exposure indicators supersede those in the 1999 World Health Organisation (WHO) Guidelines for Community Noise, which are now in the process of being updated in line with the Directive.</p>	<p>The WRMP will need to have regard to the requirements of the END.</p> <p>The SEA assessment framework should include for the protection against excessive noise.</p>
European Union (2002) <i>Directive 2002/91/EC on the Energy Performance of Buildings</i>	
<p>The European Union Energy Performance of Buildings Directive was published in the Official Journal on the 4th January 2003. The overall objective of the Directive is to <i>promote the improvement of energy performance of buildings within the Community taking into account outdoor climate and local conditions as well as indoor climate requirements and cost effectiveness.</i></p> <p>The Directive highlights how the residential and tertiary sectors, the majority of which are based in buildings, accounts for 40% of EU energy consumption.</p>	<p>The SEA should highlight any opportunities for new buildings associated with the WRMP to contribute to improved energy performance.</p>
European Commission (2004), <i>Environmental Liability Directive (2004/35/EC)</i>	
<p>The Directive establishes a framework for environmental liability based on the "polluter pays" principle, with a view to preventing and remedying environmental damage.</p>	<p>The SEA should take account of the need to ensure that proposals in the WRMP avoids causing direct or indirect damage to the aquatic environment or contamination of land that creates a significant risk to human health.</p>
European Union (2005) <i>Thematic Strategy on Air Pollution</i>	
<p>This strategy supplements current legislation. It sets out objectives for air pollution and proposes measures for achieving them by 2020.</p>	<p>The SEA undertaken for the last iteration of the WRMP scoped out air quality and consideration should be given to this approach.</p>
European Union (2006), <i>Animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals (2006/88/EC)</i>	
<p>The Directive establishes:</p> <ul style="list-style-type: none"> • Animal health requirements for the placing on the market, importation and transit of aquaculture animals and their products; 	<p>The SEA should take account of the need to maintain or enhance</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<ul style="list-style-type: none"> • Minimum measures to prevent diseases in aquaculture animals; • Minimum measures to be taken in response to suspected or established cases of certain diseases in aquatic animals. 	the quality of habitats and biodiversity.
European Union (2006) <i>Directive 2006/118EC on the protection of groundwater against pollution and deterioration</i>	
This Directive establishes specific measures as provided for in Article 17(1) and (2) of Directive 2000/60/EC (Water Framework Directive) in order to prevent and control groundwater pollution. This Directive is designed to prevent and combat groundwater pollution.	The SEA should take account of the need to maintain, protect and improve water quality across the WRMP area.
European Union (2006) <i>The Bathing Waters Directives 2006 2006/7/EC</i>	
<p>The Bathing Waters Directive set standards for the quality of bathing waters (with the exception of water intended for therapeutic bathing purposes and water used in swimming pools).</p> <p>It lays down the minimum quality criteria to be met by bathing water:</p> <ul style="list-style-type: none"> - the physical, chemical and microbiological parameters; - the mandatory limit values and indicative values for such parameters; - the minimum sampling frequency and method of analysis or inspection of such water. <p>Member States fix the values that they apply to bathing water in accordance with the guidelines of Directive 76/160/EEC. Member States may fix more stringent values than those laid down in the Directive. Where it does not give any values for certain parameters, Member States are not obliged to fix any.</p> <p>The Directive is transposed into law in England and Wales through the Bathing Water (Classifications) Regulations 2003.</p> <p>In March 2006, a revised Bathing Water Directive was adopted and become law in the UK in March 2008. As well as stricter water quality standards, it contains a requirement to provide more detailed and standardised information about bathing waters across Europe. Directive 2006/7/EC will repeal the Directive 76/160/EEC in 2014.</p> <p>Bathing waters are protected areas under the Water Framework Directive.</p> <p>Mandatory standards are given for 10 parameters: total coliforms, faecal coliforms, salmonella, enteroviruses, pH, colour, mineral oils, surface active substances (detergents), phenols and transparency.</p> <p>The Directive also sets the minimum frequency at which bathing waters should be sampled.</p>	<p>The WRMP will need to comply with set limits.</p> <p>The SEA assessment should include a guide question relating to the effects of options on the water quality at designated bathing waters.</p>
European Union (2006) <i>Sustainable Development Strategy</i>	
<p>This document sets out a single coherent strategy outlining how the EU will meet long-standing commitments to sustainable development. This document presents a renewed version of the 2001 EU Sustainable Development Strategy (SDS). The aim of the SDS is to identify and develop actions to enable the EU to achieve continuous improvement of quality of life both for current and for future generations, through the creation of sustainable communities able to manage and use resources efficiently, and to tap the ecological and social innovation potential of the economy, ensuring prosperity, environmental protection and social cohesion.</p> <p>The key objectives of the strategy are:</p> <ul style="list-style-type: none"> - Environmental protection; - Social equity and cohesion; - Economic prosperity; and - Meeting our international responsibilities. <p>The following key challenge areas include a number of targets in achieving their respective objectives:</p> <ul style="list-style-type: none"> - Climate Change and clean energy; - Sustainable Transport; - Sustainable consumption and production; - Conservation and management of natural resources; - Public Health; - Social inclusion, demography and migration; - Global poverty and sustainable development challenges. <p>The strategy was reviewed by the European Commission in 2009 (<i>Mainstreaming sustainable development into EU policies: 2009 Review of the European Union Strategy for Sustainable Development</i>), which underlined that the EU has mainstreamed sustainable development into a</p>	<p>The WRMP should reflect all of the aims and targets set out in the Sustainable Development Strategy.</p> <p>The SEA assessment framework should reflect the core and supporting principles of the strategy including climate change, sustainable transport, public health, social inclusion and poverty.</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
broad range of its policies in recent years, but that efforts still need to be intensified to address unsustainable trends such as energy consumption.	
European Union (2006) Mining Waste Directive (2006/21/EC)	
The Directive aims to prevent or reduce as far as possible any adverse effects on the environment, and any resultant risks to human health, brought about as a result of the management of waste from the extractive industries. The Directive covers the management of waste resulting directly from prospecting, extraction, treatment and storage of mineral resources and from quarrying. Operators are required to use Best Available Techniques in the management of waste facilities and the prevention of major accidents.	The WRMP should have regard to the aim to avoid adverse effects from extractive waste. The SEA assessment framework should include consideration of waste.
European Union (2007) Floods Directive 2007/60/EC	
The Floods Directive requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk. Member States are required to carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding.	The WRMP should take account of the flood risk management plans as they become available through the life of the plan. The SEA assessment framework should include flood risk.
European Union (2007) The Eel Directive 2007/1100/EC	
The Eel Directive establishes measures for the recovery of the stock of European eel and requires member states to produce Eel management plans for each catchment.	The WRMP should ensure that there are no adverse impacts on eel as a result of water resource management measures.
European Union (2008) Environmental Quality Standards Directive 2008/105/EC	
The Directive aims to control the concentration of certain substances which pose a risk to the aquatic environment. The 33 'priority substances' addressed by the Directive are defined by the Water Framework Directive (2000/60/EC), including cadmium, lead, mercury, nickel, benzene and polyaromatic hydrocarbons. The Directive sets thresholds of concentration that must not be exceeded, with limits to average values over a year to ensure long-term water quality and maximum allowable concentrations to limit short term pollution peaks. Member States must comply with the water quality standards and record an inventory of emissions and discharges of all substances in the Directive.	The assessment framework should include assessment criteria relating to water quality.
European Union (2008) Marine Strategy Framework Directive 2008/56/EC	
The Directive sets out a framework for an ecosystem-based approach to the management of human activities which supports the sustainable use of marine goods and services. The overarching goal of the Directive is to achieve 'Good Environmental Status' (GES) by 2020 across Europe's marine environment. The Directive establishes four European Marine Regions, based on geographical and environmental criteria. The North East Atlantic Marine Region is divided into four sub regions, with UK waters lying in two of these (the Greater North Sea and the Celtic Seas). Each Member State is required to develop a marine strategy for their waters, in coordination with other countries within the same marine region or sub region. Marine strategies must be implemented to protect and conserve the marine environment, prevent its deterioration, and, where practicable, restore marine ecosystems in areas where they have been adversely affected. The marine strategies must contain: <ul style="list-style-type: none"> • An initial assessment of the current environmental status of that Member State's marine waters; • A determination of what Good Environmental Status means for those waters; • Targets and indicators designed to show whether a Member State is achieving GES; • A monitoring programme to measure progress towards GES; • A programme of measures designed to achieve or maintain GES. The Directive also requires Marine Protected Areas (MPAs) to be established to support the achievement of GES.	The assessment framework should incorporate assessment criteria relating to the quality of the marine environment.
European Union (2008) EU Air Quality Directive (2008/50/EC) and previous directives (96/62/EC; 99/30/EC; 2000/69/EC & 2002/3/EC)	

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>The Directive:</p> <ul style="list-style-type: none"> - defines and establishes objectives for ambient air quality to avoid, prevent or reduce harmful effects on human health and the environment as a whole; - assesses the ambient air quality in Member States using common methods and criteria; - obtains information on ambient air quality in order to help combat air pollution and nuisance and to monitor long-term trends and improvements resulting from national and Community measures; - ensures that such information on ambient air quality is made available to the public; - seeks to maintain air quality where it is good and improving it in other cases; and - promotes increased cooperation between the Member States in reducing air pollution. 	<p>The WRMP should contribute towards achieving air quality standards set out in the Directive.</p> <p>Consider the need for air quality to be included in the SEA framework.</p>
European Union (2008) Directive on Waste (Directive 75/442/EEC, 2006/12/EC 2008/98/EC as amended)	
<p>The essential objective of all provisions relating to waste management should be the protection of human health and the environment against harmful effects caused by the collection, transport, treatment, storage and tipping of waste. Some key objectives include:</p> <ul style="list-style-type: none"> - The recovery of waste and the use of recovered materials as raw materials should be encouraged; - Member States should, in addition to taking responsible action to ensure the disposal and recovery of waste, take measures to restrict the production of waste; - It is important for the Community as a whole to become self-sufficient in waste disposal and desirable for Member States individually to aim at such self-sufficiency; - Waste management plans should be drawn up in the Member States; - Movements of waste should be reduced; - Ensure a high level of protection and effective control; - Subject to certain conditions, and provided that they comply with environmental protection requirements, some establishments which process their waste themselves or carry out waste recovery may be exempted from permit requirements; - That proportion of the costs not covered by the proceeds of treating the waste must be defrayed in accordance with the 'polluter pays' principle. 	<p>The WRMP should seek to ensure the protection of human health and the environment in relation to waste management.</p> <p>The SEA assessment should include objectives on the protection of human health and the environment.</p>
European Union (2009) EU Directive on the Conservation of Wild Birds (09/147/EC) (codified version of Council Directive 79/409/EEC as amended)	
<p>The Directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe. The main provisions of the Directive include:</p> <ul style="list-style-type: none"> • The maintenance of the populations of all wild bird species across their natural range (Article 2) with the encouragement of various activities to that end (Article 3). • The identification and classification of Special Protection Areas (SPAs) for rare or vulnerable species listed in Annex I of the Directive, as well as for all regularly occurring migratory species, paying particular attention to the protection of wetlands of international importance (Article 4). (Together with Special Areas of Conservation designated under the Habitats Directive, SPAs form a network of European protected areas known as Natura 2000). • The establishment of a general scheme of protection for all wild birds (Article 5). • Restrictions on the sale and keeping of wild birds (Article 6). • Specification of the conditions under which hunting and falconry can be undertaken (Article 7). (Huntable species are listed on Annex II of the Directive). • Prohibition of large-scale non-selective means of bird killing (Article 8). • Procedures under which Member States may derogate from the provisions of Articles 5-8 (Article 9) — that is, the conditions under which permission may be given for otherwise prohibited activities. • Encouragement of certain forms of relevant research (Article 10 and Annex V). • Requirements to ensure that introduction of non-native birds do not threatened other biodiversity (Article 11). 	<p>The WRMP should seek to protect and enhance biodiversity, particularly designated sites.</p> <p>The SEA assessment framework should include objectives, indicators and targets that cover biodiversity.</p>
European Union (2009) Renewable Energy Directive (2009/28/EC)	

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>This Directive establishes a common framework for the use of energy from renewable sources in order to limit greenhouse gas emissions and to promote cleaner transport. It encourages energy efficiency, energy consumption from renewable sources and the improvement of energy supply.</p> <p>The Member States are to establish national action plans which set the share of energy from renewable sources consumed in transport, as well as in the production of electricity and heating, for 2020. These action plans must take into account the effects of other energy efficiency measures on final energy consumption (the higher the reduction in energy consumption, the less energy from renewable sources will be required to meet the target). These plans will also establish procedures for the reform of planning and pricing schemes and access to electricity networks, promoting energy from renewable sources.</p> <p>Each Member State has a target calculated according to the share of energy from renewable sources in its gross final consumption for 2020. The UK is required to source 15 per cent of energy needs from renewable sources, including biomass, hydro, wind and solar power by 2020. From 1 January 2017, biofuels and bioliquids share in emissions savings should be increased to 50%.</p>	<p>The WRMP should seek to contribute towards increasing the proportion of energy from renewable energy sources.</p> <p>The SEA assessment framework should include consideration of use of energy from renewable energy sources.</p>
European Union (2010) Industrial Emissions Directive (integrated pollution prevention and control) 2010/75/EU	
<p>This Directive brings together the IPPC Directive (2008/1/EC) and six other Directives on titanium dioxide, VOCs and waste incineration, with the aim of reducing pollutant emissions. It covers industries with high polluting potential such as energy, production and processing of metals, minerals, chemicals, waste management and rearing of animals.</p> <p>It defines the obligations to be met by industrial activities with a major pollution potential. This includes establishing a permit procedure, requirements for Best Available Techniques (BAT) and setting out requirements for discharges.</p>	<p>The assessment framework should include criteria that ensure the protection of the environment through the prevention of pollution.</p>
European Union (2010) Energy 2020 - A Strategy for Competitive, Sustainable and Secure Energy	
<p>EU energy and climate goals have been incorporated into the Europe 2020 Strategy for smart, sustainable and inclusive growth. The energy strategy includes five priorities for Europe:</p> <ol style="list-style-type: none"> 1. Achieving an energy-efficient Europe; 2. Building a truly pan-European integrated energy market; 3. Empowering consumers and achieving the highest level of safety and security; 4. Extending Europe's leadership in energy technology and innovation; 5. Strengthening the external dimension of the EU energy market. <p>Energy 2020 is part of Resource-Efficient Europe, one of the seven key initiatives of Europe 2020.</p>	<p>The assessment framework should include criteria relating to energy where appropriate</p>
European Union (2010) Europe 2020: A strategy for smart, sustainable and inclusive growth	
<p>Europe 2020 is the EU's ten-year growth strategy. It aims to change the EU's growth model and create the conditions for growth that is smarter, more sustainable and more inclusive. It contains seven 'flagship initiatives' to provide a framework for innovation, the digital economy, employment, youth, industrial policy, poverty, and resource efficiency.</p> <p>There are also five key target areas for the EU to achieve by 2020:</p> <ol style="list-style-type: none"> 1. Employment: 75% of the 20-64 year-olds to be employed. 2. R&D: 3% of the EU's GDP to be invested in R&D. 3. Climate change and energy sustainability: greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990; 20% of energy from renewable; 20% increase in energy efficiency. 4. Education: reducing the rates of early school leaving below 10%; at least 40% of 30-34-year-olds completing third level education. 5. Fighting poverty and social exclusion: at least 20 million fewer people in or at risk of poverty and social exclusion. 	<p>The assessment framework should include criteria relating to employment, R&D, climate change and poverty where relevant.</p>
European Union (2011) EU Biodiversity Strategy to 2020 – towards implementation	
<p>The European Commission has adopted an ambitious new strategy to halt the loss of biodiversity and ecosystem services in the EU by 2020.</p> <p>The strategy provides a framework for action over the next decade and covers the following key areas:</p> <ul style="list-style-type: none"> • Conserving and restoring nature; • Maintaining and enhancing ecosystems and their services; • Ensuring the sustainability of agriculture, forestry and fisheries; 	<p>The WRMP should seek to protect and enhance biodiversity, particularly designated sites.</p> <p>The SEA assessment framework should include objectives, indicators and targets that cover biodiversity.</p>

International / European Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<ul style="list-style-type: none"> Combating invasive alien species; Addressing the global biodiversity crisis. 	
EU Directives on <i>Environmental Impact Assessment (Codified Directive 2011/92/EU and Revised Directive 2014/52/EU)</i>	
<p>The Directive, as enacted in 1985, amended, codified in 2011 and revised in 2014, sets out procedural requirements for certain development proposals to undergo an Environmental Impact Assessment (EIA) before being granted consent through the town and country planning or other consenting regimes. The UK Government is obliged to transpose the Revised EIA Directive by May 2017.</p>	<p>The SEA should recognise that certain development proposals require an EIA to be undertaken, resulting in the identification of any likely significant environmental effects and associated mitigation measures.</p>
European Union 2012 <i>Energy Efficiency Directive (2012/27/EU)</i>	
<p>The Directive establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. Under the Directive, all EU countries are required to use energy more efficiently at all stages of the energy chain from its production to final consumption.</p> <p>Specific measures relate to:</p> <ul style="list-style-type: none"> energy distributors achieving 1.5% energy savings per year through energy efficiency measures; improving the efficiency of heating systems, installing double glazed windows or insulating roofs; purchasing energy efficient buildings, products and services, and performing energy efficient renovations; access to data on consumption; large companies to audit energy consumption (implemented in the UK through the Energy Savings Opportunity Scheme Regulations 2014); national incentives for SMEs to undergo energy audits; and monitoring efficiency levels in new energy generation capacities. 	<p>The WRMP should seek to contribute towards targets for energy efficiency.</p> <p>The SEA assessment framework should include consideration of energy consumption and efficiency.</p>
European Union (2013) <i>Seventh Environmental Action Programme to 2020 ‘Living well, within the limits of our planet’</i>	
<p>The seventh Environmental Action Programme defines environmental priority objectives to be achieved by the EU up to 2020. As part of the programme, the EU aims to protect natural capital; promote resource-efficient and low-carbon growth; and safeguard health and wellbeing linked to pollutants, chemicals and climate change. The nine objectives and actions set out in the programme are:</p> <ul style="list-style-type: none"> to protect, conserve and enhance the Union's natural capital; to turn the Union into a resource-efficient, green, and competitive low-carbon economy; to safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing; to maximise the benefits of the Union's environment legislation by improving implementation; to increase knowledge about the environment and widen the evidence base for policy; to secure investment for environment and climate policy and account for the environmental costs of any societal activities; to better integrate environmental concerns into other policy areas and ensure coherence when creating new policy; to make the Union's cities more sustainable; and to help the Union address international environmental and climate challenges more effectively. 	<p>The assessment framework should, where relevant, reflect the objectives of the programme.</p>
European Union (2015) <i>Invasive Alien Species Regulation (1143/2014/EU)</i>	
<p>This Regulation seeks to address the problem of invasive alien species in a comprehensive manner so as to protect native biodiversity and ecosystem services, as well as to minimize and mitigate the human health or economic impacts that these species can have.</p>	<p>The SEA assessment framework should include guide questions relating to invasive species.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
Department for Communities and Local Government (DCLG) (2012) National Planning Policy Framework	
<p>The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The National Planning Policy Framework constitutes guidance for local planning authorities and decision-takers both in drawing up plans and as a material consideration in determining applications.</p> <p>At the heart of the NPPF is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking.</p> <p>The NPPF sets out a set of 12 core land-use planning principles that should underpin both plan-making and decision taking. These are that planning should be:</p> <ul style="list-style-type: none"> - plan led - not simply be about scrutiny, but instead be a creative exercise in finding ways to enhance and improve the places in which people live their lives - drive and support sustainable economic development - seek to secure high quality design and a good standard of amenity - take account of the different characters and roles of different areas - support the transition to a low carbon future - contribute to conserving and enhancing the natural environment and reducing pollution - encourage the re-use of brownfield land - promote mixed use developments and encourage multi uses from land in urban areas - conserve heritage assets - actively manage patterns of growth to make the fullest use of public transport, walking and cycling - take account of strategies to improve health, social and cultural well-being for all. 	<p>The WRMP should take into consideration the policies set out in the NPPF insofar as they relate to the area covered by the WRMP.</p>
DCLG (2014) National Planning Policy for Waste	
<p>Sets out detailed waste planning policies for local authorities. States that planning authorities need to:</p> <ul style="list-style-type: none"> • Need to use a proportionate evidence base in preparing Local Plans • Identify sufficient opportunities to meet the identifies needs of their area for the management of waste streams <p>Identifying suitable sites and areas for waste facilities.</p>	<p>The WRMP may need to consider the potential impact of proposals on waste generation and on waste management facilities in the WRMP area.</p> <p>The SEA should consider the effects of the WRMP on waste generation and management capacity.</p>
DECC (2010) CRC Energy Efficiency Scheme	
<p>The CRC Energy Efficiency Scheme is a Government backed legislative carbon emissions trading scheme and covers large business and public sector organisations in the UK. RC was intended to have a significant impact on reducing UK carbon emissions, offering the potential to save money through energy efficiency. It was designed to drive changes in behaviour and infrastructure, generate corporate awareness of the detrimental impacts of carbon emissions, and improve energy management practice. The Government announced in March 2016 that the scheme will be abolished from the end of the 2018/2019 compliance year.</p>	<p>The WRMP should seek to help contribute towards achieving carbon reduction.</p> <p>The SEA assessment should cover topics that will help to ensure that carbon emissions are reduced.</p>
DECC (2011) National Policy Statements for Energy Infrastructure	
<p>The energy National Policy Statements (NPSs) set out national policy against which proposals for major energy projects will be assessed and decided on by the Infrastructure Planning Commission. The following six NPSs have been designated:</p> <ul style="list-style-type: none"> - Overarching NPS for Energy (EN1); - Fossil Fuel Electricity Generating Infrastructure NPS (EN2); - Renewable Energy Infrastructure NPS (EN3) ; - Gas Supply Infrastructure & Gas and Oil Pipelines NPS (EN4); - Electricity Networks Infrastructure NPS (EN5); - Nuclear Power Generation NPS (EN6). <p>The Overarching NPS for Energy sets out that the purpose of the NPSs is to develop a clear, long-term policy framework which facilitates investment in the necessary new infrastructure (by the private sector) and in energy efficiency. The NPS highlights that the construction, operation and decommissioning of this infrastructure can lead to increased demand for water, involve discharges to water and cause adverse ecological effects resulting from physical modifications to the water</p>	<p>The WRMP may need to consider the potential impact of major energy proposals on water resources in the Welsh Water area. This may include the potential development of nuclear power stations at Wylfa and Oldbury.</p> <p>The SEA should consider the cumulative effects of the WRMP and any major energy proposals which may affect water resources in the Welsh Water area.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>environment. The NPSs expect applicants to undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment.</p> <p>One site is identified in the Welsh Water area (Wylfa, Anglesey) as being potentially suitable for the deployment of a new nuclear power station alongside further sites outside the Welsh Water including Oldbury in South Gloucestershire.</p> <p>The NPSs reiterate and are underpinned by the target to cut greenhouse gas emissions by at least 80 per cent by 2050, compared to 1990 levels.</p>	
Defra (2000) <i>Waterways for Tomorrow</i>	
<p>The key objective of this document is the promotion of waterways, encouraging their use and development whilst maximising the opportunities the waterways offer for leisure and recreation as a catalyst for urban and rural regeneration and for freight transport. The strategy also encourages the innovative use of waterways such as water transfer and telecommunication.</p>	<p>The WRMP should contribute towards meeting the objective of the strategy.</p> <p>The SEA assessment framework should ensure that consideration is given to the potential effects of the WRMP.</p>
Defra (2005) <i>Making Space for Water: Taking forward a new Government strategy for flood and coastal erosion risk management in England (first Government response to 2004 consultation)</i>	
<p>The programme seeks to embed flood and coastal erosion risk management across a range of Government policies, including planning, urban and rural development, agriculture, transport, nature conservation and conservation of the historic environment.</p> <p>Objectives:</p> <ul style="list-style-type: none"> - To reduce the threat of flooding to people and their property, and - To deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles. <p>Targets:</p> <p>No formal targets or indicators.</p>	<p>The WRMP may have some linkages with this strategy.</p> <p>The SEA should seek to ensure that flood risk in the area is not adversely affected by the implementation of the WRMP.</p>
Defra (2007) <i>The Air Quality Strategy for England, Scotland, Wales and Northern Ireland</i>	
<p>The Air Quality Strategy sets out air quality objectives and policy options to further improve air quality in the UK to benefit public health, quality of life and help to protect our environment. The strategy sets out objectives relating to particles, nitrogen dioxide, ozone, sulphur dioxide, polycyclic aromatic hydrocarbons, benzene, 1,3- butadiene, carbon monoxide, lead, nitrogen oxides and sulphur dioxide.</p>	<p>The WRMP should take account of air quality objectives in the strategy.</p> <p>The SEA should include guide questions relating to the effects of options on human health and the environment.</p>
Defra (2010) <i>Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network</i>	
<p>The report answers two questions: Do England's wildlife sites comprise a coherent and resilient ecological network? If not, what needs to be done? The report considers why these questions are important in the context of past, current and future pressures on the environment, and describe what ecological networks are and the benefits they bring. It goes on to consider the strengths and weaknesses of our current wildlife sites, before setting out a prioritised set of ecological solutions to improve the network. Finally, the report sets out 24 recommendations for practical action to Make Space for Nature and achieve a coherent and resilient ecological network.</p> <p>We propose that the overall aim for England's ecological network should be to achieve a natural environment where, compared to the situation in 2000, biodiversity is enhanced with the diversity, functioning and resilience of ecosystems re-established in a network for nature that can sustain these levels into the future, even given continuing environmental change and human pressures.</p>	<p>The WRMP should seek to preserve the ecological network.</p> <p>The SEA framework should consider the ecological network in its objectives/guidance questions.</p>
Defra (2010) <i>Air Pollution: Action in a Changing Climate</i>	
<p>This document highlights the health benefits that can be achieved through closer integration of air quality and climate change policies. Air pollution often originates from the same activities that contribute to climate change (notably transport and electricity generation), so linkages between these policy areas could help ensure that they are managed most effectively. Air quality/climate change co-benefits can be realised through actions such as promoting low-carbon vehicles and renewable sources of energy that do not involve combustion.</p> <p>The document aims to set ambitious but realistic air quality targets, and to ensure that climate and air quality targets are better aligned in future.</p>	<p>The WRMP should seek to ensure that air quality, climate change and human health are not adversely affected by the options.</p> <p>The SEA should include guide questions relating to the effects of options on human health and the environment.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
Defra (2011) Shoreline Management Plan Guidance	
<p>This is guidance for the second generation of Shoreline Management Plans and includes updates to guidance first published in 2006. A shoreline management plan (SMP) is a coastal defence management tool. It is a large-scale assessment of the risks associated with coastal processes and helps to reduce these risks to people and the developed, historic and natural environment. This guidance document sets out Defra's and the Welsh Government's strategy for managing flooding and coastal erosion.</p> <p>The guidance includes the following objectives:</p> <ul style="list-style-type: none"> - set out the risks from flooding and erosion to people and the developed, historic and natural environment within the SMP area; - identify opportunities to maintain and improve the environment by managing the risks from floods and coastal erosion; - identify the preferred policies for managing risks from floods and erosion over the next century; - identify the consequences of putting the preferred policies into practice; - set out procedures for monitoring how effective these policies are; - inform others so that future land use, planning and development of the shoreline takes account of the risks and the preferred policies; - discourage inappropriate development in areas where the flood and erosion risks are high; and - meet international and national nature conservation legislation and aim to achieve the biodiversity objectives. 	<p>The WRMP should take into account its effects on areas with a SMP.</p> <p>The SEA assessment should take into account the effects of the options on the coast where relevant.</p>
Defra (2011) Mainstreaming Sustainable Development	
<p>This paper set out the government's commitment to sustainable development and the measures it would take to mainstream it into overall government policy. New measures to support this included:</p> <ul style="list-style-type: none"> - ministerial leadership and oversight - leading by example - embedding sustainable development in Government policy - transparency and independent scrutiny 	<p>The WRMP should seek to ensure that the principles of sustainable development are integrated into the decision making process</p>
Defra (2011) Natural Environment White Paper: The Natural Choice: Securing the Value of Nature	
<p>The Natural Environment White Paper (2011) recognises that nationally, the fragmentation of natural environments is driving continuing threats to biodiversity. It sets out the Government's policy intent to:</p> <ul style="list-style-type: none"> - improve the quality of the natural environment across England; - move to a net gain in the value of nature; - arrest the decline in habitats and species and the degradation of landscapes; - protect priority habitats; - safeguard vulnerable non-renewable resources for future generations; - support natural systems to function more effectively in town, in the country and at sea; and - create an ecological network which is resilient to changing pressures. <p>By 2020, the Government wants to achieve an overall improvement in the status of the UK's wildlife including no net loss of priority habitat and an increase of at least 200,000 hectares in the overall extent of priority habitats. Under the White Paper, the Government has also put in place a clear institutional framework to support nature restoration which includes Local Nature Partnerships creating new Nature Improvement Areas (NIAs).</p>	<p>The WRMP should reflect the Government's policy intent set out in the White Paper.</p> <p>The SEA assessment framework should include objectives, indicators and targets that reflect the Government's policy intent set out in the White Paper.</p>
Defra (2011) Biodiversity 2020: A strategy for England's wildlife and ecosystem services	
<p>This new biodiversity strategy for England provides a comprehensive picture of how we are implementing our international and EU commitments. It sets out the strategic direction for biodiversity policy for the next decade on land (including rivers and lakes) and at sea.</p> <p>The strategy sets 20 targets across 5 strategic goals:</p> <ul style="list-style-type: none"> - Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society; - Reduce the direct pressures on biodiversity and promote sustainable use; 	<p>The WRMP should contribute towards meeting the targets and objectives within the strategy.</p> <p>The SEA should include objectives to improve status of biodiversity and enhance benefits of biodiversity and its ecosystem services, and reduce pressures on ecosystems.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>- Improve status of biodiversity by safeguarding ecosystems, species and genetic diversity;</p> <p>- Enhance the benefits to all from biodiversity and ecosystem services; and</p> <p>Enhance implementation through participatory planning, knowledge management and capacity building.</p>	
Defra (2012) National Policy Statement for Waste Water	
<p>This National Policy Statement (NPS) sets out Government policy for the provision of major waste water infrastructure. It will be used by the Infrastructure Planning Commission (IPC) to guide its decision making on development consent applications for waste water developments that fall within the definition of Nationally Significant Infrastructure Project (NSIP) as defined in the Planning Act 2008. As well as considering the general need for new waste water infrastructure, this NPS covers two NSIPs which have been assessed as required to meet this need although these do not fall within the Welsh Water or neighbouring areas and are therefore unlikely to influence, or be influenced by, the WRMP.</p>	<p>The WRMP should consider any unforeseen NSIP proposals that come forward prior to adoption which may affect water resources in the Welsh Water area.</p> <p>The SEA should consider the cumulative effects of the WRMP and any unforeseen NSIP proposals that come forward which may affect water resources in the Welsh Water area.</p>
Defra (2012) UK post 2010 Biodiversity Framework	
<p>The Framework is to set a broad enabling structure for action across the UK between now and 2020:</p> <p>i. To set out a shared vision and priorities for UK- scale activities, in a framework jointly owned by the four countries, and to which their own strategies will contribute;</p> <p>ii. To identify priority work at a UK level which will be needed to help deliver the Aichi targets and the EU Biodiversity Strategy</p> <p>iii. To facilitate the aggregation and collation of information on activity and outcomes across all countries of the UK, where the four countries agree this will bring benefits compared to individual country work; and</p> <p>iv. To streamline governance arrangements for UK- scale activity</p> <p>The Framework sets out 20 new global 'Aichi targets' under 5 strategic goals:</p> <ul style="list-style-type: none"> • Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society • Reduce the direct pressures on biodiversity and promote sustainable use • To improve the status of biodiversity by safeguarding ecosystems species and genetic diversity • Enhance the benefits to all from biodiversity and ecosystem services <p>Enhance implementation through participatory planning, knowledge management and capacity building</p>	<p>The WRMP should contribute towards meeting the targets and objectives within the framework.</p> <p>The SEA should include objectives to improve status of biodiversity and enhance benefits of biodiversity and its ecosystem services, and reduce pressures on ecosystems.</p>
Defra (2013) The National Adaptation Programme – Making the Country Resilient to a Changing Climate	
<p>This Programme contains a mix of policies and actions to help adapt successfully to future weather conditions, by dealing with the risks and making the most of the opportunities.</p> <p>It sets out a number of objectives, including:</p> <ul style="list-style-type: none"> • To provide a clear local planning framework to enable all participants in the planning system to deliver sustainable new development, including infrastructure that minimises vulnerability and provides resilience to the impacts of climate change. • To increase the resilience of homes and buildings by helping people and communities to understand what a changing climate could mean for them and to take action to become resilient to climate risks. <p>To ensure infrastructure is located, planned, designed and maintained to be resilient to climate change, including increasingly extreme weather events.</p>	<p>The WRMP should ensure that proposals are resilient to the effects of climate change. Where possible, options should be considered that enhance resilience.</p> <p>The SEA should consider the effects of options on climate change resilience.</p>
Defra (2016) Creating a Great Place for Living – Enabling Resilience in the Water Sector	
<p>Climate change and population growth are putting increasing pressure on the water sector in England. The sector needs to adapt to ensure that it can continue to meet the needs of people, businesses and the environment – and the Government's framework needs to adapt too. This roadmap sets out how Defra will enhance its policy framework during this Parliament to secure the long-term resilience of the sector, helping to deliver a cleaner, healthier environment, benefiting people and the economy.</p>	<p>The WRMP should have regard to longer term planning beyond the minimum 25 year period.</p> <p>The SEA Assessment Framework should include an objective and</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
	question relating to longer term resilience of water supply.
Defra, Scottish Government, Welsh Government (2015) <i>The Great Britain Invasive Non-native Species Strategy</i>	
<p>The strategy sets out key aims and actions for addressing the threats posed by invasive non-native species, including the prevention of invasive species arriving in Britain, early detection and monitoring, eradication and control. It also aims to:</p> <ul style="list-style-type: none"> • get people to work better together, including the government, stakeholders, land managers and the general public; and • improve co-ordination and co-operation on issues at a European and international level. <p>- The strategy covers the period 2015 to 2020.</p>	<p>The WRMP should seek to avoid the spread of invasive species.</p> <p>The SEA should consider the effects of the WRMP on biodiversity.</p>
Environment Agency (2008) <i>Better Sea Trout and Salmon Fisheries: Our Strategy for 2008-2021</i>	
<p>The strategy has the goal of more sea trout and more salmon in more rivers bringing more benefit. This goal is to be brought about through achieving three broad targets:</p> <ol style="list-style-type: none"> 1 Self-sustaining sea trout and salmon in abundance in more rivers; 2 Economic and social benefits optimised for sea trout and salmon fisheries; 3 Widespread and positive partnerships, producing benefits. <p>There are twelve more detailed targets lying below these broad goals which relate to salmon and fisheries. These could be relevant to monitoring the effects of the WRMP, e.g. a target of 70 per cent of rivers outside the 'at risk' (i.e. better than) the 'at risk' category in 2011 and 2021 to demonstrate rivers meeting their potential for salmon</p>	<p>The WRMP should take the strategy into account where the option may have an effect on salmon and trout, e.g. where an option may involve inserting or removing a barrier to fish.</p> <p>The SEA should include a guide question in relation to the effects of options on recreation (i.e. recreational angling) and also appropriate targets in monitoring proposals.</p>
Environment Agency (2011) <i>National Flood and Coastal Erosion Risk Management Strategy for England</i>	
<p>This strategy describes what needs to be done by all organisations involved in flood and coastal erosion risk management. These include local authorities, internal drainage boards, water and sewerage companies, highways authorities, and the Environment Agency. They all act to reduce the risk of flooding and coastal erosion, and manage its consequences.</p> <p>The strategy sets out a statutory framework that will help communities, the public sector and other organisations to work together to manage flood and coastal erosion risk. It will support local decision-making and engagement in FCERM, making sure that risks are managed in a co-ordinated way across catchments and along each stretch of coast. This includes the development of local flood risk management strategies by lead local flood authorities, as well as our strategic overview of all sources of flooding and coastal erosion.</p>	<p>The WRMP should seek to ensure that activities do not result in additional risk of flooding or coastal erosion.</p> <p>The SEA framework should consider flooding and coastal erosion.</p>
Environment Agency (2013) <i>Areas of Water Stress: Final Classification</i>	
<p>The report is the Environment Agency's formal advice on which areas in England are of serious water stress.</p>	<p>The WRMP should seek to manage any water stressed areas.</p> <p>The SEA assessment framework should consider the effects of the WRMP on water resources and the associated socio-economic and environmental receptors.</p>
Environment Agency (2016) <i>Creating a Better Place: Our Ambition to 2020</i>	
<p>This document includes the EA's vision, principles and purpose, and sets out its objectives to create a cleaner healthier environment which benefits people and the economy, a nation better protected against natural threats and hazards, and its commitment to work in partnership. The key objectives for 2016 to 2020 are:</p> <ul style="list-style-type: none"> - a cleaner, healthier environment which benefits people and the economy; - a nation better protected against natural threats and hazards, with strong response and recovery capabilities; and - higher visibility, stronger partnerships and local choices. 	<p>The SEA and WRMP should consider the EA's priorities.</p>
Environment Agency (undated) <i>Restoring Sustainable Abstraction Programme</i>	

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>EA note that there is evidence to suggest that unsustainable abstraction of groundwater and surface water could be contributing to environmental damage of rivers and wetlands in England and Wales, including sites of national and international conservation importance. In May 1997, at the Government's Water Summit, a commitment was made to reverse the damage caused by past decisions. EA investigates where over-abstraction has occurred and work with local people to restore sustainable supplies.</p>	<p>The WRMP will need to sustainably manage abstraction.</p> <p>The SEA should include a guide question relating to whether abstraction will contribute to environmental damage of rivers and wetlands.</p>
Environment Agency (various) Drought Plans	
<p>Drought Plans prepared by the EA:</p> <ul style="list-style-type: none"> - outline how the EA will manage water resources during a drought and defines their role and responsibilities; - aim to reconcile the competing interests of the environment, the need for public water supply and other abstractions; - show what additional environmental monitoring the EA will carry out; - provide a framework for liaison with water companies, awareness campaigns and determination of drought permits; - range from high-level activities where they co-ordinate drought management over England and Wales to a local level where they outline specific operational activities. <p>Those plans particularly relevant to the Welsh Water area include the Head Office Drought Plan (covering England and Wales), Drought Plans for Wales and the Midlands as well as area plans for south east, south west and north Wales and the west Midlands.</p>	<p>The WRMP should, where appropriate, take into account and accord with the provisions contained within the EA Drought Plans listed.</p> <p>The SEA assessment framework should include an objective/guide question on the effects of the WRMP on water resources and commentary on whether they affect the water resource zones' ability to manage drought. Data contained within the plans listed may inform the baseline and assessment of plan options.</p>
Environment Agency and Natural Resources Wales (2017) Water Resources Planning Guideline: Interim Update	
<p>The Guideline outlines the key stages associated with the preparation of WRMPs and the process and content of Plans. The process of developing a WRMP requires an estimation of baseline supply forecast and an estimation of baseline demand forecast. The uncertainties and target headroom required are then estimated. The calculation of the baseline supply demand balance for each year of the plan's period are then used to determine if there are any years or critical periods where there is likely to be a supply-demand balance deficit.</p> <p>A long list of demand and supply options which could be used to manage the supply demand balance deficit is considered. Options are discounted based on their unfeasibility using economic, technological and environmental criteria until a feasible (constrained) list of options that could be used is presented. The capital, operating and social and environmental costs (including carbon costs) of each of the feasible options are assessed using industry standard methodologies. Investment modelling is then undertaken which takes account of the capital, operation and social and environmental costs of the options to determine a least-cost water resources strategy. Further scenario modelling and sensitivity testing is then applied to the strategy to determine the robustness of the proposals.</p> <p>The final planning solution for managing supply and demand to meet the required balance and target headroom is presented in the Draft WRMP for formal consultation. The preferred options in the plan are presented with a justification of their inclusion and timing for implementation.</p>	<p>The WRMP process and outcomes will need to demonstrate compliance with the Guidelines.</p> <p>The SEA should draw on work undertaken as part of the WRMP process to assess options and anticipated effects.</p>
HM Government (1975) Salmon and Freshwater Fisheries Act	
<p>The act encompasses fishing regulation, as well as illegal obstruction of migratory pathways and prohibited modes of destroying fish. The act allows the salmon to maintain an environmentally stable population and support the fishing industry.</p>	<p>The SEA and WRMP should consider the protection of Salmon and freshwater fish.</p>
HM Government (1975) Reservoirs Act	
<p>The Reservoirs Act 1975 provides a legal framework to ensure the safety against failure of large raised reservoirs.</p> <p>The Reservoirs Act 1975 applies to reservoirs that hold at least 25,000 cubic metres of water above natural ground level.</p> <p>Safety legislation for reservoirs in the United Kingdom was introduced in 1930 after several reservoir disasters had resulted in loss of life. This law was superseded by the Reservoirs Act 1975.</p> <p>Under the Reservoirs Act 1975 reservoir owners (undertakers) have ultimate responsibility for the safety of their reservoirs.</p> <p>Reservoir owners must appoint a panel engineer (a specialist civil engineer who is qualified and experienced in reservoir safety) to supervise the design and construction of the reservoir, to</p>	<p>The WRMP should consider reservoirs.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>continuously supervise the reservoir when built (supervising engineer) and to carry out periodic inspections (inspecting engineer).</p> <p>Two amendments to the Act for Wales in 2016 (SI 78 (W. 35) and SI 80 (W. 37)) relate to registration, record keeping and inspection of high-risk reservoirs.</p>	
HM Government (1979) <i>Ancient Monuments and Archaeological Areas Act</i>	
<p>This is the main legislation concerning archaeology in the UK. This Act, building on legislation dating back to 1882, provides for nationally important archaeological sites to be statutorily protected as Scheduled Ancient Monuments. Section 61(12) defines sites that warrant protection due to their being of national importance as 'ancient monuments'. These can be either Scheduled Ancient Monuments or "any other monument which in the opinion of the Secretary of State is of public interest by reason of the historic, architectural, traditional, artistic or archaeological interest attaching to it".</p>	<p>The WRMP should seek to avoid adverse impacts on cultural heritage assets.</p>
HM Government (1981) <i>Wildlife and Countryside Act</i>	
<p>The Act makes it an offence (with exceptions) to;</p> <ul style="list-style-type: none"> - Intentionally kill, injure or take any wild bird or their eggs or nests; - Intentionally kill, injure, or take, possess, or trade in any wild animal listed in Schedule 5; - Prohibits interference with places used for shelter or protection, or intentionally disturbing animals; and - Pick, uproot, trade in, or possess (for the purposes of trade) and wild plant listed in Schedule 8. <p>The Act also provides for the notification of Sites of Special Scientific Interest (SSSI) and require surveying authorities to maintain up to date definitive maps and statements, for the purpose of clarifying public rights of way.</p>	<p>The WRMP must ensure full compliance with the Act.</p> <p>The SEA should ensure a positive contribution to the wildlife within the operational area.</p>
HM Government (1990) <i>Planning (Listed Building and Conservation Areas) Act 1990</i>	
<p>This Act was passed to better regulate the way in which large and small scale developments were approved by local authorities in England and Wales. It provides local planning authorities the power to take steps requiring land to be cleaned up when conditions adversely affect the amenity of an area.</p>	<p>The WRMP should seek to avoid adverse impacts on cultural heritage assets.</p> <p>The SEA assessment framework should include specific objectives relating to cultural heritage.</p>
HM Government (1991) <i>Water Resources Act</i>	
<p>The Water Resources Act applies to England and Wales and established the National Rivers Authority (now the Environment Agency) to regulate water pollution, water resources, flood defence, fisheries and navigation. The Act covers water abstraction and impounding and discharges to surface and groundwaters and coastal waters.</p>	<p>The WRMP must ensure full compliance with the Act</p>
HM Government (1994) <i>UK Biodiversity Action Plan (BAP)</i>	
<p>The aim of the action plan is to conserve and enhance biological diversity in the UK and to contribute to the conservation of national and global biodiversity and include the follow aims to maintain and, where practicable, to enhance:</p> <ul style="list-style-type: none"> - The overall populations and natural ranges of native species and the quality and range of wildlife habitats and ecosystems; - Internationally and nationally important and threatened species, habitats and ecosystems; - Species, habitats and natural and managed ecosystems that are characteristic of Kent; - The biodiversity of natural and semi-natural habitats, where this has diminished over 3 recent decades, and - Public awareness of, and involvement in, conserving biodiversity. 	<p>Ensure that WRMP and SEA encourage conservation and offer protection to areas and species of high conservation importance as identified in this action plan.</p>
HM Government (2000) <i>Countryside and Rights of Way Act 2000</i>	
<p>This act extends the public's ability to enjoy the countryside and safeguards landowners and occupiers. The Act creates a new statutory right of access to open country and registered common land, modernise the right of way system, give greater protection to Sites of Special Scientific Interest (SSSIs), provide greater protection arrangements for Areas of Outstanding Natural Beauty (AONBs) and strengthen wildlife enforcement legislation.</p>	<p>The SEA must make sure that the Act is supported and that public rights of way and access to the countryside are maintained and where possible enhanced.</p>
HM Government (2003) <i>Water Act 2003</i>	

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>The four broad aims of the Act are</p> <ul style="list-style-type: none"> - the sustainable use of water resources; - strengthening the voice of consumers; - a measured increase in competition; and - the promotion of water conservation. <p>It amends the Water Industry Act 1991 so that water companies:</p> <ul style="list-style-type: none"> - are given a duty to prepare and publicise drought plans; - are placed under a duty to agree and publicise water resource management plans; and - are placed under an enforceable duty to further water conservation. <p>As part of the Act the Water Services Regulation Authority (Ofwat) became the economic regulator of the water and sewage industry in England and Wales.</p>	<p>The WRMP will be used by Ofwat to assess supply-demand balance and quality enhancement elements as part of the Periodic Review of Price Limits. It is therefore important that the WRMP is a fair and transparent review of water resources and is inclusive of the environmental impacts anticipated.</p> <p>The SEA must ensure that the full obligations are met in terms of the environmental implications to abstraction and discharges.</p>
HM Government (2005) UK Sustainable Development Strategy	
<p>The strategy for sustainable development aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations.</p> <p>This is implemented with 4 key priorities:</p> <ul style="list-style-type: none"> - Sustainable consumption and production; - Climate change; - Natural resource protection; - Sustainable communities. 	<p>The WRMP and SEA must consider and implement the key priorities and objectives of the strategy</p>
HM Government (2006) Climate Change and Sustainable Energy Act 2006	
<p>The Act was enacted after the publication of the UK Climate Change Programme (2006). It places an obligation on the government to report to Parliament on greenhouse gas emissions in the UK and action taken by Government to reduce these emissions.</p>	<p>The WRMP should take into account carbon emissions associated with the options.</p> <p>The SEA could include an objective/guide question in the assessment framework to reduce greenhouse gas/carbon dioxide emissions. Consider whether the monitoring arrangements can be utilised to monitor the effects of the WRMP.</p>
HM Government (2006) Natural Environment and Rural Communities Act 2006	
<p>An act to make provision about bodies concerned with the natural environment and rural communities to make provision in connection with wildlife sites of special scientific interest. National Parks and the Broads; to amend the law relating to rights of way to make provision as to the inland Waterways Amenity Advisory Council; to provide for flexible administrative arrangements in connection with functions relating to the environment and rural affairs and certain other functions; and connected purposes.</p> <p>Section 41 (S41) of the Act required the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The S41 list is used to guide decision-makers such as public bodies in implementing their duty under section 40 of the Act, to have regard to the conservation of biodiversity in England, when carrying out their normal functions.</p>	<p>The WRMP and SEA should have regard to protected wildlife sites and species and rights of way.</p>
HM Government (2007) Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended 2010)	
<p>The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Council Directive 79/409/EEC on the conservation of wild birds (Wild Birds Directive) into national law. They came into force on 21 August 2007. These regulations apply to the UK's offshore marine area which covers waters beyond 12 nautical miles, within British Fishery Limits and the seabed within the UK Continental Shelf Designated Area. The Conservation (Natural Habitats, &c.) Regulations (GB: 1994 (as amended in 2007); NI: 1995) form the legal basis for the implementation of the Habitats and Birds Directives in terrestrial areas of the UK and territorial waters out to 12nm.</p>	<p>The WRMP and SEA need to have regard to the offshore European designated sites.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
HM Government (2008) <i>Climate Change Act 2008</i>	
<p>This Act aims:</p> <ul style="list-style-type: none"> - to improve carbon management and help the transition towards a low carbon economy in the UK; and - to demonstrate strong UK leadership internationally, signalling that the UK is committed to taking its share of responsibility for reducing global emissions in the context of developing negotiations on a post-2012 global agreement at Copenhagen next year. <p>The Act seeks greenhouse gas emission reductions through action in the UK and abroad of at least 80 per cent by 2050, and reductions in CO₂ emissions of at least 26 per cent by 2020, against a 1990 baseline. The 2020 target will be reviewed soon after Royal Assent to reflect the move to all greenhouse gases and the increase in the 2050 target to 80 per cent.</p> <p>Further the Act provides for a carbon budgeting system which caps emissions over five year periods, with three budgets set at a time, to set out our trajectory to 2050. The first three carbon budgets will run from 2008-12, 2013-17 and 2018-22, and must be set by 1 June 2009.</p>	<p>The WRMP should take into account carbon emissions associated with the options.</p> <p>The SEA could include an objective/guide question in the assessment framework to reduce greenhouse gas/carbon dioxide emissions. Consider whether the monitoring arrangements can be utilised to monitor the effects of the WRMP.</p>
HM Government (2008) <i>Future Water: The Government's Water Strategy for England</i>	
<p>This strategy sets out how the Government want the water sector to look by 2030 and some of the steps required to achieve it. The vision is for rivers, canals, lakes and seas to have improved for people and wildlife with benefits for angling, boating and other recreational activities and that the supply of excellent quality drinking water is continued. It is for the sustainable delivery of secure water supplies and an improved and protected water environment.</p> <p>The strategy sets out actions to deal with water demand (e.g. introducing stricter water efficiency targets in building regulations for new homes), water supply (e.g. through use of 25 year water resources management plans and encouraging the use of rainwater harvesting where appropriate). No specific targets are listed.</p>	<p>The WRMP should have regard to its contribution towards achieving the strategy.</p> <p>The SEA assessment framework should ensure that the effects on the water sector's sustainability are fully considered.</p>
HM Government (2009) <i>Marine and Coastal Access Act 2009</i>	
<p>The Marine and Coastal Access Act sets out a number of measures including the establishment of Marine Conservation Zones (MCZs) and Marine Spatial Plans. It also includes amendments to the Salmon and Freshwater Fisheries Act, 1975.</p>	<p>The WRMP should take into account its effects on coastal areas.</p> <p>The SEA assessment should take into account the effects of the actions on the coast where relevant.</p>
HM Government (2009) <i>The Eels (England and Wales) Regulations 2009 (as amended 2011)</i>	
<p>These regulations were introduced in 2009 and amended in 2011. They afford powers to the Environment Agency to implement measures for the recovery of European eel stocks and have important implications for operators of abstractions and discharges.</p>	<p>The SEA and WRMP should have regard to Eel populations.</p>
Defra (2009) <i>The Groundwater (England and Wales) Regulations 2009</i>	
<p>The Groundwater Regulations are designed to implement a daughter directive to the European Water Framework Directive and prevent or limit the inputs of polluting substances into groundwater. Substances controlled under these regulations fall into two categories:</p> <p>a) Hazardous substances, defined as those which are toxic, persistent or liable to bioaccumulate must be prevented from entering groundwater. Substances in this list may be disposed of to the ground, under a permit, but must not reach groundwater. They include pesticides, sheep dip, solvents, hydrocarbons, mercury, cadmium and cyanide.</p> <p>b) Non-hazardous pollutants are less dangerous, and can be discharged to groundwater under a permit, but must not cause pollution. Examples include sewage, trade effluent and most wastes. Non-hazardous pollutants include any substance capable of causing pollution and the list is much wider than the previous List 2 substances.</p>	<p>The WRPM will need to comply with the requirements of the Regulations where appropriate.</p> <p>The SEA assessment should include an objective relating to the effects of options on groundwater quality.</p>
HM Government (2009) <i>The UK Renewable Energy Strategy</i>	
<p>The Strategy sets out to:</p> <ul style="list-style-type: none"> • the mechanisms to provide financial support for renewable electricity and heat worth around £30 billion between now and 2020; • Drive delivery and clear away barriers; • Increase investment in emerging technologies and pursue new sources of supply; and <p>Create new opportunities for individuals, communities and business to harness renewable energy.</p>	<p>The WRMP should contribute towards increasing the proportion of energy from renewable energy sources.</p> <p>The SEA assessment framework should include consideration of the use of energy from renewable energy sources.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
HM Government (2010) <i>Flood and Water Management Act 2010</i>	
<p>The Flood and Water Management Act 2010 aims to provide better, more sustainable management of flood risk for people, homes and businesses, help safeguard community groups from unaffordable rises in surface water drainage charges and protect water supplies to the consumer. The Act will also implement recommendations made by Sir Michael Pitt in his review of the 2007 floods. This will include giving water companies new powers to better control non-essential domestic uses of water during periods of water shortage. Additionally, Lead Local Flood Authorities (LLFAs) in England and Wales have a duty to prepare and maintain local level Flood Risk Management Strategies.</p> <p>The Act places a number of statutory duties on water companies including:</p> <ul style="list-style-type: none"> - a duty to act consistently with the National Strategy; and - a duty to have regard to the content of the Local Flood Risk Management Strategies. <p>Does not contain any targets.</p>	<p>The WRMP should be in conformity with the Act.</p> <p>The SEA should include objectives relating to flooding and water use.</p>
HM Government (2011) <i>UK Marine Policy Statement</i>	
<p>The Marine Policy Statement (MPS) sets out the framework for preparing Marine Plans and taking decisions affecting the marine environment, supporting the delivery of the following high level marine objectives:</p> <ul style="list-style-type: none"> - Achieving a sustainable marine economy; - Ensuring a strong, healthy and just society; - Living within environmental limits; - Promoting good governance; - Using sound science responsibly. <p>Does not contain any targets.</p>	<p>The WRMP should take into account its effects on coastal areas.</p> <p>The SEA assessment should take into account the effects of the actions on the coast/marine environment where relevant.</p>
HM Government (2011) <i>UK Renewable Energy Roadmap</i>	
<p>The Renewable energy roadmap, published in 2011 sets out how the UK will reach the goal of generating 15% of UK energy use from renewables by 2020. It presented a framework and set of actions for the delivery of renewable energy deployment. The first update of the Roadmap reported on progress up to the end of 2012 and the second update provides analysis on further achievements and changes that have taken place in 2013.</p>	<p>The WRMP should contribute towards increasing the proportion of energy from renewable energy sources.</p> <p>The SEA assessment framework should include consideration of the use of energy from renewable energy sources.</p>
HM Government (2011) <i>Carbon Plan: Delivering our Low Carbon Future</i>	
<p>This sets out how the UK will achieve decarbonisation within the framework of energy policy: To make the transition to a low carbon economy while maintaining energy security, and minimising costs to consumers, particularly those in poorer households.</p>	<p>The WRMP should contribute towards increasing the proportion of energy from renewable energy sources.</p> <p>The SEA assessment framework should include consideration of the use of energy from renewable energy sources.</p>
HM Government (2011) <i>Water for Life: White Paper</i>	
<p><i>Water for Life</i> describes a vision for future water management in which the water sector is resilient, in which water companies are more efficient and customer focused, and in which water is valued as the precious and finite resource it is.</p> <p><i>Water for Life</i> includes several proposals for deregulating and simplifying legislation, to reduce burdens on business and stimulate growth. Ofwat's proposals for reducing its regulatory burdens complement these.</p>	<p>WRMP should ensure that future water management is resilient, efficient and customer focused</p> <p>In order to ensure future water management is resilient SEA should consider resilience to climate change and should consider the human environment to ensure water companies remain customer focused.</p>
HM Government (2014) <i>Water Act 2014</i>	

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p><i>The purpose of the Act was to make provision about the water industry; about compensation for modification of licences to abstract water; about main river maps; about records of waterworks; for the regulation of the water environment; about the provision of flood insurance for household premises; about internal drainage boards; about Regional Flood and Coastal Committees; and for connected purposes.</i></p>	<p>WRMP should ensure that future water management is resilient, efficient and customer focused</p>
HM Government (2015) Infrastructure Act 2015	
<p>The Infrastructure Act (<i>inter alia</i>) gives environmental authorities new powers to require landowners to take action on invasive non-native species or permit others to enter the land and carry out those operations.</p>	<p>The SEA assessment framework should include guide questions relating to invasive species.</p>
HM Government (2016) The Culture White Paper	
<p>The White Paper includes a number of actions that are relevant to the historic environment:</p> <ul style="list-style-type: none"> • Support Historic England to establish Heritage Action Zones in England, working with partners to stimulate the productivity of the historic environment through regeneration and growth. • Support the heritage sector to advise local communities on how they can make best use of their historic buildings. 	<p>WRMP should contribute to conserving and enhancing the historic environment</p> <p>The SEA assessment framework should ensure consideration of the conservation and enhancement of the historic environment.</p>
HM Government (2016) Environmental Permitting (England and Wales) Regulations 2016 SI 1154	
<p>The Regulations provide a consolidated system of environmental permitting in England and Wales, and transpose the provisions of 15 EU Directives. Provides a system for environmental permits and exemptions for industrial activities, mobile plant, waste operations, mining waste operations, water discharge activities, groundwater activities, flood risk activities and radioactive substances activities. It also sets out the powers, functions and duties of the regulators.</p> <p>Certain flood risk activities are now regulated under the Environmental Permitting Regulations, with environmental permits required for some activities. There are slight variations between England and Wales.</p>	<p>The WRMP should accord with these Regulations.</p>
HM Government (2017) Conservation of Habitats & Species Regulations 2017	
<p>These regulations consolidate all the various amendments made to the Conservation (Natural Habitats) Regulations 1994 in respect of England and Wales. The 1994 Regulations transposed Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law.</p> <p>The Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European Sites.</p> <p>Under the Regulations, competent authorities i.e. any Minister, government department, public body, or person holding public office, have a general duty, in the exercise of any of their functions, to have regard to the EC Habitats Directive.</p> <p>New provisions implement aspects of the Marine & Coastal Access Act 2009. These provisions provide for:</p> <ul style="list-style-type: none"> - the transfer of certain licensing functions from Natural England to the Marine Management Organisation (MMO); <p>Marine Enforcement Officers to use powers under the Marine Act to enforce certain offences under the Habitats Regulations.</p>	<p>The WRMP must ensure full compliance with the Regulations.</p> <p>The SEA should take into account the effects of the actions on biodiversity</p>
HM Treasury (2016) National Infrastructure Delivery Plan	
<p>This document is the Government's updated National Infrastructure Delivery Plan. It sets out the plan to 2021 and beyond and takes a targeted approach to infrastructure investment and delivery across different sectors. It contains major commitments to improve the UK's transport, energy, communications, waste, water, housing and flood and coastal erosion, as well as steps to attract new private sector investment. It includes reference to the production of Water Resources Management Plans and the Ofwat price review.</p>	<p>The WRMP will be produced as indicated in the Delivery Plan.</p>
Natural England (2011) UK Geodiversity Action Plan	

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>The UKGAP sets out a framework for enhancing the importance and role of geodiversity across the UK, and provides a shared context and direction for geodiversity action through a common aim, themes, objectives and targets which link national, regional and local activities.</p> <p>The themes (on which the plan's objectives are based) include: furthering our understanding of geodiversity; gathering and maintaining information on our geodiversity; conserving and managing our geodiversity; inspiring people to value and care for our geodiversity; and sustaining resources for our geodiversity. It also aims to influence planning policy, legislation and development design.</p>	<p>The WRMP should take into account the aims of the UKGAP.</p> <p>The SEA assessment should consider effects of options on geodiversity and outline enhancement and mitigation opportunities where these are identified.</p>
Ofwat (2008) <i>Water Supply and Demand Policy</i>	
<p>Summarised the key areas of water supply and demand, focusing on water efficiency, leakage, metering, and climate change.</p>	<p>The WRMP should ensure it balances demand and supply issues.</p> <p>The SEA framework should ensure that consideration is given to the socio-economic and environmental impact of any demand and supply policies.</p>
Ofwat (2016) <i>Water 2020</i>	
<p>This document sets out Ofwat's decisions on the design of its water and wastewater services regulatory framework in England and Wales. The approach aims to deliver the following benefits:</p> <ul style="list-style-type: none"> • Greater customer engagement and understanding • A sustainable investment model and a fair balance of risk and reward • Choice where possible, and ensuring markets are effective for customers • A focus on the long-term, targeted and risk-based <p>Support for sustainable improvements in the environment</p>	<p>The WRMP should take account of the regulatory framework.</p> <p>The SEA assessment should include criteria relating to the provision of water to customers and environmental protection.</p>
JNCC and Defra (2012) <i>UK Post-2010 Biodiversity Framework</i>	
<p>The framework sets out UK priorities for work on the Convention on Biological Diversity, and follows on from the 1994 UK Biodiversity Action Plan. It sets out a vision that, 'by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people'. The goals and activities to meet this aim are grouped under the categories of International / European context; facilitating and contributing to common country approaches and solutions; evidence provision; and reporting.</p>	<p>The WRMP should support the protection and enhancement of biodiversity.</p> <p>The SEA assessment should include criteria relating to the protection of species and habitats.</p>
Countryside Council for Wales (2001) <i>Register of Landscapes of Historic Interest</i>	
<p>Cadw, the Countryside Council for Wales (CCW) and the International Council on Monuments and Sites (ICOMOS UK), has compiled a Register of Landscape of Historic Interest in Wales. The register identifies 58 landscapes of outstanding or special historic interest, which are considered to be the best examples of different types of historic landscapes in Wales.</p> <p>The Register provides information to decision makers and landscape managers, to help ensure that the historic character of the landscape is sustained, and that where change is contemplated, it is well-informed. It is accompanied by a good practice guide, which explains how the Register should be used in assessing the effect of major developments on the historic landscape.</p> <p>A guide to good practice on using the register was published in 2007 and remains in use.</p>	<p>The WRMP should be developed with consideration of landscapes of historic interest.</p> <p>The SEA should include assessment criteria relating to protection and enhancement of the landscapes and seascapes, including those with historic interest features.</p>
Valuing Our Environment Partnership (2010) <i>Valuing the Welsh Historic Environment</i>	
<p>This document is a review and does not contain objectives or targets as such. It can be assumed however that the protection and enhancement of the historic environment is a key objective.</p> <p>It showed that in 2010 the historic environment contributes approximately £840 million to Wales's gross value added, some £1.8 billion in respect of output and supports 30,000 full time equivalent jobs.</p>	<p>The WRMP should consider effects of options on historic environment assets.</p> <p>The SEA should include a guide question relating to protecting and enhancing the historic environment.</p>
Welsh Government (1998) <i>Technical Advice Note 14: Coastal Planning</i>	
<p>TAN 14 seeks to protect the coastline in relation to development, landscape, biodiversity and recreation</p>	<p>The WRMP should take into account its effects on coastal areas.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
	The SEA assessment should take into account the effects of the options on the coast where relevant.
Welsh Government (2014) Technical Advice Note 21: Waste	
<p>This guidance note provides advice about how the land use planning system should contribute to sustainable waste resource management. The TAN states that land use planning system has an important role to play in facilitating sustainable waste management and should:</p> <ul style="list-style-type: none"> - provide a planning framework which enables adequate provision to be made for waste resource management facilities to meet the needs of society for the re-use, recovery and disposal of waste; - help meet the needs of business and encourage competitiveness; - encourage sensitive waste management, enhance the overall quality of the environment and avoid risks to human health; - have regard to the need to protect areas of designated landscape and nature conservation value from inappropriate development; - have regard to the need to protect the amenity of the community and of land uses and users affected by existing or proposed waste management facilities; - minimise adverse environmental impacts resulting from the handling, processing, transport and disposal of waste; - consider what new facilities may be needed, in the light of waste forecasts; and - ensure that opportunities for incorporating re-use/recycling facilities in new developments are properly considered. 	<p>The WRMP should contribute, where appropriate to the sustainable management of waste.</p> <p>The SEA should take into account the implication of the options on waste.</p>
Welsh Government (2004) Technical Advice Note 15: Development and Flood Risk	
TAN 15 sets out a precautionary framework to guide planning decisions. The approach seeks to first, direct new development away from those areas which are at high risk of flooding and, second, where development has to be considered in high risk areas (Zone C), allow only those developments which can be justified to be located within such areas.	<p>The WRMP should take account of flood risk management.</p> <p>The SEA should include a guide question relating to flood risk.</p>
Welsh Government (2008) People, Places, Futures: The Wales Spatial Plan 2008 Update	
<p>The <i>Wales Spatial Plan</i> provides the context and direction of travel for local development plans and the work of local service boards. The 2008 update brings the <i>Wales Spatial Plan</i> into line <i>with One Wales</i>, and gives status to the area work which has developed since 2006. The key themes of the update (and the <i>Wales Spatial Plan</i> before it) are set out below:</p> <p>Building Sustainable Communities</p> <p>Our future depends on the vitality of our communities as attractive places to live and work. We need to reduce inequalities between communities whilst retaining their character and distinctiveness.</p> <p>Promoting a Sustainable Economy</p> <p>We need an innovative, high value-added economy for Wales which utilises and develops the skills and knowledge of our people; an economy which both creates wealth and promotes the spreading of that prosperity throughout Wales; an economy which adds to the quality of life as well as the standard of living and the working environment.</p> <p>Valuing our Environment</p> <p>The quality of our natural environment has an intrinsic value as a life support system, but also promotes wellbeing for living and working and contributes to our economic objectives. Safeguarding and protecting our natural and historic assets, and enhancing resilience to address the challenges of climate change, will enable us to attract people to our communities and provide the wellbeing and quality of life to encourage them to stay and preserve the foundations for the future.</p> <p>Achieving Sustainable Accessibility</p> <p>We will develop access in ways that protect the environment, encourage economic activity, widen employment opportunities, ensure quality services and integrate the social, environmental and economic benefits that travel can have.</p> <p>Respecting Distinctiveness</p> <p>A cohesive identity which sustains and celebrates what is distinctive about Wales, in an open and outward-looking way, is central to promoting Wales to the World, as well as to our future economic competitiveness and social and environmental wellbeing.</p>	<p>The WRMP should have regard to the key themes of the <i>Wales Spatial Plan Update</i>.</p> <p>The SEA objectives should cover the key themes set out in the <i>Wales Spatial Plan Update</i>.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
Welsh Government (2009) <i>One Wales One Planet: The Sustainable Development Scheme for Wales</i>	
<p>One Wales One Planet seeks to build on the two previous Sustainable Development Schemes. It sets out proposals to promote sustainable development, how the Welsh Government will make sustainable development a reality for people in Wales, and the benefits that people will see from this, particularly in less well-off communities.</p> <p>The strategy states that the Welsh Government is committed to working in partnership with others and notes that businesses can:</p> <ul style="list-style-type: none"> - Develop resource efficiency within the organisation and through supply chains, improving productivity and competitiveness; - Reduce waste; - Develop environmental and sustainability policies and targets; - Monitor performance and resource use and report publicly on them; - Engage with the workforce in both adopting sustainable practices and encouraging employees to become sustainable champions in their own communities; - Engage with and support local communities. 	<p>The WRMP should consider effects of options on sustainable development in Wales.</p> <p>The SEA should include guide questions relating to improving resource efficiency, reducing waste, monitoring and public reporting, encouraging sustainable practices among the workforce and engaging with and supporting local communities. The SEA should include proposals for monitoring the effects of the WRMP on the environment and sustainability and could utilise targets that arise from this document.</p>
Welsh Government (2006) <i>Environment Strategy for Wales</i>	
<p>The Environment Strategy for Wales sets out the challenges and vision for Wales up to 2026. It covers themes under climate change; resource use; biodiversity, landscapes and seascapes; local environment; and environmental hazards. The priorities identified in the Strategy are to</p> <ul style="list-style-type: none"> - minimise greenhouse gas emissions and adapt to the impacts of climate change; - conserve and enhance biodiversity; - monitor and regulate known and emerging environmental hazards; - tackle unsustainable practices, like waste production and disposal; and - conserve and enhance land and sea, built environment, natural resources and heritage, developing and using them in a sustainable and equitable way and for the long term benefit of the people of Wales. 	<p>The WRMP should aim to contribute to the Environment Strategy for Wales.</p> <p>The SEA assessment should include effects of options on biodiversity, marine, flood and water management, the historic environment, people and the environment and environmental quality.</p>
Welsh Government (2015) <i>National Transport Finance Plan 2015</i>	
<p>The Plan sets out five strategic transport priorities for the next 5 years:</p> <ul style="list-style-type: none"> - Reducing greenhouse gas emissions and other environmental impacts; - Integrating local transport; - Improving access between key settlements and sites; - Enhancing international connectivity; - Increasing safety and security. 	<p>The WRMP should consider any transport-related implications arising from the options and seek to reflect the transport hierarchy where possible.</p> <p>The SEA assessment should include an objective on improving and/or integrating transport and reducing greenhouse gases.</p>
Welsh Government (2008) <i>The Wales Transport Strategy</i>	
<p>The Strategy sets out the Welsh Government's main aims in improving transport. The strategic priorities are:</p> <ul style="list-style-type: none"> • Reducing greenhouse gas emissions and other environmental impacts; • Improving public transport and better integration between modes; • Improving links and access between key settlements and sites across Wales and strategically important all-Wales links; • Enhancing international connectivity; and • Increasing safety and security. 	<p>The WRMP should consider any transport-related implications arising from the options and seek to reflect the transport hierarchy where possible.</p> <p>The SEA assessment should include an objective on improving and/or integrating transport and reducing greenhouse gases.</p>
Welsh Government (2009) <i>Technical Advice Note 16: Sport, Recreation and Open Space</i>	
<p>TAN 16 Makes provision for sport and recreational activities within the planning system. This includes the provision of recreational facilities and informal open space, as well as protecting existing recreational facilities and open spaces in urban and rural areas in Wales.</p>	<p>The WRMP should take account of sport, recreation and open spaces.</p> <p>The SEA should include a guide question relating to recreation.</p>
Welsh Government (2009) <i>Technical Advice Note 5: Nature Conservation and Planning</i>	

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>Technical Advice Note 5 sets out how the planning system should contribute to protecting and enhancing biodiversity and geological conservation. It stipulates that the planning system should:</p> <ul style="list-style-type: none"> - work to achieve nature conservation objectives through a partnership between local planning authorities, Countryside Council for Wales (CCW), the Environment Agency Wales, voluntary organisations, developers, landowners and other key stakeholders; - integrate nature conservation into all planning decisions looking for development to deliver social, economic and environmental objectives together over time; - ensure that the UK's international and national obligations for site, species and habitat protection are fully met in all planning decisions; - look for development to provide a net benefit for biodiversity conservation with no significant loss of habitats or populations of species, locally or nationally; - help to ensure that development does not damage, or restrict access to, or the study of, geological sites and features or impede the evolution of natural processes and systems especially on rivers and the coast; and - plan to accommodate and reduce the effects of climate change by encouraging development that will reduce damaging emissions and energy consumption and that help habitats and species to respond to climate change. 	<p>The WRMP should seek to protect and enhance biodiversity and geodiversity.</p> <p>SEA objectives should reflect the need to conserve and, where possible, enhance, biodiversity and geodiversity.</p>
Welsh Government (2010) <i>Climate Change Strategy for Wales</i>	
<p>The Climate Change Strategy for Wales and associated action plan sets out the Welsh Government's policy intentions in relation to climate change and expands on the commitments set out in One Wales.</p> <p>The strategy re-iterates the One Wales commitments to 3 per cent annual carbon reductions and sets out, that by 2020, the Welsh Government expect to see:</p> <ul style="list-style-type: none"> - Businesses have reduced energy costs and emissions; - Employees actively engaged in reducing emissions from their workplaces; - Consumers demanding low carbon goods and services and concerned about sustainability performance of businesses; - Growth of social enterprises and community businesses providing low carbon goods and services locally; <p>Core businesses operating, and people employed, in businesses that provide low carbon goods and services.</p>	<p>The WRMP should incorporate climate change mitigation and adaptation measures, e.g. reducing carbon emissions.</p> <p>The SEA should include a guide question relating to mitigation and adaptation to climate change.</p>
Welsh Government (2012) <i>Energy Wales: A Low Carbon Transition</i>	
<p>Energy Wales and the supporting delivery plan set out what the Welsh Government intends to do to drive the change to a sustainable, low carbon economy for Wales. The Welsh Government commits to:</p> <ul style="list-style-type: none"> • Engage and support businesses that help to achieve Wales's low carbon ambition; • Ensure that regulatory processes are as simplified and efficient as they can be and provide businesses with clarity and stability; • Engage the UK Government to ensure that there is a credible framework for capital investment to support the transition to a low carbon economy; • Support vital energy intensive industries in the transition to a low carbon economy; • Pursue energy efficiency; • Focus on low carbon sources of energy generation and approaches which will help to deliver lower overall emissions; and • Assist the most vulnerable in Welsh society and work to ensure that costs of reform do not fall disproportionately on poor households. <p>The delivery plan also sets out key delivery themes around low carbon energy, Anglesey Energy Island, energy efficiency and distributed energy generation.</p>	<p>The WRMP should seek to incorporate low carbon energy and energy efficiency.</p> <p>The SEA should include a guide question relating to climate change mitigation.</p>
Welsh Government (2015) <i>Wales Rural Development Programme 2014-2020</i>	
<p>The Programme was adopted by the European Commission in May 2015. It is a 7 year investment programme supporting a wide range of activities which contribute to the following objectives:</p> <ul style="list-style-type: none"> • fostering the competitiveness of agriculture; • ensuring the sustainable management of natural resources, and climate action; 	<p>The WRMP should consider the effect of options on rural areas.</p> <p>The SEA assessment should note where options will have significant effects on rural areas.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<ul style="list-style-type: none"> achieving a balanced territorial development of rural economies and communities, including the creation and maintenance of employment. 	
Welsh Government (2016) <i>Technical Advice Note 12: Design</i>	
<p>Technical Advice Note 12 sets out the Welsh Government's land use planning policy in respect of promoting sustainability through good design. It advocates a holistic approach to design that considers:</p> <p>Movement - promoting sustainable means of travel;</p> <p>Access- ensuring access for all;</p> <p>Character - sustaining or enhancing local character, promoting legible development, promoting a successful relationship between public and private space, promoting quality, choice and variety, promoting innovative design;</p> <p>Community safety - ensuring attractive, safe public spaces and security through natural surveillance;</p> <p>Environmental sustainability - achieving efficient use and protection of natural resources, enhancing biodiversity and designing for change.</p>	<p>The WRMP should promote good design in the development of any new facilities required as part of plan options.</p> <p>SEA objectives should include the promotion of good design.</p>
Welsh Government (2010) <i>Towards Zero Waste, One Wales: One Planet – Overarching Waste Strategy Document for Wales</i>	
<p>Towards Zero Waste is the overarching waste strategy for Wales. The key outcomes that the Strategy aims to achieve are:</p> <ul style="list-style-type: none"> a sustainable environment in which we reduce the impact of waste in Wales to within our environmental limits by 2050; a Fair and Just Society, in which citizens can achieve their full human potential and contribute to the wellbeing of Wales through actions on waste prevention, reuse and recycling; a Prosperous Society With a sustainable, resource efficient economy. <p>The strategy sets out a long-term aim of zero waste by 2050 and a medium term aim of achieving a high recycling society by 2025. This is supported by a range of recycling and other waste management targets including in relation to commercial and industrial waste.</p>	<p>The WRMP should promote waste reduction, reuse and recycling ahead of landfill disposal.</p> <p>SEA objectives should reflect aspirations of the Strategy.</p>
Welsh Government (2016) <i>Planning Policy Wales (Edition 9)</i>	
<p>Planning Policy Wales sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes and procedural advice given in circulars. It sets out key policy objectives for Local Development Plans (LDPs) in Wales which reflect the sustainable development agenda.</p>	<p>Options recommended in the WRMP will need to confirm to LDPs.</p> <p>The SEA objectives should reflect the Welsh Government's commitments to sustainable development.</p>
Welsh Government (2011) <i>Welsh Government Policy Statement: Preparing for a Changing Climate</i>	
<p>This Policy Statement sets out how the Welsh Government will implement relevant provisions of the Climate Change Act 2008. It provides technical advice on how to assess climate risks and how to develop adaptation plans and in this context Welsh Water is identified as a key reporting authority.</p>	<p>The WRMP should incorporate climate change mitigation and adaptation measures where appropriate.</p> <p>The SEA should include a guide question relating to mitigation and adaptation to climate change. Monitoring recommendations in the SEA should reflect the 3 per cent year on year emission reduction target set by the Welsh Government.</p>
Welsh Government (2011) <i>National Strategy for Flood and Coastal Erosion Risk Management in Wales</i>	
<p>Provides the national framework for flood and erosion risk management, setting out the four overarching objectives required to achieve this for Wales:</p> <ul style="list-style-type: none"> reducing the consequences for individuals, communities, businesses and the environment from flooding and coastal erosion; raising awareness of and engaging people in the response to flood and coastal erosion risk; providing an effective and sustained response to flood and coastal erosion events; prioritising investment in the most at risk communities. 	<p>The WRMP should contribute to the reduction in flood risk and coastal erosion where possible.</p> <p>The SEA framework should consider flooding and coastal erosion.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
The Flood and Water Management Act 2010 specifies that local flood risk management strategies for Wales (as required under the 2010 Act) must be consistent with the national flood and coastal erosion risk management strategy for Wales.	
Welsh Government (2010) <i>The Biodiversity Framework for Wales</i>	
This document sets out to provide a delivery mechanism for a number of biodiversity related Outcomes set out in the Wales Environment Strategy. It defines the importance of biodiversity, describing the current situation in Wales. It considers policy and legislative drivers at a European, British and Welsh scale and sets out the roles and responsibilities of the groups and bodies responsible for halting and ultimately reversing the loss of biodiversity in Wales.	This document highlights a number of bodies with whom DCWW may need to work to ensure development of the WRMP contributes to protecting and enhancing biodiversity.
Welsh Government (2013) <i>Historic Environment Strategy for Wales</i>	
This strategy summarises the areas which the Welsh Government will prioritise for action, and aims to protect Wales' heritage whilst encouraging public access, enjoyment and participation. The Strategy sets out the role of the historic environment in delivering tangible social, economic and environmental benefits for Welsh communities. It also aims to further develop the economic role of heritage in Wales and maximise educational, training and leisure opportunities.	The WRMP should protect and enhance the historic environment. The SA should include assessment criteria relating to protection and enhancement of the historic environment.
Welsh Government (2016) <i>Historic Environment (Wales) Act 2016</i>	
The Act improves the existing systems for the protection and sustainable management of the Welsh historic environment. It also gives more effective protection to listed buildings and scheduled monuments and enhances existing mechanisms for the sustainable management of the historic environment. The Act also creates new measures that enables authorities to halt works if protected buildings or monuments are under threat from unauthorised activities and to take action against those who have damaged or destroyed monuments.	The WRMP have regard to the requirements of the Act. The SEA assessment should include criteria relating to the protection of the historic environment.
Welsh Government (2015) <i>Water Strategy for Wales</i>	
This Strategy sets out our long-term policy direction in relation to water. The aim is to ensure we have a more integrated and sustainable approach to managing our water and associated services in Wales. This Strategy has been developed within this context and will contribute to the implementation of our wider natural resource management policy. A more integrated approach to the way water resources in Wales are managed will help to promote the coordinated management of water, land and related resources. This in turn will enable us to maximise economic and social benefits, including tackling poverty in an equitable way while protecting vital ecosystems and the environment. The Strategy aims ensure the long-term needs of a sustainable and resilient environment and that there are sufficient, reliable water resources and waste water services available in Wales. This approach will also drive green growth by providing an essential resource for businesses, as well as providing new opportunities for employment.	WRMPs are specifically mentioned in the Strategy in relation to the reduction of water leakage. The WRMP will have a key role in contributing to the wider objectives of the Strategy. The SEA should include objectives/guide questions relating to sustainable resource use.
Welsh Government (2013) <i>Partnership for Growth: The Welsh Government Strategy for Tourism 2013 – 2020</i>	
The strategy identifies the priorities to deliver a prosperous and competitive tourism industry in Wales. It sets out how Welsh tourism will be promoted and communicated more effectively and how investment will be directed to improve quality and choice for the consumer.	The WRMP could take account of the benefits that tourism can bring to Wales. The SEA should include assessment criteria relating the importance of tourism and/or recreation.
Welsh Government (2015) <i>The Welsh National Marine Plan – Initial Draft</i>	
This draft plan sets out how the Welsh Government will achieve sustainable development in the Welsh marine area through the sustainable management of marine natural resources. It covers both Welsh inshore and offshore waters and sets out the following vision, which will be achieved through the plan's objectives and policies: <ul style="list-style-type: none"> • By 2036, Welsh seas are clean, healthy, safe, productive and biologically diverse: <ul style="list-style-type: none"> • Through an ecosystem based approach, our seas are healthy and resilient and support a sustainable and thriving economy. • Through access to and enjoyment of the marine environment, health and wellbeing are improving. 	The WRMP should take into account its effects on coastal areas. The SEA assessment should take into account the effects of the actions on the coast/marine environment where relevant.

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<ul style="list-style-type: none"> Blue growth is creating more jobs and wealth; and, is helping coastal communities become more resilient, prosperous and equitable with a vibrant culture. <p>The Welsh marine area is making a strong contribution to energy security and climate change emissions targets through the responsible deployment of low carbon technologies.</p>	
Welsh Government (2015) <i>Well-being of Future Generations (Wales) Act 2015</i>	
<p>The Act includes 7 goals that all public bodies should work towards:</p> <ul style="list-style-type: none"> A prosperous Wales A resilient Wales A healthier Wales A more equal Wales A Wales of cohesive communities A Wales of vibrant culture and thriving Welsh Language A globally responsible Wales <p>The Act establishes a statutory Future Generations Commissioner for Wales, whose role is to act as a guardian for the interests of future generations in Wales, and to support the public bodies listed in the Act to work towards achieving the well-being goals.</p> <p>The Act also establishes Public Services Boards (PSBs) for each local authority area in Wales. Each PSB must improve the economic, social, environmental and cultural well-being of its area by working to achieve the well-being goals.</p>	<p>The WRMP should consider how it can contribute to the seven well-being goals set out in the Act.</p> <p>The SEA Framework should reflect the seven well-being goals.</p>
Welsh Government (2015) <i>Nature Recovery Plan</i>	
<p>The Nature Recovery Plan for Wales is aimed at addressing the underlying causes of biodiversity loss by:</p> <ul style="list-style-type: none"> putting nature at the heart of decision-making in Wales; increasing the resilience of the natural environment in Wales; and taking specific action for habitats and species. <p>It sets out how Wales will deliver the commitments of the UN Convention on Biological Diversity and the EU Biodiversity Strategy to halt the decline in biodiversity by 2020 and then reverse that decline. It also sets out current and proposed actions, particularly through the Well-being of Future Generations (Wales) Act 2015, and emphasises the approach to natural resource management introduced in the 2016 Environment Act Wales.</p>	<p>The WRMP should support the protection and enhancement of biodiversity, and promote resilience in ecosystems.</p> <p>The SEA assessment should include criteria relating to the protection of species and habitats, and the enhancement of ecosystem resilience.</p>
Welsh Government (2016) <i>The Environment (Wales) Act 2016</i>	
<p>The overarching aims of the Act are to enable Wales' resources to be managed in a more proactive, sustainable and joined-up way and to establish the legislative framework necessary to tackle climate change.</p> <p>Some of the specific provisions in the Act include:</p> <ul style="list-style-type: none"> Helping to plan and manage Wales' natural resources at a national and local level, through a State of Natural Resources Report, a National Natural Resources Policy and area statements. Providing Natural Resources Wales (NRW) with a general purpose that aligns fully with the statutory principles for the sustainable management of natural resources. Providing NRW with powers to undertake land management agreements and experimental schemes. Providing public authorities with a reshaped requirement to seek to maintain and enhance biodiversity and promote resilience of ecosystems. Placing statutory emission reduction targets and carbon budgeting to support their delivery. Enabling improvements to the existing scheme for single use carrier bags. Providing the Welsh Ministers with powers to take action to achieve higher levels of recycling for business waste, food waste treatment and energy recovery. Clarifying the law for a number of existing environmental regulatory regimes including marine licensing, shellfisheries management, land drainage and flood risk management. <p>The Act requires all public authorities (including water/sewerage statutory undertakers), when carrying out their functions in Wales, to seek to "maintain and enhance biodiversity". In doing so, public authorities must also seek to "promote the resilience of ecosystems". This new duty under s6</p>	<p>The WRMP should enhance biodiversity, promote resilience in ecosystems and maintain and enhance biodiversity.</p> <p>The SEA framework should include consideration of resilience in ecosystems and the maintenance and enhancement of biodiversity and resource use.</p>

National Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
<p>also requires public authorities to prepare and publish a plan on how they intend to comply with the biodiversity and resilience of ecosystems obligations, and to report every three years on the actions they have taken.</p> <p>Under s7 of the Act, Welsh Ministers must prepare and publish a list of the organisms and habitat which are of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales, which will be kept under review with NRW. This list will inform the biodiversity duties under s6 above.</p>	
Welsh Government (2016) <i>The State of Natural Resources Report (SoNaRR)</i>	
<p>The report sets out the states of Wales' natural resources. It assesses the extent to which natural resources in Wales are being sustainably managed, and recommends a proactive approach to building resilience. The report identifies risks and threats and opportunities for integrated solutions that provide multiple benefits (social, cultural, environmental and economic).</p>	<p>The WRMP should have regard to opportunities to address risks and threats identified in the report and identify integrated solutions.</p> <p>The SEA should have regard to the risks, threats and opportunities identified in the report and the extent to which opportunities for integrated solutions can be incorporated in the WRMP.</p>
Welsh Government (2017) <i>Natural Resources Policy</i>	
<p>The Natural Resources Policy (NRP) is the second statutory product of the Environment (Wales) Act. The focus of the NRP is the sustainable management of Wales' natural resources, to maximise their contribution to achieving goals within the Well-being of Future Generations Act. The policy sets out three National Priorities. These are:</p> <ul style="list-style-type: none"> • Delivering nature-based solutions, • Increasing renewable energy and resource efficiency, • Taking a place-based approach. <p>Nature-based solutions may include developing resilient ecological networks, climate change adaptation and mitigation, flood risk management, green infrastructure, better soil and peat bog management, among others.</p>	<p>The WRMP should have regard to the National Priorities in the NRP.</p> <p>The SEA should include assessment criteria relating to protection and enhancement of the environment, ecology, soils, flooding and climate change.</p>
Welsh Government (2016) <i>Guiding Principles for Developing Water Resources Management Plans</i>	
<p>The Guiding Principles set out the Welsh Government's expectations in terms of the role and content of WRMPs. The link is also made with recent legislation (including the Environment (Wales) Act and the Well-being of Future Generations (Wales) Act 2015). The process for preparing WRMPs is also set out in the document.</p>	<p>The WRMP will need to have regard to the Guiding Principles as a key over-arching document.</p>

Regional Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
Water Company (various) Drought Plans	
<p>Drought Plans set out the steps that each water company will take through the stages of developing drought, drought, severe drought and recovery from drought to ensure their supply of water resources. Drought Plans must be produced by all water companies to fulfil their requirements under the Water Act 2003. Those Drought Plans relevant to the WRMP are:</p> <ul style="list-style-type: none"> - Dee Valley Water Drought Plan; - Albion Water Draft Drought Plan; - Severn Trent Water Drought Plan; - United Utilities Drought Plan; and - Thames Water. 	<p>The WRMP will need to be in accordance with neighbouring Drought Plans and take into account those triggers and supply and demand side options which are relevant to the Welsh Water area.</p> <p>The SEA assessment framework should include a guide question on the effects of the WRMP on water resources and commentary on whether they affect the water resource zones' ability to manage drought. The baseline should, where appropriate, take into account relevant information from neighbouring plans.</p>
Water Company (various) Water Resources Management Plans	
<p>Water companies in England and Wales, are required to prepare, maintain and publish a WRMP under the Water Industry Act 1991, updated by the provisions in section 37A-D of the Water Act 2003 and the Water Act 2014 and the Environment (Wales) Act 2016. The plan must set out how a water company intends to maintain the balance between supply and demand for water over a minimum of a 25 year period. This is complemented by a water company drought plan, which sets out the short-term operational steps a company will take as a drought progresses.</p> <p>Those neighbouring Water Resource Management Plans relevant to the plan are:</p> <ul style="list-style-type: none"> - Dee Valley; - Severn Trent Water - United Utilities - Bristol Water - Thames Water. 	<p>The WRMP should take account of emerging neighbouring plans where appropriate.</p> <p>The SEA should include an objective/guide question relating to water resources.</p>
Dŵr Cymru Welsh Water (2007) Our Sustainable Future	
<p>Our Sustainable Future sets out Welsh Water's long term strategy which comprises the following dimensions:</p> <ul style="list-style-type: none"> - Protecting public health; - Safeguarding the environment; - Responding to climate change; - Meeting customer's expectations; - Looking after our assets; - Financing the business; - Employer of choice; and - Affordability and value for money <p>The document identifies a range of priorities and targets under these themes including, for example:</p> <ul style="list-style-type: none"> - Undertaking, where appropriate, improvements to the quality of discharges to meet the requirements of the Habitats Directive; - Improving preliminary treatment at 15 key wastewater treatment works; - Reducing total carbon footprint by 25 per cent; - Renewing 220km of sewers; - Providing robust infrastructure to enable the economic growth of Wales. 	<p>The WRMP should seek to support the delivery of Our Sustainable Future.</p> <p>The objectives and guide questions that comprise the SEA Framework should, where appropriate, reflect the priorities set out in this strategy.</p>
Dŵr Cymru Welsh Water (2017) Making Time for Nature: Dŵr Cymru Welsh Water's Plan for Maintaining and Enhancing Biodiversity	
<p>Making Time for Nature is Welsh Water's first statutory plan published under section 6 of the Environment (Wales) Act 2016 (the 'biodiversity duty'). It signposts what Welsh Water will do between now and the end of 2019 to maintain and enhance biodiversity and promote the resilience of ecosystems, and sets out 30 actions to be delivered by 2019.</p>	<p>The WRMP should seek to support the delivery of Making Time for Nature.</p> <p>The SEA assessment should include criteria relating to the protection of species and habitats, and the enhancement of ecosystem resilience.</p>

Sub-regional/ Local Plans and Programmes	
Purpose of the Document, including Objectives and Targets relevant to the Water Resources Management Plan and SEA	Relationships and Influences on the WRMP and the SEA
Area of Outstanding Natural Beauty Management Units (various) AONB Management Plans	
<p>The following AONBs are present in the Welsh Water area:</p> <ul style="list-style-type: none"> - Anglesey; - Clywdian Range and Dee Valley; - Gower; - Llyn; - Wye Valley. <p>The management plans for AONBs contain actions to ensure the protection and enhancement of the landscape.</p>	<p>WRMP options within AONBs should be consistent with the management plan.</p> <p>The SEA assessment framework should consider the effects of options on landscapes, including designated landscapes.</p>
Defra (Various) Eel Management Plans	
<p>Eel management plans describe the current status of Eel populations across river basin districts and assesses compliance with targets set out in EU Council Regs 110/2207.</p> <p>Relevant Eel Management Plans are set out below:</p> <ul style="list-style-type: none"> - Eel Management Plan for Western Wales River Basin District - Eel Management Plan for Severn River Basin District; - Eel Management Plan for Dee River Basin District. 	<p>The WRMP should take Eel management plans into account.</p>
Environment Agency / Natural Resources Wales (various) Flood Risk Management Plans	
<p>Flood Risk Management Plans (FRMPs) give an overview of the flood risk across each river catchment. They recommend ways of managing those risks now and over the next 50-100 years. FRMPs consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea, (coastal flooding), which is covered in Shoreline Management Plans. They also take into account the likely impacts of climate change, the effects of how we use and manage the land, and how areas could be developed to meet our present day needs without compromising the ability of future generations to meet their own needs.</p> <p>Those FRMPs present in the Welsh Water area are:</p> <ul style="list-style-type: none"> - Wye and Usk; - Eastern Valleys; - Taff and Ely; - Ogmore to Tawe (including Thaw and Cadoxton); - Loughor to Taf; - Pembrokeshire and Ceredigion Rivers; - North West Wales; - Conwy and Clwyd; - River Dee. 	<p>The WRMP should take FRMPs into account.</p> <p>The SEA should include a guide question relating to flood risk.</p>
Environment Agency / Natural Resources Wales (various) River Basin Management Plans	
<p>River Basin Management Plans (RBMPs) set out how the water environment will be managed and provide a framework for more detailed decisions to be made. RBMPs set out a more integrated approach to river basin management based on the following principles:</p> <ul style="list-style-type: none"> - Integrate and streamline plans and processes; - Set out a clear, transparent and accessible process of analysis and decision-making; - Focus at the river basin district level; - Work in partnership with other regulators; - Encourage active involvement of a broad cross-section of stakeholders; - Make use of the alternative objectives to deliver sustainable development; - Use Better Regulation principles and consider the cost-effectiveness of the full range of possible measures; - Seek to be even handed across different sectors of society and sectors of industry; - Seek to be even handed and transparent in the management of uncertainty; - Develop methodologies and refine analyses as more information becomes available. <p>RBMPs in the Welsh Water area are Severn, Western Wales and Dee.</p>	<p>The WRMP should reflect the broad objectives of these plans.</p> <p>The SEA objectives should reflect the need to manage water resources on a catchment basis in a sustainable manner.</p>
Environment Agency / Natural Resources Wales (various) Catchment Abstraction Management Strategies	
<p>Catchment Abstraction Management Strategies (CAMS) set out how water resources will be managed in each catchment and provide information on how existing abstraction licenses are managed and the availability of water for further abstraction.</p> <p>Within each CAMS, river flows and groundwater levels are monitored and assessed alongside the amount of water which has been abstracted on average over the previous six years and the situation</p>	<p>The WRMP should take CAMS into account.</p> <p>The SEA should include a guide question relating to sustainable water use.</p>

<p>if all abstraction licences were used to full capacity. This data is used to determine the water availability for each water body.</p> <p>CAMS within the Welsh Water area include:</p> <ul style="list-style-type: none"> - River Wye - Teifi and North Ceredigion - Carmarthen Bay - Anglesey - Conwy - Llŷn and Eryri - River Usk - Thaw and Cadoxton - The Cleddau and Pembrokeshire Coastal Rivers - The Swansea Bay - Clwyd - Dee - Meirionnydd 	
<p>Environment Agency (2017) Wye Waterway Plan 2017-2022</p>	
<p>The plan sets out the Environment Agency's responsibilities for navigation on the Rivers Wye and Lugg and the wider responsibilities for the conservation of these rivers. The plan's vision is to develop and promote appropriate navigation and recreational activities for all waterway users on the Rivers Wye and Lugg, while protecting and enhancing the unique conservation status of the waterway. The plan's aims include:</p> <ul style="list-style-type: none"> • manage, improve and enhance navigation opportunities for the waterway; • encourage the appropriate use and enjoyment of the waterway by walkers, anglers and other recreational users; • contribute to enhanced biodiversity, heritage and landscape values of the waterway; and • develop the health, economic and social benefits of navigation, to the advantage of everyone. <p>It includes a prioritised action plan to complete within the next five years.</p>	<p>WRMP options in the Wye catchment should be consistent with the aims of the Wye Waterway Plan.</p> <p>The SEA assessment should consider the effects of options on recreational use of waterways.</p>
<p>Environment Agency (various) Salmon Action Plans</p>	
<p>Salmon action plans have been produced for the following river catchments in Wales;</p> <ul style="list-style-type: none"> - Cleddau; - Clwyd; - Conwy; - Dee; - Dwyfor; - River Dyfi; - Dysynni; - Glaslyn and Dwyrdd; - Mawddach; - Nevern; - Ogmere; - Ogwen; - Rheidol; - Taf; - Taff and Ely; - Tawe; - Teifi; - River Usk; - River Wye. <p>The aim of the action plans is to ensure the objectives set out in the National Salmon Strategy are met. They set out what needs to be done to support and restore salmon populations. Individual targets are set out in each action plan</p>	<p>The WRMP should consider the effect of options on salmon populations.</p> <p>The SEA assessment framework should include a guide question relating to the effects of options on fish.</p>
<p>Local Biodiversity Action Plans (LBAPs), including Species and Habitats Action Plans (various)</p>	

<p>27 LBAPs in Wales and one for Herefordshire.</p> <p>Each Local Biodiversity Action Plan works on the basis of partnership to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets. They include targets for increasing and enhancing biodiversity.</p> <p>Species Action Plans set objectives with regard specific species and set out proposed actions and targets along with which agency will be responsible for carrying them out.</p> <p>Habitat Action Plans sets objectives with regard specific UK habitats and sets out proposed actions targets along with which agency will be responsible for carrying them out.</p>	<p>WRMP options should take into account LBAP objectives.</p> <p>The SEA assessment should consider effects of options on biodiversity and outline enhancement and mitigation opportunities where these are identified.</p>
<p>Local Geodiversity Action Plans (LGAPs)</p>	
<p>Local Geodiversity Action Plans (LGAPs) set out actions to conserve and enhance the geodiversity of a particular area. In general they aim to identify, conserve and enhance the best sites that represent the geological history of an area. They also aim to promote geological sites, provide a local geodiversity audit and influence local planning policy.</p> <p>Two LGAPs exist or are in development in Wales (Anglesey and Clwydian Range and Dee Valley AONB), in addition to Herefordshire in England (among others).</p>	<p>WRMP options should take into account the aims of the LGAPs.</p> <p>The SEA assessment should consider effects of options on geodiversity and outline enhancement and mitigation opportunities where these are identified.</p>
<p>Local Planning Authority (various) Land Use Plans</p>	
<p>The Welsh Water area covers a large number of Local Planning Authorities. These have been identified as:</p> <ul style="list-style-type: none"> - Conwy; - Blaenau Gwent; - Brecon Beacons National Park; - Bridgend - Caerphilly; - Cardiff; - Carmarthenshire; - Ceredigion; - Denbighshire; - Flintshire; - Gwynedd; - Herefordshire; - Merthyr Tydfil; - Monmouthshire; - Neath Port Talbot; - Newport; - Pembrokeshire; - Pembrokeshire Coast National Park; - Powys; - Rhondda Cynon Taff; - Snowdonia National Park; - Swansea; - Torfaen; - Vale of Glamorgan; - Wrexham; - Ynys Mon. <p>The main objectives of the existing and emerging Land Use Plans in these areas are related to the sustainable development of the area.</p>	<p>WRMP options should be consistent with the Land Use Plans of those local authorities that will be affected by the option.</p>
<p>National Park Management Plans (various)</p>	
<p>The following National Parks are present in the Welsh Water area:</p> <ul style="list-style-type: none"> - Snowdonia; - Brecon Beacons; - Pembrokeshire Coast. <p>The management plans for National Parks contain actions to ensure the protection and enhancement of the landscape and natural environment of these areas.</p>	<p>WRMP options within the National Parks should be consistent with the respective management plan.</p> <p>The SEA assessment framework should consider the effects of options on landscapes and the natural environment, including designated areas.</p>



Shoreline Management Plans (various)	
<p>Shoreline Management Plans are prepared in England and Wales. They are developed by Coastal Groups with members drawn from local authorities and other stakeholders. They identify the most sustainable approach to managing the flood and coastal risks to the coastline in the short term (up to 20 years), medium term (20 to 50 years) and long term (50 to 100 years).</p> <p>Relevant plans include:</p> <ul style="list-style-type: none">• North West England and North Wales Shoreline Management Plan• Severn Estuary Shoreline Management Plan• Lavernock Point to St Ann's Head Shoreline Management Plan• West of Wales Shoreline Management Plan	<p>WRMP options should take into account the policies and actions of the SMP.</p> <p>Where appropriate, the SEA should consider the cumulative effect of SMP policies and actions and WRMP options.</p>



Appendix B

Criteria for Assessing Significance

Objective	Key Questions	Effect	Description	Illustrative Guidance
1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity.	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?	++	Significant Positive	The option would result in a major enhancement of the quality of designated habitats due to changes in flow or groundwater levels or water quality. The option would result in a major increase in the population of a priority species.
	Will the option protect and enhance non-designated sites and local biodiversity?	+	Positive	The option would result in a minor enhancement of the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels or water quality. The option would result in a minor increase in the population of a priority species.
	Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?	0	Neutral	The option would not result in any effects on European, national designated or non-designated sites and/or species.
	Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?	-	Negative	The option would result in minor, short term negative effects on non-designated sites (e.g. through decreases in flows/water quality, or some loss of habitat leading to a temporary loss of ecosystem structure and function).
	Will the option protect, and enhance where appropriate, coastal and marine habitats and species?	--	Significant Negative	The option would have a negative effect on European or national designated sites and/or protected species (i.e. on the interest features and integrity of the site, by preventing any of the conservation objectives from being achieved or resulting in a long term decrease in the population of a priority species). These effects could not be reasonably mitigated. The option would result in major, long term negative effects on non-designated sites (e.g. through decreases in flows/water quality, or significant loss of habitat leading to a long term loss of ecosystem structure and function).
	Will the option prevent the spread/introduction of invasive non-native species? Will the option maintain and enhance the green infrastructure network and the biodiversity it supports? Will the option contribute to the restoration of species that are currently not achieving management objectives? Will the option maintain and enhance ecosystem resilience?	?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
2. To ensure the appropriate and efficient use of	Will additional land be required for the development or implementation of the option or	++	Significant Positive	No option is expected to have a significant positive effect on achieving this objective.

Objective	Key Questions	Effect	Description	Illustrative Guidance
land and protect and enhance soil quality and geodiversity.	will the option require below ground works leading to land sterilisation?	+	Positive	The option would be located on a brownfield site and would have no effect on soils or existing land uses. The option would result in the remediation of contaminated land.
	Will the option utilise previously developed land?	0	Neutral	The option would have no effect on soils or land use.
	Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?	-	Negative	The option would not be located on a brownfield site and/or would result in a minor loss of best and most versatile agricultural land, or would be in conflict with existing land uses. The option would result in land contamination.
	Will the option minimise the loss of best and most versatile agricultural land?	--	Significant Negative	The option would not be located on a brownfield site and would result in a major loss of best and most versatile agricultural land, or would be in conflict with existing land uses. The option would result in land contamination.
	Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination?	?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.	Will the option minimise the demand for water resources?	++	Significant Positive	The option would result in a major increase in river flows. The option would result in a major increase in groundwater levels.
	Will the option result in changes to river flows?	+	Positive	The option would achieve water savings through demand management and does not require abstraction to achieve deployable output. The option would result in a minor increase in river flows. The option would result in a minor increase in groundwater levels.
	Will the option result in changes to groundwater levels?	0	Neutral	The option would have no discernible effect on river flows or groundwater levels.
		-	Negative	The option would result in minor decreases in river flows. The option would result in minor decreases in groundwater levels.
		--	Significant Negative	The option would result in major decreases in river flows. The option would result in major decreases in groundwater levels.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
4. To protect and enhance the	Will the option protect and improve surface, groundwater,	++	Significant Positive	The option would address failure of WFD Good Ecological Status/Good Ecological Potential.

Objective	Key Questions	Effect	Description	Illustrative Guidance
quality of surface and groundwater resources and the ecological status of water bodies.	estuarine and coastal water quality?	+	Positive	The option would result in minor improvements in surface and ground water quality.
	Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?	0	Neutral	The option would have no discernible effect on surface/coastal water quality or on groundwater quality. The option would not lead to a change in WFD classification.
	Will the option support the achievement of protected area objectives?	-	Negative	The option would affect river and/or coastal water quality and lead to short term or intermittent effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not be avoided but could be mitigated. The option would result in minor decreases in groundwater quality.
	Will the option support the achievement of environmental objectives set out in River Basin Management Plans?	--	Significant Negative	The option would affect river and/or coastal water quality and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated. The option would result in the deterioration of WFD classification. The option would result in major decreases in groundwater quality.
	Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?			
	?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.	
5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?	++	Significant Positive	No options are expected to have a significant positive effect on achieving this objective.
		+	Positive	The option has the potential to help alleviate flooding in the catchment.
	Will the option have the potential to help alleviate flooding in the catchment area now or in the future?	0	Neutral	The option would involve the construction of above-ground water supply infrastructure, but is located outside floodplain areas. It is anticipated that the option would neither cause nor exacerbate flooding in the catchment.
	Will the option be at risk of flooding now or in the future?	-	Negative	The option would involve the construction of above-ground water supply infrastructure and be located within the 1 in 1000 year floodplain.
	Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?	--	Significant Negative	The option would involve the construction of above-ground water supply infrastructure and be located within the 1 in 100 year floodplain.

Objective	Key Questions	Effect	Description	Illustrative Guidance
	<p>Will the option promote the use of sustainable drainage systems?</p> <p>Will the option promote opportunities for collaborative working with other risk management authorities?</p> <p>Will the option affect the risk of flooding to people and/or property?</p> <p>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</p>	?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
6. To limit the causes and potential consequences of climate change and to adapt to future changes.	Will the option reduce or minimise greenhouse gas emissions?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
	Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?	+	Positive	The option would result in a sustained decrease in greenhouse gas emissions (100-999 tonnes CO ₂ e/a) and would increase resilience/decrease vulnerability to climate change effects.
	Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?	0	Neutral	The option would have no discernible effect on greenhouse gas emissions, nor would the option increase resilience/decrease vulnerability to climate change effects.
	Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?	-	Negative	The option would result in a minor or temporary major increase in greenhouse gas emissions (100-999 tonnes CO ₂ e) or the option would not increase resilience/decrease vulnerability to climate change effects.
	Will coastal erosion have consequences on the operation of this option now or in the future, taking account of expected climate change sea level rise?	--	Significant Negative	The option would result in major or long term increases in greenhouse gas emissions (>1000 tonnes CO ₂ e) and the option would not increase resilience/decrease vulnerability to climate change effects.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
7. To ensure the protection and enhancement of human health.	<p>Will the option ensure the continuity of a safe and secure drinking water supply?</p> <p>Will the option impact on physical health and mental well-</p>	++	Significant Positive	The option would lead to a major increase in deployable output (>10 Ml/d) of drinking water, would have a sustained positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits.



Objective	Key Questions	Effect	Description	Illustrative Guidance
	<p>being by affecting opportunities for informal outdoor recreation?</p> <p>Will the option maintain surface water and bathing water quality within statutory standards?</p> <p>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</p> <p>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</p>	+	Positive	The option would lead to a minor increase in deployable output (1-10 MI/d) of drinking water, would have a temporary positive effect on the health of local communities and would ensure that surface water and bathing water quality is maintained within statutory limits.
		0	Neutral	No option is expected to have a neutral effect on achieving this objective.
		-	Negative	The option would result in the deterioration of surface water or bathing water quality and would have a temporary effect on human health (e.g. noise).
		--	Significant Negative	The option would result in the deterioration of surface water or bathing water quality and have a long term effect on human health (e.g. noise).
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
8. To maintain and enhance the economic and social well-being of the local community.	<p>Will the option ensure sufficient infrastructure is in place for predicted population increases?</p> <p>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</p> <p>Will the option help to meet the employment needs of local people?</p> <p>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</p> <p>Will the option improve access to local services and facilities (e.g. sport and recreation)?</p> <p>Will the option contribute to sustaining and growing the local and regional economy?</p> <p>Will the option avoid disruption through effects on the transport network?</p>	++	Significant Positive	The option would result in a significant increase in construction jobs (capital spend of >£10m). The option would create new, and significantly enhance existing, recreational facilities within the operational area. The option would provide an additional deployable output of >10 MI/d.
		+	Positive	The option would result in an increase in construction jobs (capital spend £5-9.9m). The option would enhance existing recreational facilities within the operational area. The option would provide an additional deployable output of 1-10 MI/d.
		0	Neutral	The option would have no effect on local employment opportunities, the regional or local economy, or on recreational facilities. The option would provide an additional deployable output of <1 MI/d.
		-	Negative	The option would reduce the availability and quality of existing recreational facilities within the operational area. It is not expected that any options will have a negative effect on employment opportunities, the economy or deployable output.

Objective	Key Questions	Effect	Description	Illustrative Guidance
	Will the option be resilient to future changes in resources (both financial and human)? Will the option improve opportunities for social interaction and community cohesion?	--	Significant Negative	The option would result in the removal of existing recreational facilities within the operational area. It is not expected that any options will have a negative effect on employment opportunities, the economy or deployable output.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
9. To ensure the sustainable and efficient use of water resources.	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	++	Significant Positive	The option would involve reducing leakage from the supply network or is a water efficiency option with a deployable output of >5 MI/d.
		+	Positive	The option would involve reducing leakage from the supply network or is a water efficiency option with a deployable output of <5 MI/d.
		0	Neutral	The option is not a leakage reduction or water efficiency option.
		-	Negative	No options are expected to result in a negative effect on achieving this objective.
		--	Significant Negative	No options are expected to result in a significant negative effect on achieving this objective.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
10. To promote the efficient use of resources.	Will the option seek to minimise the demand for raw materials? Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
		+	Positive	The option would re-use or recycle substantial quantities of waste materials and any new infrastructure would incorporate substantial sustainable design measures and materials. There would be no increase in energy consumption.
		0	Neutral	The option would largely rely on existing infrastructure and only require small quantities of additional materials to realise deployable output. No additional energy use required.
		-	Negative	The option would require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. There are limited opportunities for sustainable design or the use of sustainable materials. The option would result in a minor increase in energy consumption.



Objective	Key Questions	Effect	Description	Illustrative Guidance
		--	Significant Negative	The option would require significant new infrastructure that cannot be provided through the re-use or recycling of waste materials. There are no opportunities for sustainable design or the use of sustainable materials. The option would result in a major increase in energy consumption.
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
11. To conserve and enhance the cultural, historic and industrial heritage resource.	Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings?	++	Significant Positive	The option would result in enhancements to designated heritage assets and/or their setting, fully realising the significance and value of the asset, such as: <ul style="list-style-type: none"> • Securing repairs or improvements to heritage assets, especially those identified in the Historic England Buildings/Monuments at Risk Register; • Improving interpretation and public access to important heritage assets. There would be no damage to known archaeological sites or remains or geologically important sites.
	Will the option avoid or minimise damage to archaeologically important sites?	+	Positive	The option would result in enhancements to heritage assets and/or their setting, whether designated or not. There would be no damage to known archaeological sites or remains or geologically important sites.
	Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?	0	Neutral	The option would have no effect on cultural heritage assets or archaeological sites/remains.
	Will the option affect public access to, or enjoyment of, features of cultural heritage?	-	Negative	The option would result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. There would be limited damage to known, undesignated archaeological sites/remains or geologically important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
	Will the option protect or enhance Welsh language and culture?			

Objective	Key Questions	Effect	Description	Illustrative Guidance
		--	Significant Negative	<p>The option would diminish the significance of designated heritage assets and/or their setting such as:</p> <ul style="list-style-type: none"> Demolition or further deterioration in the condition of designated heritage assets especially those identified in the Historic England Buildings/Monuments at Risk Register; Loss of public access to important heritage assets and lack of appropriate interpretation. <p>There would be major damage to known, designated archaeological sites/remains or geologically important sites with a consequent loss of significance only partly mitigated by archaeological investigation.</p>
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.
12. To conserve and enhance landscape character	<p>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</p> <p>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</p> <p>Will the option affect public access to existing landscape features?</p> <p>Will the option minimise adverse visual impacts?</p>	++	Significant Positive	The option would result in new, above ground infrastructure that significantly enhances the local landscape, townscape or seascape.
		+	Positive	The option would result in new, above ground infrastructure that has a minor positive effect on the local landscape, townscape or seascape.
		0	Neutral	The option would result in new, above ground infrastructure but is not located within or visible from a protected/designated landscape, townscape or seascape and would have no effect on the character or public amenity value of its setting.
		-	Negative	The option would result in new, above ground infrastructure that has a minor negative effect on the local landscape, townscape or seascape.
		--	Significant Negative	<p>The option would have a negative effect on designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated.</p> <p>The option would result in new, above ground infrastructure that has a major negative effect on the local landscape, townscape or seascape.</p>
		?	Uncertain	From the level of information available, the effect that the option would have on this objective is uncertain.



Appendix C

Feasible Options Assessment Matrices



Feasible Supply-side Options

Pembrokeshire Resource Zone

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM001 Re-instate Milton source for industrial customers (non-potable)	Construction	-/?	0	0	0	-	0	0	0	0	-	0	-
	Operation	?	0	-	0	0	-	0	0	0	-	0	0

Construction

This option would reinstate the existing Milton borehole, currently used as an emergency source during periods of high demand to supplement the potable supply from Bolton Hill WTW. Water would be abstracted from the borehole and softened and blended with existing supplies to deliver water to the South Pembrokeshire Industrial Supplies. This would allow other water that is currently abstracted from the Eastern Cleddau to be used over the wider WRZ. The option would include the following works: new borehole pumps; installation of an upgraded power supply and new mains cable connector; and a new 0.5km raw water main (200mm diameter) from boreholes would be required to connect the Milton supply to the existing raw water main. The Milton borehole is currently licence exempt, however a licence will be required for future abstractions.

Pembrokeshire Marine / Sir Benfro Forol SAC has the potential to be affected by the option as the borehole is located <0.5km from the SAC. The closest features are Estuaries; Mudflats and Sandflats; and Atlantic Salt Meadows, which are all present within Radford Pill (the estuary inlet closest to Milton). Mitigation measures or amendments to the scheme design may need to be taken to ensure that construction activities and any resulting dust and disturbance do not have an adverse effect on this habitat and any associated species. There is a small risk of effects on the interest features of the Pembrokeshire Bat Sites and Bosherton Lakes/ Saffleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC, depending on raw water main route and impact on hedges. Ecological effects would be reduced by using best practice construction measures, and the scheme would be unlikely to affect the features of this designated site as a result of construction. There are no other ecological international, national and locally designated sites within or in the immediate vicinity of this option. The pipeline would cross areas farmland which has the potential for temporary disturbance. A negative effect has been identified in respect of biodiversity at this stage given the potential for short term, localised disturbance, in addition to uncertainty relating to the pipeline route and the effects on Pembrokeshire Marine / Sir Benfro Forol SAC as noted in the HRA.

The route of the new pipeline is likely to cross some areas of agriculture/pasture land. However, disruption would be temporary and the ground reinstated after construction. Overall, a neutral effect has been identified with respect to geology and soils.

Construction of this option is not expected to have any effects on water quantity.



The construction of the 500m of new pipeline and borehole works could lead to some very minor or localised effects on parts of the groundwater waterbody. However, this would be dependent upon the construction method used, e.g. cut and cover laying of the pipes has the potential to disturb groundwater more than HDD. However, in all cases any effects are expected to be temporary and limited to the construction route. Therefore, it is not anticipated that construction of this option would affect water quality, provided best construction techniques are adopted.

The proposed route crosses areas within the Flood Zones 2 and 3, however construction works would not be expected to exacerbate flood risk provided that mitigation measures are implemented. A minor negative effect has therefore been identified in respect of flood risk.

Construction would result in the release of 59 tonnes of CO₂e which has been assessed as having a neutral effect on climate change.

The route of the new water main would cross some areas of agriculture/pasture land and pass through some urban areas. There may therefore be temporary noise and dust effects from construction plant experienced by any recreational users; however, this would be very localised and transitory.

During construction, there is potential for some very localised disruption to traffic as the new pipeline is installed, however the small scale of the work means that disruption is expected to be negligible. The capital expenditure of the scheme is too low to have an effect on the local economy though job creation. Overall this is considered to have a neutral effect with respect to wellbeing.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on water efficiency during construction.

Raw materials and energy would be required for the construction of the new water main and borehole installation, and waste would also be generated. The effect waste and resources has been identified as negative.

The new pipeline route does not pass any listed buildings and negative effects on heritage features are not expected.

The site is located just outside (<0.5km) the Pembrokeshire Coast National Park. The construction of the new pipeline and the upgrade of borehole pumps would have short term impacts on the landscape during construction and this option has been assessed as having a minor negative effect against the landscape objective.

Operation

The HRA notes that the effects of the abstraction on key features of the nearest SSSI (and therefore on the Pembrokeshire Marine / Sir Benfro Forol SAC also) are likely to be negligible. However, it may not be possible to conclude no likely significant effects and hence no adverse effect without additional scheme-specific studies. This has been identified as an uncertain effect with respect to biodiversity.

There would be no operational effects on land use/soils.

As this option includes the abstraction of groundwater from the Pembrokeshire Carboniferous Limestone aquifer, there may be an operational effect on water quantity. The abstraction is from a large groundwater body located near the coast, such that the effect on water quantity is expected to be minor and localised, however the potential for a negative effect remains.

This option requires abstraction from an existing borehole and there is the potential that due to its proximity to the Milford Haven Inner transitional and coastal waterbody there is an increased risk for saltwater intrusion into the aquifer. Any effect would be localised and minor compared to the scale of the entire groundwater waterbody. In addition, the borehole could act as a pathway for contaminants into the aquifer if not maintained appropriately, although given best practice, past track record and regulation this should be mitigated. Overall a neutral effect has been identified with respect to water quality.

This option is not located within a flood zone and operation of the option would neither cause nor exacerbate flooding on the site or elsewhere.

The option would result in an increase in greenhouse gas emissions of 895 tonnes per annum of CO₂e, with a negative effect identified in relation to climate change.

The operation of the scheme would help secure water supplies, although the DO (0.02 Ml/d) would be very minor. Overall, the option has therefore been assessed as having a neutral effect on health and wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water resources.

The operation of this option would not involve additional infrastructure or resources but would result in energy usage as noted above. This has been identified as a minor negative effect with respect to waste and resources.

No effect on heritage features or assets during operation is anticipated.

The new pipeline and borehole required, once in operation, and assuming restoration of the pipeline for this option would not have an effect on landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM002b Upgrade zonal infrastructure from Bolton Hill WTW to make use of spare capacity (South Route): across the Cleddau bridge	Construction	0	0	0	0	0	-	0	+/-	0	-	0	0
	Operation	0	0	0	0	0	-	+	+	0	-	0	0

Construction

This option would involve an increase in production at Bolton Hill WTW and transfer to the Tenby area to address the predicted deficit. An additional 5 MI/d of resource can be provided to Bolton Hill from various sources and to realise this a treatment works extension must be undertaken to increase capacity, and various sections of infrastructure would need to be upgraded. Specifically, additional pipework on the Cleddau Bridge (diameter 250mm, 870m) would be required. For the DO gain of 2.46MI/d to be realised it needs to be combined with a supply option.

The option includes pipework to attach to the Cleddau Bridge to cross the Cleddau, which is part of the Pembroke Marine / Sir Benfro Forol SAC. The Pembrokeshire Marine / Sir Benfro Forol SAC interest features include Allis shad; Atlantic Salt Meadows; coastal lagoons; estuaries; large shallow inlets and bays; mudflats and sandflats; reefs; River Lamprey; sandbanks; Sea Lamprey; and Twaite shad. There is a theoretical possibility for construction impacts on the SAC if construction work on the pipeline on the bridge is not appropriately controlled or mitigated (arising from spillages and introduction of construction wastes into the SAC). The HRA also identifies the potential for effects on greater and lesser horseshoe bats and otters associated with Pembrokeshire Bat Sites and Bosherton Lakes / Safleoedd Ystum Sir Benfro a Llynnoedd Bosherton SAC and Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC. However, appropriate mitigation control and measures (including normal good working practices) would be used to ensure that the proposed works could be undertaken and accommodated without adverse effects on these SACs. In consequence, the option is not anticipated to have any effects in relation to biodiversity.

The proposed works at Bolton Hill WTW under this option are minor involving clarification, filtration and chlorination plant, to be located on the existing site, which is assessed as neutral. No other works within the option would have an effect on the geology and soils.

Construction of the option will have no discernible effects on river flows or groundwater levels.

The proposed works at Bolton Hill WTW and on the Cleddau Bridge under this option are minor. With the use of best construction practice the works would result in no effect on the aquatic environment or groundwater. The works are over 200m from the nearest watercourse.

The works on the Cleddau Bridge would be above the coastal river and as such will not have any direct impact on Cleddau river. The provision of the additional pipework and connection to mains are not expected to have any impact on the WFD status of the waterbody. In addition, the upgrade works to the Cleddau Bridge is downstream of the Westfield Pill (headwaters to tidal limit) and so will not have any impact on this waterbody. Therefore, no effects are therefore anticipated with respect to water quality.



The option is not within an area at risk of flooding so no effects are identified in relation to flood risk.

Construction of this option would result in the release of 786 tCO₂e, which has been identified as a minor negative effect with respect to climate change.

Limited effects on human health would be expected as surrounding areas are sparsely populated and any temporary effects such as noise and dust would be limited to users of the Cleddau Bridge. The option is therefore not anticipated to have a discernible effect on health during construction.

During construction, there may be localised disruption to traffic along the route of the new water main and this could have a minor adverse effect on the local communities and bridge users. The capital expenditure of the scheme is high enough to have a meaningful impact on the local economy through job creation. This option has therefore been identified as having a mixed minor positive and minor negative effect with respect to wellbeing during the construction phase.

This option is not a leakage reduction or water efficiency option so would have a neutral effect on water resources.

Construction of this option would entail the use of raw materials required for the additional filtration systems at the Bolton Hill WTW with limited scope for use of recycled materials. Raw materials and energy would also be required for the construction of the new 870 m pipeline and waste would be generated. Opportunities to reduce waste and reuse materials, along with any potential for sustainable design should be incorporated into the design without compromising structural requirements and should be considered at the planning stages. This has been identified as a minor negative effect with respect to waste and resources.

No designated heritage sites would be affected by the proposed works during the construction phase.

The site is not within a designated landscape area and given the nature of the project it is not anticipated to give rise to landscape effects during the construction phase.

Operation

Given the nature of the option it is not anticipated to have any effect in relation to biodiversity and geology and soils.

The option will have no discernible effects on river flows or groundwater levels and no effects are identified with respect to water quantity.

The operation of the new pipeline will have no impact on the waterbody as the new pipeline is downstream of the water body. As such, no effect on the aquatic environment or groundwater is anticipated during operations to impact on the WFD status of the waterbody. No effects are therefore anticipated with respect to water quality during the operational phase.

The option is not within an area at risk of flooding so no effects are identified in relation to flood risk.

The option would result in a long term increase in greenhouse gas emissions (492 tonnes per annum of CO₂e), and a minor negative effect has been identified in relation to climate change.

An additional 5 MI/d of resource can be provided to Bolton Hill WTW as a result of this option, with a final DO gain of 2.46MI/d. A minor positive effect on human health and wellbeing is therefore anticipated from the provision of a secure drinking water supply.

The option is not a leakage reduction or water efficiency option and is not anticipated to have an effect on water resources.

The operation of this option would not involve additional infrastructure or resources but would result in ongoing energy usage. This has been identified as a minor negative effect with respect to waste and resources.

No designated heritage sites would be affected by the operation of this option.

There would be new above ground infrastructure associated with this option, but the sites are not within designated landscape areas and therefore no adverse landscape effects are expected during operation.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM003 Dam raising of Llys y fran	Construction	--/?	-	0	-	-	--	-	++/-	0	--	0	-
	Operation	-/?	0	?	-	+	0	0	0	0	0	0	-

Construction

Llys-y-Fran reservoir was originally constructed in 1971. In 1992 the reservoir top water level was raised from 94.48m to 96.17m. The reservoir was designed so that if required, a second phase of raising could be undertaken that would potentially take the top water level to 106.68m. This option does not currently address additional pumping and treatment at Presili or elsewhere (Llys-y-Fran is a river regulating reservoir and controls release of water into the river for abstraction elsewhere), which would be required in order to significantly increase DO gain.

The Llys-y-Fran reservoir abuts the boundary of the Cleddau Rivers SAC/SSSI. In consequence, the HRA notes that the designated site may be directly or indirectly affected by construction works on the dam (e.g. runoff, sediment deposition etc.), although it may be possible to mitigate this with appropriate construction measures. Construction would result in some land take. Whilst the actual area of land built on would be very small (i.e. the dam itself), there would be a need for construction compounds, material storage, welfare facilities etc. which could cause localised disturbance to habitats and species. Overall, consistent with the definitions of significance, a significant negative effect has been identified but with some uncertainty, as the effects may be more limited due to the application of mitigation measures.

The raising of the reservoir would lead to a loss of undeveloped land which is assessed as a negative effect on geology and soils.

No effects are anticipated on water quantity.

There is a risk of impacts on water quality from the construction of the option. However, activities such as raising the dam and valve house building are not predicted to have long term impacts on WFD status. Appropriate precautions would need be taken during the construction to protect the quality of the water environment during construction. Overall, a minor negative effect has been identified in respect of water quality.

The option is located in an area susceptible to flooding but construction is not expected to increase flood risk on site or elsewhere.

Construction would result in the release of 7,438 tonnes of CO₂e which would have a significant negative effect on climate change.

Limited effects on human health would be expected as surrounding areas are sparsely populated and any temporary effects such as noise would be limited to recreational users. It is likely that opportunities to fish in the reservoir might be reduced and temporarily suspended during construction if water levels are lowered.



The option would involve a high capital spend and depending on the contractors employed, it could have a significant positive effect on local construction employment opportunities. However the reduction in recreational angling opportunities during construction means that this has been identified as a mixed significant positive and minor negative effect with respect to wellbeing.

Construction is not expected to have effects on water efficiency.

Raw materials and energy would be required for the construction works; waste would also be generated. This has been assessed as having a significant negative effect on waste and resources.

No designated heritage sites would be affected by the raising of the dam.

The reservoir is not affected by any landscape designations although works are likely to result in short term negative effects on landscape character and the visual amenity of recreational receptors.

Operation

Operational effects of the option are uncertain and but are expected to be negative, including a permanent loss of habitat (from raising the reservoir) and effects on species due to alterations in water temperatures associated with water release from a deeper reservoir. The HRA notes that future operating parameters for the reservoir are uncertain, but it is likely that the current flow regime will be maintained and the additional water should allow greater flexibility in operation, including release of compensation flows. The dam is thought to act as a barrier to some fish species, and modification may provide an opportunity to reduce the effect through the installation of additional measures. Overall a mixed minor negative and uncertain effect has been identified with respect to biodiversity.

No effects on soils/land use are anticipated.

The raising of the reservoir would lead to a loss of undeveloped land which is assessed as a negative effect on geology and soils.

As the future operating parameters for the reservoir are uncertain, it is not clear to what extent the current flow regime will be changed, and as such it has been assessed as uncertain.

There is a potential risk of minor impacts on WFD elements due to the increase in the size and depth of the reservoir potentially impacting benthic ecology. However, the scale of impact is not predicted to impact on the long term status of WFD compliance elements or the waterbody's' objectives. Overall, a minor negative effect has been identified in respect of water quality.

The operation of the option could contribute to attenuation of flood flows in the catchment by reducing river flow levels during times of high precipitation. This has been assessed as having a positive effect on flood risk.

Operational energy usage is currently unknown but is expected to be negligible. In consequence, effects on climate change have been assessed as neutral.

The operation of the scheme would help secure water supplies, although the gain (0.66 Ml/d) would be very minor. Overall, the option has therefore been assessed as having a neutral effect on health and wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency.

The operation of this option would not involve additional infrastructure, resources or ongoing energy usage.

The option would not have effects on the setting of designated heritage assets but there would be a permanent landscape and visual change to the valley in which the reservoir sits as a result of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resources	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM012 Desalination plant for non-potable supplies to Milford Haven	Construction	--	-	0	-	0	--/?	0	++	0	--	0	-
	Operation	--/?	0	0	-	0	--	0	0	0	--	0	-

Construction

This option is for a new desalination plant to supplement industrial users in Pembroke. This option would involve the construction of a seawater desalination plant with new seawater intake/outfall and a new treated water pumping station on the coast to the west of the Pembroke Power Station. Treated water would be transferred (via a new 2km pipeline to an existing reservoir, Greenhill), for blending with alternative supplies. It is assumed that the plant would not run continuously, only at times to meet demands that cannot be met by other resources. A new abstraction licence and discharge consent would be required.

The desalination plant intake and pumping station would be located in Pembrokeshire Marine SAC and Milford Haven Waterway SSSI although the pipeline would run through countryside which carries no ecological designation. The HRA identifies that construction of intake and outfall would directly affect the Pembrokeshire Marine SAC, through impacts arising from disturbance, the release of nutrient rich sediments and direct habitat loss, although effects arising from constructing the pipeline are likely to be minor and temporary (arising from disturbance and the land take necessary). Overall the effects have been assessed as significant and negative.

This option is expected to require some land take (works would be undertaken on a new desalination plant and treated water pump station). In consequence, effects on geology and soils have been identified as a minor negative effect.

Construction of the new desalination plant is not expected to have effects on water quantity.

There is a risk of effects on water quality from the construction of the option. Depending on construction methods it is possible the construction of the new pipeline into the waterbody could lead to the release of nutrient rich sediments. However, any impact is likely to be localised and temporary. Overall, a minor negative effect has been identified in respect of water quality.

The option location is susceptible to flooding along the coast but construction is not expected to increase flood risk on site or elsewhere.

The CO₂e emissions associated with construction have not been calculated, but given the size of the construction project, they are expected to have a significant negative effect on climate change. For reference when the option was assessed previously it was estimated to use materials with an embodied carbon of 2,320 tCO₂e.



Limited effects on human health would be expected as surrounding areas are sparsely populated and industrial and any temporary effects such as noise and/or disruption to coastal pathways would be limited to recreational users.

The option would involve a high capital spend which could have a significant effect on local construction employment opportunities. This has been identified as a significant positive effect on wellbeing.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on water efficiency.

Raw materials and energy would be required for the construction works; waste would also be generated. This has been assessed as having a significant negative effect on waste and resources.

Two listed buildings (a former school building and church of Saint Mary) are located at Pwllcrochan. These designated heritage sites are over 200 m away from the option and are unlikely to be impacted.

The construction work would not be affected by any landscape designations, although works are likely to result in short term impacts on landscape character and the visual amenity of recreational receptors.

Operation

Operation of this plant would result in discharge of brine which may have localised effects on some features within Pembrokeshire Marine SAC depending on dilution profiles. Fish entrainment is also possible. The Claeddau Rivers SAC is not linked to the site by a direct impact pathway but some mobile interest features may be vulnerable to the effects of the scheme (indirectly via possible effects on the fish species of Pembrokeshire Marine SAC). This has been identified as a significant negative effect, although some uncertainty remains.

There would be no operational effects on geology and soils.

Operation is likely to have a negative effect on water quality due to the pumping of brine back to sea. This is considered to have an adverse effect on the water environment. It is assumed that any effluent is treated and discharged to the coastal waterbody, which has the potential for a minor negative effect in respect of water quality, although this would have to be of an acceptable standard to be consented.

The presence of the plant could contribute to additional drainage flows from runoff on additional hardstanding during times of high precipitation. However, with engineered drainage in place it is believed to have a neutral effect on flood risk.

Operational energy usage is currently unknown but is likely to be substantial since the costs of desalinating sea water are comparatively high. In consequence, effects on climate change are expected to be significant negative. For reference when the option was assessed previously it was estimated that the operational energy requirement resulted in 4,034 tCO₂e per year.

While the option has a high design capacity of 15 Ml/d, the DO gain of the plant is much lower at 0.66 Ml/d due to constraints in the WRZ. This would be too low to make a contribution to human health and the wellbeing of the local community, and the option has therefore been assessed as having a neutral effect on health and wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency.

The operation of this option would not involve additional infrastructure and resources but would result in substantial energy usage as noted above.

The option would not have effects on the setting of designated heritage assets but there would be a permanent landscape and visual change to the area as a result of this option, albeit the local area already contains industrial areas.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM014 Abstraction from Afon Taf	Construction	--	-	0	0	-	--	0	+/-	0	--	0	-
	Operation	0/-	0	0	0	-	-	0	0	0	-	0	-

Construction

This option involves a new intake and pumping station at Whitland, a new pipeline (13.5 km) to Canaston Bridge and then onward transfer to Bolton Hill WTW via existing infrastructure. A new abstraction licence is required. This option does not include upgrades to zonal infrastructure, which would be required to achieve a higher DO gain.

The water mains route crosses the Afonydd Cleddau/Cleddau Rivers SAC and Afon Cleddau Dwyreiniol/Eastern Cleddau River SSSI at one location in Canaston Bridge. The HRA also notes the presence of the Pembrokeshire Marine / Sir Benfro Forol SAC, which has the potential to be affected by the option. The closest features are Estuaries; Mudflats and Sandflats; and Atlantic Salt Meadows, which are all present within Radford Pill (the estuary inlet closest to Milton), however no effects from construction activity are anticipated. There are no other international, national and locally designated conservation sites within or in the immediate vicinity of this option. The route of the proposed pipeline also crosses a number of other non-designated watercourses. The extent of any effects will depend on the proposed route, although it is noted that it is proposed to follow the approximate route of the A40 either in the verge or adjacent land which may also result in disturbance to habitats. The exact location of the pumping station at Whitland is not known but could be on either greenfield or previous developed land to the south of the town, with abstraction intake from the river located in the waterbody. It is anticipated that standard best practice construction measures would manage any potential effects on the watercourses and such that there would be no overall change in biological status and ecology of the watercourses. Overall, a significant negative effect has been identified in respect of biodiversity given the potential for short term, localised disturbance at designated sites and temporary loss of habitat in areas along the pipeline route.

A small area of land would be required for the new intake and associated pumping station; aerial photographs suggest that this would be on undeveloped land, although there are potential developed sites located slightly further away that could also be suitable for its location. The water mains would be routed along the A40 road and open ground, crossing both previously developed land and undeveloped land. This has been identified as a minor negative effect with respect to geology and soils.

Construction of this option would not involve any in channel works or alterations to the flow regime to any watercourses, as where any watercourses would be crossed, existing structured would be used. No effect is predicted on water quantity.

This option includes several watercourse crossings. There is a potential for the chemical status of the watercourses to be affected due to chemical spillage from plant machinery and the introduction of contaminated soils. It is anticipated that standard best practice construction measures would manage these effects such that there would be no overall change in water quality.



Construction may be affected by flooding since the new pumping station option and the proposed route crosses areas within the Flood Zones 2 and 3. Construction works would not be expected to exacerbate flood risk provided that mitigation measures are implemented. A negative effect has therefore been identified in respect of flood risk.

Construction of the scheme would generate around 2,449 tCO₂e which has been assessed as having a significant negative effect on climate change.

The route of the pipeline is adjacent to the A40 road which serves a number of houses. It is possible that there might be limited noise and dust effects experienced at these properties but the human health effects of this option would be negligible due to the rural construction area.

The route of the pipeline follows the A40 road, with proposed siting on the verge or on land adjacent to the road. In consequence, during construction, there is the potential for delays as well as localised disruption to traffic which could have a temporary adverse effect on road users and local communities. Capital costs are substantial so there is considered to be a benefit to the local economy and the option may help meet employment needs of local people during construction period, directly or indirectly. Overall this is considered to have a mixed minor positive and minor negative effect with respect to wellbeing.

This option is not a leakage reduction or water efficiency option and would have no effect on water resources.

The option would lead to demand for additional raw materials as construction of this option would necessitate new infrastructure with limited option to use recycled products.

The option route passes near two Grade II Listed Buildings (Gwindy Farmhouse with walls and railings to garden and Old Stable Block at Gwindy) and two Scheduled Monuments (Pengawse Medieval House Site and Redstone Cross Round Barrows). Since construction works would be temporary no adverse effects are expected.

This option would not be located within protected/designated landscapes. The closest protected/designated landscapes is an ancient woodland. Construction may have short term, temporary negative effects on other receptors along the mains route including residential properties. However, adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year depending on the season in which works are undertaken. Overall, this option has been assessed as having a minor negative effect on landscape.

Operation

It is anticipated that standard best practice and regulated materials would ensure that during the operational phase there would be no overall change in biological status or ecology of the watercourses. Whilst the CAMS report noted that there was water available, the abstraction of 5Ml/d water from the lower reaches of the Afon Taf during periods of low flows could in theory affect habitat and species; however, any new abstraction will need to be licensed, and consequently effects on the Afon Taf river biota during varying flow regimes will be addressed and suitably controlled. The HRA also identifies the Pembrokeshire Marine / Sir Benfro Forol SAC as potentially being affected by the option. There is no data available on the current condition of these features within the Radford Pill (the estuary inlet closest to Milton), although the SSSI data for this area does not suggest that the current abstraction regime is negatively affecting any of the shared (i.e. SAC) interest features. It is considered that the effects of the abstraction on these features (and therefore this SAC) is likely to be negligible, particularly as the abstraction would be within the parameters of the existing usage. However, it is may not be possible to conclude no adverse effect without additional scheme-specific studies. A neutral effect with some uncertainty has therefore been identified with respect to biodiversity.

Operation of this option would have no further effects on land use/soils although there would be small permanent losses of land for the new intake and associated pumping station but this has already been taken into account at the construction stage. Therefore no effects are predicted on geology and soils.

The CAMS report concluded that water is available in this location and abstraction of 5Ml/d from the lower reaches of Afon Taf is unlikely to have effect on groundwater levels.

It is anticipated that standard best practice and regulated materials would ensure that during the operational phase there would be no overall change in water quality of the watercourses. The Afon Taf, where the new intake would be located, is WFD compliant and there is no risk of deterioration by 2027. The WFD Assessment concludes that there would be no effect on WFD objectives provided that the risk of residual effects from the construction of the option are addressed at detailed design stage or when construction methods are confirmed.

The option would involve the construction of above-ground infrastructure (new pumping station) located within the 1 in 100 year floodplain (Flood Zone 3). A negative effect has therefore been identified in respect of flood risk.

Greenhouse gas emissions associated with the operation of this option are estimated at 675 tCO₂e per annum, which would have a negative effect on climate change.

The operation of the scheme would help secure water supplies, although the gain (0.03 Ml/d) would be very minor. Overall, the option has therefore been assessed as having a neutral effect on health and wellbeing.



This option would ensure continuity of clean drinking water supply, thus having a positive effect on human health and support local tourism and other businesses. CAMS states that up to 5 MI/d may be available for abstraction, however this option would need to be combined with an upgrade to zonal infrastructure to achieve a commensurate DO gain (there is currently a minor gain of 0.03 MI/d). This option would ensure that sufficient infrastructure is in place to sustain a seasonal influx of tourists, and to cater for needs of projected population growth, thus having socio-economic benefits.

This option is not a leakage reduction or water efficiency option and would have no effect on water resources.

The option would require a substantial amount of additional energy during operation as reflected in the operational carbon figure above but would not consume other materials, thus its effect on resource consumption is considered to be minor negative.

No effect on the historic environment during operation of this option is anticipated.

As the operational above ground works include a new pumping station, this is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM016a East West Transfer Felindre to Pembrokeshire - existing assets	Construction	--/?	0	0	0	-	--	-	++/-	0	--	--	0
	Operation	0	0	0	0	0	-	+	+	+	-	0	0

Construction

The option would allow transfer of surplus capacity at Felindre WTW to partially address the forecast deficit in the Pembrokeshire WRZ through additional transfers. The transfer would require 4km new main from Brondini SRV to Capel Dewi WTW, and the reinforcement of 38km existing infrastructure west of Capel Dewi WTW to allow the onwards transfer to Brandy Hill SRV. Additional and upgraded pumps would also be required. For the option existing points of storage would be used.

The option crosses Bishops Pond SSSI, Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC and Aber Taf / Taf Estuary SSSI, in addition to crossing Afon Tywi / River Tywi SAC and SSSI in several places. The pipeline route also passes less than 50 meters from the Beacon Bog SSSI and would be located within or on the edge of several ancient woodland sites. The HRA notes that it is likely that any effects on the SACs could be avoided with normal planning, avoidance or mitigation measures (such as best-practice, scheduling works outside migration periods, etc.). There are no other international, national and locally designated conservation sites within or in the immediate vicinity of this option. This option would cross a number of watercourses. It is anticipated that standard best practice construction measures would manage any potential impacts on the watercourses and such that there would be no overall change in biological status of the watercourses. The pipeline follows existing roads in the some parts which may help to reduce effects on the environment, while other sections of reinforcement work would take place in open countryside. Mitigation measures would need to be taken along the route to ensure that construction activities and any resulting dust and disturbance do not have an adverse effect on habitats and any associated species; however, there remains the localised land take and disruption from excavation. At this stage, given the proposed siting of the route through designated sites, a significant negative effect has been identified in respect of biodiversity given the potential for direct effects. However, if the route were modified to avoid SACs and SSSIs, the residual effects are anticipated to be short term, localised disturbance and as such would be assessed as a minor negative.

The pipeline reinforcement works follow the route of existing infrastructure, large sections of which follow a route along existing roads thus using previously developed land. Some areas of agriculture/pasture land would be crossed as part of the reinforcement works, but this would still be in the path of existing infrastructure. Overall, a neutral effect has been identified in respect of geology and soils.

There are a number watercourse crossings within this option. It is anticipated that best practice design principles and construction methods for the construction of watercourse crossings would be used, and these would result in no perceptible alteration of the baseline morphological conditions. Construction of this option is likely to have no effect on water quantity.

There is a potential for the water quality to be affected due to chemical spillage from machinery and the introduction of contamination particularly where the trenching runs close to and crosses watercourses. It is not expected that construction of this option would affect water quality or water resources, provided best management practices are adopted to ensure that pollutants do not escape into watercourses or groundwater. Any impacts would be localised and temporary and overall there would be no change in water quality or WFD objectives.

This option would be located within Flood Zone 3 (high risk of flooding with less than 1% or greater annual probability of flooding) near Abergwili and within the river estuaries southeast of St Clears. Construction of the option would neither cause nor exacerbate flooding on the site or elsewhere. As the pipeline would pass through areas at risk from flooding, which may cause some sections of the construction site to become inundated, a minor negative effect has been identified with respect to flood risk.

The construction would cause emissions of 11,718 tonnes of CO₂e, resulting in significant negative effects with respect to climate change.

Some sections of the new and reinforced water mains route is adjacent to existing roads which serve a small number of residential properties. It is possible that there might be temporary noise and dust effects experienced at these properties. In addition, the construction associated with the upgrading of the pipe would be expected to have short term adverse effects on residential receptors (especially those within 150m) due to impacts on air quality and noise from construction plant and machinery. Construction of this option has been assessed as having a minor negative effect on health.

During construction, there may be localised disruption to traffic along the route of water mains reinforcement which could have an adverse effect on the local communities. However, the high capital expenditure of the scheme is likely to have a meaningful impact on the local economy through job creation. Overall this is considered to have a mixed significant positive and minor negative effect with respect to wellbeing.

This option is not a leakage reduction or water efficiency option and would therefore have no effect on water efficiency.

The option would require new infrastructure of a significant scale. Raw materials and energy would be required for the construction of the new water main and reinforcement of the existing water mains; waste would also be generated and thus the effect on resource consumption and waste would be significant negative.

The pipeline reinforcement route crosses through the Bryn Helyg Round Barrow Scheduled Monument. The route is also adjacent to the Garn-Fawr Castle Mound and St Clears Mound and Bailey Castle Scheduled Monuments, however as the work in these areas is along an existing pipeline route, this would reduce the likelihood of encountering previously unknown archaeological deposits associated with these assets. There are also a number of listed buildings along the pipeline route including the Barn at Penlanffos Farm and a war memorial cross at Llangynog, however, provided the Listed Buildings are properly protected, no direct effects on these heritage assets are anticipated. Any indirect effects on the settings of the listed buildings and Garn-Fawr Castle Mound and St Clears Mound and Bailey would be temporary prior to restoration. Due to the crossing of Bryn Helyg Round Barrow, a significant negative effect with respect to cultural heritage has been identified.

The works for this option are not located within a designated landscape area. Construction would be temporary and along existing roadways in many areas and therefore no effects with respect to landscape due to the construction works are expected.

Operation

This option only includes transfer of water through a pipeline and there would be no water storage or discharge. The HRA notes that no operational effects would be expected. No international, national and locally designated conservation sites would be affected by the operation of this option.

There would be no operational effects on geology and soils.

As this option only includes transfer of water through the pipeline with no other operational requirement there would be no operational effects on water quantity.

As the option only includes transfer of water through the pipeline with no other operational requirement it is anticipated that standard best practice and appropriate materials would ensure that during the operational phase there would be no overall change in water quality and WFD objectives.

Although a section of the pipeline would pass through a flood zone, this would not involve any above ground infrastructure and therefore a neutral effect with respect to flooding has been identified. Operation of the option would neither cause nor exacerbate flooding on the site or elsewhere.

The operational energy demand for this scheme would result in carbon emissions of 801 tonnes of CO₂e. This is reflected in a minor negative effect with respect to climate change.

A DO gain of 3.67Ml/d would help ensure there is a safe and secure supply of drinking water in the area and to address the forecast deficit in the Pembrokeshire WRZ, which has been identified as a minor positive effect for this option. No nuisance effects are anticipated during operation of this scheme, and overall the option has been identified as having a minor positive effect with respect to human health. This supply would also have a positive effect on the local community, with a minor positive effect with respect to wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency. However, the upgrading of pipelines during this option would result in leakage reduction and would therefore result in more efficient management of water supplies. Therefore a minor positive effect on water efficiency has been identified.



The operation of this option would not involve additional infrastructure or resources but would result in ongoing energy usage as noted above.

No effect on heritage features or assets during operation is anticipated.

The new and reinforced pipeline required for this option would not have an effect on landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM016b East West Transfer Felindre to Pembrokeshire	Construction	--/?	0	0	0	-	--	-	++/-	0	--	--	0
	Operation	0	0	0	0	0	-	+	+	+	-	0	0

Construction

The option would allow transfer of surplus capacity at Felindre WTW to partially address the forecast deficit in the Pembrokeshire WRZ through additional transfers via Brondini WPS and Brondini SRV to Penlanffos SRV. From here the additional capacity would be moved west via Brandy Hill SRV from where it can be transferred in to the Pembrokeshire zone. The option would use a new dedicated 38km main (400mm main (possibly 450mm)) for transfer from Brondini SRV to Brandy Hill SRV. For the option existing points of storage would be used.

The option crosses Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC and Aber Taf / Taf Estuary SSSI, in addition to crossing Afon Tywi / River Tywi SAC and SSSI. This option would be located within or on the edge of restored ancient woodland sites near Bryn Hyfryd, Allt y Ciliau, Cwmffrwd, Cloigyn and Cynheidre. In addition, the option passes less than 50 meters from the Beacon Bog SSSI to the east of Llangynog. Mitigation measures will need to be taken to ensure that construction activities and any resulting dust and disturbance do not have an adverse effect on these habitats and any associated species. There are no other ecological international, national and locally designated sites within or in the immediate vicinity of this option. This option would cross a number of watercourses. It is anticipated that standard best practice construction measures would manage any potential impacts on the watercourses and such that there would be no overall change in biological status of the watercourses, although construction may need to be timed to minimise potential impacts on migratory fish. The pipeline follows existing roads in the most part and this may help to reduce impacts to the environment. At this stage, given the proposed siting of the route through designated sites, a significant negative effect has been identified in respect of biodiversity given the potential for direct effects. However, if the route were modified to avoid the SACs and SSSIs, the residual effects are anticipated to be short term, localised disturbance and as such would be assessed as a minor negative.

Most of the option would follow a route close to or along existing roads thus using previously developed land and would cross pre-existing bridges. The option route would cross only small areas of agriculture/pasture land. Overall, a neutral effect has been identified in respect of geology and soils.

There are a number of watercourse crossings within this option. It is anticipated that best practice design principles and construction techniques/ methods for the construction of watercourse crossings would be used, and these would result in no perceptible alteration of the baseline morphological conditions. Construction of this option is likely to have no impact on water quantity.

There is a potential for the water quality to be affected due to chemical spillage from machinery and the introduction of contamination particularly where the trenching runs close to and crosses watercourses. It is not expected that construction of this option would affect water quality or water resources, provided best management practices are adopted to ensure that pollutants do not escape into watercourses or groundwater. Any impacts would be localised and temporary and overall there would be no change in water quality or WFD objectives.



This option would be located within Flood Zone 3 (high risk of flooding with less than 1% or greater annual probability of flooding) within the river estuaries southeast of St Clears. Construction of the option would neither cause nor exacerbate flooding on the site or elsewhere. As the pipeline would pass through some areas at risk from flooding, which may cause some sections of the construction site to become inundated, a minor negative effect has been identified with respect to flood risk.

The construction would cause emissions of 14,414 tonnes of CO₂e, resulting in significant negative effects with respect to climate change.

The route of the new and existing water mains is adjacent to existing roads which serve a small number of residential properties. It is possible that there might be temporary noise and dust effects experienced at these properties. In addition, the construction associated with the upgrading of the pipe would be expected to have short term adverse effects on residential receptors (especially those within 150m) due to impacts on air quality and noise from construction plant and machinery. Construction of this option has been assessed as having a minor negative effect on health.

During construction, there may be major delays on the section of pipeline requiring work along the A484 at Cwmffrwd as well as localised disruption to traffic along the route of the new and existing water mains. This could have an adverse effect on the local communities. However, the high capital expenditure of the scheme is likely to have a meaningful impact on the local economy through job creation. Overall this is considered to have a mixed significant positive and minor negative effect with respect to wellbeing.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on water efficiency.

The option would require new infrastructure of a significant scale. Raw materials and energy would be required for the construction of the new water main and upgrade of the existing water mains; waste would also be generated and thus the effect on resource consumption and waste would be significant negative.

The pipeline route crosses through the Bryn Helyg Round Barrow Scheduled Monument. The route is also adjacent to St Clears Mound and Bailey Castle and the Cwrt Malle Moated site, Llangynog, Scheduled Monuments. There are a number of listed buildings along the pipeline route including mileposts (at Cynheidre and Pontyates) and a war memorial cross at Llangynog. However, the pipeline would be routed within the public highway and provided the heritage sites are properly protected, there would be no direct effects on Listed Buildings. The water mains to be upgraded are also adjacent to a Grade II listed building (Mount Hill at Tre-gynwr and Pont Antwn)). Any indirect effects on the settings of the listed buildings and St Clears Mound and Bailey Castle and the Cwrt Malle Moated site, Llangynog, would be temporary prior to restoration. Due to the crossing of Bryn Helyg Round Barrow, a significant negative effect with respect to cultural heritage has been identified.

The works for this option are not located within a designated landscape area. Construction of this option would be temporary and mainly along existing roadways and therefore no effects with respect to landscape due to the construction works are expected.

Operation

This option only includes transfer of water through a pipeline and there would be no water storage or discharge and therefore no risk of transfer of species etc. No ecological international, national and locally designated sites are expected to be affected by the operation of this option.

There would be no operational effects on land use/ soils.

As this option only includes transfer of water through the pipeline with no other operational requirement there would be no operational effects on water quantity.

As the option only includes transfer of water through the pipeline with no other operational requirement it is anticipated that standard best practice and appropriate materials would ensure that during the operational phase there would be no overall change in water quality and WFD objectives.

Although a section of the pipeline would pass through a flood zone, this would not involve any above ground infrastructure and therefore there a neutral effect with respect to flooding has been identified. Operation of the option would neither cause nor exacerbate flooding on the site or elsewhere.

The operational energy demand for this scheme would result in carbon emissions of 187 tonnes of CO₂e. This is reflected in a minor negative effect with respect to climate change.

A DO gain of 4.93MI/d would help ensure there is a safe and secure supply of drinking water in the area and to address the forecast deficit in the Pembrokeshire WRZ, which has been identified as a minor positive effect for this option. No nuisance effects are anticipated during operation of this scheme, and overall the option has been identified as having a minor positive effect with respect to human health. This supply would also have a positive effect on the local community, with a minor positive effect on wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency. However, the upgrading of pipelines during this option would result in leakage reduction and would therefore result in more efficient management of water supplies. Therefore a minor positive effect on water efficiency has been identified.



The operation of this option would not involve additional infrastructure or resources but would result in ongoing energy usage as noted above.

No effect on heritage features or assets during operation is anticipated.

The new pipeline required for this option would not have an effect on landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM024a Canaston Bridge - High-Lift VSDs	Construction	0	0	0	0	-	-	0	+	0	-	0	0
	Operation	0	0	0	0	-	+/-	0	0	+	-	0	0

Construction

This option involves asset upgrades at Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau, and hence reduce unnecessary over-release of compensation flows from Llys y Fran reservoir. The abstraction licence requires that compensation releases from Llys y Fran reservoir match the maximum rate of abstraction, meaning that water is typically wasted due to the difference between the maximum rate of abstraction and the daily total abstraction. The option requires a new low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d and replacement of the fixed speed high-lift pumps with variable speed pumps.

Canaston Bridge is adjacent to Afonydd Cleddau / Cleddau Rivers SAC and the Afon Cleddau Dwyreiniol / Eastern Cleddau River SSSI. The works associated with this option therefore have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.); however, the HRA identifies that these risks can be avoided or controlled through the normal project planning process and standard best-practice measures, particularly given the small scale of the works. The development site is also approximately 650m from the Pembrokeshire Marine / Sir Benfro Forol SAC and the Milford Haven Waterway SSSI, and the western edge of the site is bounded by ancient woodland; however, construction work is not expected to affect these areas. There are no other designated sites within or in the immediate vicinity of this option and works would take place within an existing site such that localised effects on habitats and species are expected to be negligible. Overall, this option has been assessed as a neutral effect with respect to biodiversity.

Replacement of the pumps is not expected to have any effect on geology and soils.

Construction of the option would have no effects on river flows or groundwater levels. It is not expected that construction would affect water quality, provided best practice is adhered to and mitigation measures implemented (such as dust suppression, soil containment and emergency response procedures) to avoid release of pollutants into watercourses.

The development site is located within Flood Zone 2 (risk of flooding is up to 0.1% in any given year), although other parts of the site are within Flood Zone 3 (high risk of flooding, with 1% or greater annual probability of flooding). In consequence, works may be vulnerable to flooding (depending on timing). In consequence, works may be vulnerable to flooding (depending on timing). Construction of the option is not expected to cause nor exacerbate flooding on the site or elsewhere. As construction work would be located within Flood Zone 2, the option has been assessed as having a minor negative effect on flood risk.

Carbon emissions associated with the construction of this option would be small and a minor negative effect has therefore been determined against this objective.



Construction activity has the potential to result in noise and air quality impacts; however, reflecting the site's rural location, the number of receptors likely to be affected in the immediate vicinity of the site would be very small, with the closest residential dwellings being approximately 150m from the site. Overall, this option has been assessed as having a neutral effect on health.

Construction work would have a beneficial effect on the local economy due to job creation, with a substantial capital spend. Construction is not expected to affect recreational activities or cause transport disruption. A minor positive effect has therefore been identified in respect of wellbeing.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on water resources during construction. Effects on waste and resources have been assessed as minor negative as small quantities of additional materials and waste would be associated with the replacement of the pumps.

The Blackpool Iron Furnace Scheduled Monument and two Grade II* listed buildings are located approximately 0.5km from the site. The Bush Inn Camp Scheduled Monument and three further Grade II listed buildings are situated approximately 1km from the site. As the construction works would be relatively minor in scale and located within an existing facility that benefits from screening (trees), no effects on the settings of these assets are predicted and a neutral effect has therefore been identified in respect of cultural heritage.

Canaston Bridge is located within the Pembrokeshire Coast National Park; however, as the construction work would be very limited in scale and take place within an existing site that benefits from screening (trees), effects on landscape have been assessed as neutral.

Operation

Once operational, this option would minimise the over-release of water by configuring pumps so that the rate of abstraction from the river is close to constant, which minimises the difference between the maximum rate of abstraction and the total daily abstraction. This would allow water to be conserved within Llys y Fran by matching compensation releases to actual abstraction. No changes to the abstraction licence would be required.

No ecological international, national and locally designated sites would be affected by the operation of this option. The HRA notes that operation would result in 'less' water passing down the Afon Cleddau as the compensation releases match the actual abstraction more closely; however, as the operation would be within the terms of the existing abstraction licence effects on biodiversity are not anticipated.

There would be no operational effects on land use/soils.

As noted above, the optimisation of compensation releases would reduce the amount of water passing down the Afon Cleddau; however, this would be within the terms of the existing abstraction licence. There would also not be a significant increase in abstraction during operation of the new pumps. Overall, this has been assessed as a neutral effect on water quantity. No effects on water quality are anticipated as a result of operation of the option.

The new pumps would be located within Flood Zone 2 and would therefore be at risk of inundation in the event of a flood. Operation of the option would neither cause nor exacerbate flooding on the site or elsewhere. Overall this has been assessed as a minor negative effect with respect to flood risk.

There would be ongoing operational energy demand for this scheme that would result in the release of greenhouse gases. DCWW has identified that minimising the unnecessary release of compensation flows would improve the storage position in Llys y Fran reservoir at the end of a drought, which has the potential to reduce vulnerability to the effects of climate change. Overall, this option has been assessed as having a mixed minor negative and minor positive effect on climate change.

A DO gain of 0.66 MI/d would be too low to make a substantive contribution to human health and the wellbeing of the local community.

This option is not a leakage reduction or water efficiency option. However, operation of the option would be expected to allow greater control of compensation releases, minimising wastage. In consequence, the option has been assessed as having a minor positive effect on water resources.

The operation of this option would require ongoing energy usage for the pumps. This has been assumed to be a minor energy requirement, which has been assessed as having a minor negative effect with respect to waste and resources.

No effects on heritage features or assets during operation are anticipated. While the option would be located within the Pembrokeshire Coast National Park, new infrastructure would be small in scale and located within an existing facility that benefits from screening such that there are not expected to be any notable effects on local landscape character, the special qualities of the National Park or visual amenity. Overall, neutral effects have therefore been identified in respect of cultural heritage and landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM024b Canaston Bridge – Upgrade Pumping Station	Construction	-	-	0	0	--	-	0	++	0	-	0	-
	Operation	0	0	0/+	0	-	+/-	0	0	+	-	0	0

Construction

This option involves asset upgrades at Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau, and hence reduce unnecessary over-release of compensation flows from Llys y Fran reservoir. The abstraction licence requires that compensation releases from Llys y Fran reservoir match the maximum rate of abstraction, meaning that water is typically wasted due to the difference between the maximum rate of abstraction and the daily total abstraction. The option requires a low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d and may require an increase in available bankside storage (a new reservoir with a capacity of 30,000m³).

The Canaston Bridge site is adjacent to Afonydd Cleddau / Cleddau Rivers SAC and the Afon Cleddau Dwyreiniol / Eastern Cleddau River SSSI. The works associated with this option have the potential to cause contamination of surface waters by site-derived pollutants and disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.); however, the HRA identifies that these risks can be avoided or controlled through the normal project planning process and standard best-practice measures. The site is also approximately 650m from the Pembrokeshire Marine / Sir Benfro Forol SAC and the Milford Haven Waterway SSSI, and the western edge of the site is bounded by ancient woodland; however, construction work is not expected to affect these areas. There are no other designated sites within or in the immediate vicinity of this option. Construction of the new reservoir would result in the loss of a small area of greenfield land to the south of the existing site which may cause a localised loss of/disturbance to habitats and species. Overall, this option has been assessed as a minor negative effect on biodiversity.

Construction of the reservoir would result in the loss of approximately 1ha of greenfield land which has been assessed as having a minor negative effect on geology and soils.

Construction of the option would have no effects on river flows or groundwater levels. It is not expected that construction would affect water quality, provided best practice is adhered to and mitigation measures implemented (such as dust suppression, soil containment and emergency response procedures) to avoid release of pollutants into watercourses. Additionally, the construction of the new reservoir and pipes would be set back from the river behind the current storage reservoir, reducing the risk of contaminants being released into the waterbody.

The proposed reservoir site is located within Flood Zone 3 (high risk of flooding, with 1% or greater annual probability of flooding), while the low-lift intake would be situated within Flood Zone 2 (risk of flooding is up to 0.1% in any given year). Construction of the option is not expected to cause nor exacerbate flooding on the site or elsewhere. As construction work would be located within a high risk flood zone, this option has been assessed as having a significant negative effect with respect to flood risk.

Construction has been estimated to result in the emission of 379 tCO₂e, which has been identified as a minor negative effect on climate change.



Construction activity has the potential to result in noise and air quality impacts; however, reflecting the site's rural location, the number of receptors likely to be affected in the immediate vicinity of the site would be very small, with the closest residential dwellings being approximately 150m from the site. Overall, this option has been assessed as having a neutral effect on health.

With a high capital spend, construction work would have a significant effect on the local economy through job creation. Construction is not expected to affect recreational activities or cause substantial transport disruption. A significant positive effect has therefore been identified in respect of wellbeing.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on water resource during construction.

Raw materials and energy would be required for replacement of the pumps and the construction of the reservoir, and waste would also be generated, particularly as a result of reservoir excavation. This has been assessed as having a minor negative effect with respect to waste and resources.

The Blackpool Iron Furnace Scheduled Monument and two Grade II* listed buildings are located approximately 0.5km from the site. The Bush Inn Camp Scheduled Monument and three further Grade II listed buildings are situated approximately 1km from the site. As the construction works would be within/adjacent to an existing site, there is not predicted to be any effects on the settings of these assets. In consequence, a neutral effect has been identified with respect to cultural heritage.

Canaston Bridge is located within the Pembrokeshire Coast National Park, and as a result construction may cause adverse visual effects within the designated landscape. However, as the construction work would take place within and adjacent to an existing and remote site, effects on landscape have been identified as minor negative.

Operation

Once operational, the option would use the new bankside storage reservoir to attenuate the impact of the high-lift pump abstraction rate, such that the low lift pumps can pump at a constant rate equivalent to the total abstraction. This would allow water to be conserved within Llys y Fran reservoir by matching compensation releases to actual abstraction, giving a DO gain of 0.66 Ml/d. No changes to the abstraction licence would be required.

No ecological international, national and locally designated sites would be affected by the operation of this option. The HRA notes that operation would result in 'less' water passing down the Afon Cleddau as the compensation releases match the actual abstraction more closely; however, as operation would be within the terms of the existing abstraction licence effects on biodiversity are not anticipated.

There would be no operational effects on land use/soils.

As noted above, the optimisation of compensation releases would reduce the amount of water passing down the Afon Cleddau; however, this would be within the terms of the existing abstraction licence and negligible effects are anticipated. There would also not be a significant increase in abstraction during operation of the new pumps. In addition, the new reservoir should reduce the pressure on the need for abstraction during times of low flows in the river, which would have a minor positive effect on water quantity at these times. Overall, this option has been assessed as having a mixed neutral and minor positive effect on water quantity. No effects on water quality are anticipated as a result of operation of the option.

The new pumps would be located within Flood Zone 2 and would therefore be at risk of inundation in the event of a flood. The new reservoir would be situated within Flood Zone 3; however, this would not be significantly vulnerable to the effects of flooding. Operation of the option would neither cause nor exacerbate flooding on the site or elsewhere. Overall, this option has been assessed as a minor negative effect with respect to flood risk.

The operational energy demand for this scheme has been estimated to result in carbon emissions of 113 tonnes of CO₂e. DCWW has identified that minimising the unnecessary release of compensation flows would improve the storage position in Llys y Fran reservoir at the end of a drought, which has the potential to reduce vulnerability to the effects of climate change. Overall, this option has been assessed as having a mixed minor negative and minor positive effect on climate change.

A DO gain of 0.66 Ml/d would be too low to make a contribution to human health and the wellbeing of the local community.

This option is not a leakage reduction or water efficiency option. However, operation of the option would be expected to allow greater control of compensation releases, minimising wastage. In consequence, the option has been assessed as having a minor positive effect on water resources.

The operation of this option would require ongoing energy usage for the pumps. Using operational carbon emissions as a proxy for energy use, this has been assumed to be a minor energy requirement, which has been identified as a minor negative effect with respect to waste and resources.



No effect on heritage features or assets during operation is anticipated. While the option would be located within the Pembrokeshire Coast National Park, the new reservoir would be located adjacent to the existing pumping station and reservoir. Given the relatively small scale of the reservoir and the context of an existing operational site, there are not expected to be any notable effects on local landscape character, the special qualities of the National Park or visual amenity. Neutral effects have therefore been identified in respect of cultural heritage and landscape.

Tywyn Aberdyfi Resource Zone

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA001 Abstraction from Afon Dysynni and transfer to Afon Fathew	Construction	-/?	-	0	-	-	-	-	-	0	-	0	--
	Operation	0/?	0	-	0	0	-	0	0	0	-	0	0

Construction

The option would allow transfer of 0.6 Ml/d abstracted water to the Afon Fathew at a point upstream of Pen y Bont WTW and thereby allow an increased abstraction at the WTW. The option requires: a new intake and pumping station at the Afon Dysynni, 3.8km of new pipeline main, a new break pressure tank upstream of the outfall to Afon Fathew and new outfall to Afon Fathew. An abstraction licence is not currently in place for Afon Dysynni, and a new licence would be required.

The construction of the new pumping station at the Afon Dysynni could have effects downstream, if sediment were mobilised or spillages occurred. The Lleyn Peninsula and the Sarnau SAC is the main downstream receptor and standard construction mitigation measures should ensure no effects occur. The route of the proposed pipeline would pass within 50 metres of the Crag Yr Aderyn (Bird's Rock) SSSI and SPA. Mitigation measures would need to be taken to ensure that construction activities and any resulting dust and disturbance do not have an adverse effect on this habitat and any associated species. The HRA notes that scheme-specific detailed design and sensitive timings of works for the red-billed chough in this SPA would be required. There are no other international, national and locally designated conservation sites within or in the immediate vicinity of this option. The pipeline follows existing roads in the most part and this may help to reduce disturbance to habitats. A minor negative effect has been identified in respect of biodiversity given the potential for short term, localised disturbance of ecology, with some uncertainty remaining as noted in the HRA reflecting potential effects on Craig yr Aderyn (Bird's Rock) SPA.

The option would follow a route along existing roads in the most part, thus using previously developed land. A small area of land take would be required for a new intake and pumping station and for a new break pressure tank and discharge and the option route crosses a small area of open ground. This has been identified as a minor negative effect with respect to geology and soils.

There are a number watercourse crossings within this option. It is anticipated that best practice design principles and construction methods for watercourse crossings and would result in no perceptible changes to the baseline morphological conditions. Construction of this option is therefore expected to have no impact on water quantity.

Minor indirect effects on the existing baseline water quality could occur via the disturbance of contaminated sediments. In addition, there is a potential for the water quality to be affected due to chemical spillage from machinery and the introduction of contamination, particularly where the trenching runs close to and crosses watercourses. However, considering the implementation of best practice construction



techniques, and the scale and duration of any effects in the context of the water body size, these effects are expected to be localised and of short duration. This has been identified as a minor negative effect with respect to water quality.

The pipeline works would be located in Flood Zone 3 (1% or greater annual probability of flooding), which has been identified as a minor negative effect with respect to flood risk. Construction of the option would neither cause nor exacerbate flooding elsewhere.

The construction would result in emissions of 585 tonnes of CO₂e, resulting in a minor negative effect with respect to climate change.

The route of the new water main is adjacent to existing roads which serve a small number of residential properties. It is possible that there might be temporary noise and dust effects experienced at these properties. Construction of this option has been identified as having a minor negative effect with respect to health.

There is possible local disruption associated with construction, which may require extended road closure and diversions. An avoidance of periods of peak tourist influx during summer months should be considered. The capital expenditure of the scheme is assessed as insufficient to have a substantive effect on the local economy and local employment creation. There are trout fisheries in the River Dysynni which would need to be suitably protected from any effects from construction. Overall, the option has been identified as a minor negative effect with respect to wellbeing.

This option is not a leakage reduction or water efficiency option and would therefore have no impact on water resources.

Raw materials and energy would be required for the construction of the new water main; waste would also be generated. The effect on resource consumption and waste has been identified as negative.

There are a number of listed buildings along the new pipeline route including farm buildings at Pont y garth, Ty-Coch and Nant-y-Mynach. However, the pipeline would be routed within the public highway and provided the heritage sites are properly protected, there would be no direct effects on heritage assets. Any indirect effects on the settings of the listed buildings would be temporary prior to restoration. Construction works would be temporary and any effects are expected to be negligible.

The works for this option are located within the Snowdonia National Park, a landscape sensitive zone and thus construction of a new pumping station and 3.8km of new pipeline could have a temporary but significant adverse landscape and visual effect on the designated landscape. Overall, a significant negative effect has therefore been identified with respect to landscape.

Operation

Craig yr Aderyn (Bird's Rock) SPA and SSSI would not be affected by the operation of this option. The Lleyn Peninsula and the Sarnau SAC is the main downstream receptor of the Afon Dysynni and the low-flow effects associated with the abstraction of up to 0.6MI/day from the Afon Dysynni has the potential to result in a flow regime that could result in negative effects on ecology downstream. The scheme would require a new abstraction licence, however the Meirionnydd CAMS (2015) states that there is water available in this catchment. In addition to normal licensing processes, this is likely to mean that any effect on biodiversity is neutral, however some uncertainty remains.

There would be no operational effects on geology and soils.

Abstraction of up to 0.6MI/day is likely to have an effect on the hydrological regime of the Afon Dysynni, especially in respect of the frequency and duration of low flows. The proposed abstraction volumes would be unlikely to result in significant changes to the higher end of the flow regime that maintains the baseline morphological characteristics of the Afon Dysynni. This has been identified as a minor negative effect with respect to water quantity.

Based on the potential for impacts on hydrology at low flows it is possible that water quality elements could be affected both through decreases in dilution potential of any discharges/runoff into the river, and also through lower flows affecting elements such as dissolved oxygen. However, the Meirionnydd CAMS (2015) states that there is water available in this catchment. Therefore based on this and a new licence controlling abstractions from causing damage, any impact on water quality is likely to be negligible. The new discharge would be controlled by an appropriate permit and there would be only a very limited and localised point at which any effects could occur. Any effects on water quality are expected to be negligible.

Above ground infrastructure associated with the option is not located within any flood zones, and operation would neither cause nor exacerbate flooding elsewhere.

Operation of the option would result in an increase in greenhouse gas emissions of 118 tonnes of CO₂ due to a small amount of energy use associated with the pumping of water. This has been identified as a minor negative effect on climate change.

A DO of 0.38 MI/d would be too low to make a contribution to human health and the wellbeing of the local community. In addition, there is no provision for storage at the abstraction so it is reliant on river flow, and would not be as resilient as other source types. This has been identified as a neutral effect with respect to human health and wellbeing.



This option is not a leakage reduction or water efficiency option and would have no impact on water resource.

The operation of this option would not involve additional infrastructure or resources but would result in a small energy usage as noted above. This has been identified as a minor negative effect with respect to waste and resources.

No effect on heritage features or assets during operation is anticipated.

The new pipeline and associated works required for this option would not have an effect on landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA004 New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW)	Construction	-	-	0	-	--	--	-	-	0	-	0	--
	Operation	0/?	0	-	0	--	-	0	0	0	-	0	-

Construction

This option allows Pen y Bont WTW to receive abstracted water from the Afon Dysynni directly via a new raw water transfer main. Due to topography the supply will need to be pumped from source. It requires the construction of a pumping station at Pont y Garth, the laying of approximately 6km of pipeline running alongside a road to the WTW at Pen y Bont. An abstraction licence is not currently in place for Afon Dysynni, and a new licence would be required. This option may also be supplemented with additional raw water storage as described in Option TYA009a.

The intake, pumping station and pipeline lie beyond the boundaries of any nationally or internationally ecologically designated sites. A section of the rocky outcrop above the road where the pipeline would run is designated as Craig yr Aderyn (Bird's Rock) SPA and SSSI, and although the route would not cross the SPA/SSSI, construction at the base of the outcrop has the potential to disturb birds in the protected area. The HRA notes that scheme-specific detailed design and sensitive timings of works for the red-billed chough (associated with Craig yr Aderyn (Bird's Rock) SPA) would be required, but that significant effects are not anticipated. No BAP habitats or species or ancient woodland have been identified as being affected by construction of the scheme. The Afon Dysynni flows into Broadwater SSSI approximately 400m downstream of the Pen y Bont WTW and the Lleyn Peninsula and the Sarnau SAC is also a downstream receptor of the Afon Dysynni, but it is not expected that construction would cause pollution to escape into the Afon Dysynni and cause harm to the Broadwater SSSI or the Lleyn Peninsula and the Sarnau SAC. Overall a minor negative effect has been identified with respect to biodiversity.

A small area of land (~25m²) would be required for the new intake and associated pumping station; aerial photographs suggest that this would be on undeveloped land. The pipeline would be routed along the road and open ground crossing both previously developed land (PDL) and undeveloped land. This has been identified as a minor negative effect with respect to geology and soils.

Construction of this option has the potential to impact on river flows principally associated with the impounding/over pumping works that would be necessary to install the pipeline that may cross small/minor drainage ditches. Trenched watercourse crossings are likely to be installed within a very short timeframe, and are likely to only affect flow over in <100m section of the watercourse. The effects on the flow regime would be negligible.

This option includes several watercourse crossings. Trenching across a watercourse introduces several potential risks to the aquatic environment such as channel bed extraction and reinstatement, suspended sediment increase through exposure and run-off, the potential for contaminated soil to be introduced to the watercourse and fuels and other chemicals from plant machinery. The disconnection of flow also may potentially affect the biological status of the watercourse although best construction practice appropriate mitigation (such as dust suppression, spill containment, emergency response procedures) and fact that the watercourses are predominantly small tributaries means that any impacts would only be localised and temporary, with a minor negative effect on water quality.



The pipeline would cross extensive areas of Flood Zone 3 (1% or greater annual probability of flooding) and the new pumping station is located in Flood Zone 3, which may pose difficulties for construction (depending on timing of installation) but would be unlikely to increase flood risk elsewhere. The construction of this scheme is therefore identified as having a significant negative effect with respect to flooding.

Construction of the scheme would result in the emission of 716 tonnes of CO₂e which would contribute to climate change and is thus assessed as a minor negative effect against this objective.

The route of the pipeline is adjacent to a road which serves a number of scattered houses and farms and terminates at the Pen y Bont WTW. It is possible that there might be limited noise and dust effects experienced at these properties but the human health effects of this option would be minor in nature.

The route of the pipeline is a national Cycle Route and thus there may be disruption and diversions to cyclists, thus having an adverse effect on recreational and tourism particularly during the summer months. During construction, highway disruption to access along the chosen route for local farms and residents could be substantial possibly requiring extended road closure and diversions (of approximately 10km). This could have a minor adverse effect on the local communities. There are trout fisheries in the River Dysynni which would need to be suitably protected from any effects from construction. The capital expenditure of the scheme is assessed as insufficient to have a substantive effect on the local economy and local employment creation. Overall this has been identified as a minor negative effect with respect to wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency.

Raw materials would be required for the construction of the new pumping station and pipeline as well as energy use and waste generation, which has been identified as a minor negative effect with respect to waste and resources.

The intake location is situated close to Pont y Garth which is a Grade II listed structure (substantial double-span road bridge of 18th Century origin). The design and siting of the intake would need to take this into consideration but no adverse effect on the setting of the historic building is anticipated from construction. The pipeline route passes near a number of listed buildings including buildings at Ty Coch, Perfeddnant, Cilcemaes and Glan-y-morfa but since construction works would be temporary no adverse impacts are expected. Craig yr Aderyn Hillfort is a Scheduled Monument but the distance from the pipeline route (over 250 m) means that it would be unlikely to be affected by the construction of this scheme.

All of the works are within Snowdonia National Park and thus construction of a new pumping station and 6km of new pipeline could have a temporary but significant adverse landscape and visual effect on the designated landscape. Overall a significant negative effect has therefore been identified with respect to landscape.

Operation

Craig yr Aderyn (Bird's Rock) SPA and SSSI would not be affected by the operation of this option. The Lleyn Peninsula and the Sarnau SAC is the main downstream receptor of the Afon Dysynni and the low-flow effects associated with the abstraction of up to 3.2Ml/day from the Afon Dysynni has the potential to result in a flow regime that could result in negative effects on ecology downstream. The scheme would require a new abstraction licence, however the Meirionnydd CAMS (2015) states that there is water available in this catchment. In addition to normal licensing processes, this is likely to mean that any effect on biodiversity is neutral, however some uncertainty remains.

No further effects would occur to land, soils or geology as a result of the operation of this scheme.

Abstraction of up to 3.2Ml/day is likely to have an impact on the hydrological regime of the Afon Dysynni, especially in respect of the frequency and duration of low flows. However, the Meirionnydd Catchment Abstraction Management Strategy (2015) states that there is water available in this catchment. Therefore based on this and a new licence controlling abstractions from causing damage, any impact on water quantity is likely to be minor although given the scale of abstraction this needs to be confirmed as there will be localised impacts. Overall a minor negative effect has been identified with respect to water quantity.

Based on the potential for impacts on hydrology at low flows there is the potential that water quality could be affected both through decreases in dilution potential of any discharges/runoff into the river but also through lower flows potentially having an impact on elements such as dissolved oxygen. However, the Meirionnydd CAMS (2015) states that there is water available in this catchment. Therefore based on this and a new licence controlling abstractions from causing damage, any impact on water quality is likely to be negligible.

The new pumping station would be located within Flood Zone 3 (1% or greater annual probability of flooding). A significant negative effect has therefore been identified with respect to flooding.

Operation of the option would result in the release of 515 tonnes of CO₂ as a result of energy use associated with the pumping of water. This has been identified as a minor negative effect on climate change.



The operation of the scheme would help secure water supplies during dry weather/peak demand, although the gain (0.44 MI/d) would be very minor. Overall, the option has therefore been assessed as having a neutral effect on health and wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water resources.

The operation of this option would not involve additional infrastructure or resources, however there would be a requirement for ongoing energy usage which has been identified as a minor negative effect with respect to waste and resources.

There are no listed buildings or other designated heritage assets expected to be affected by the operation of this scheme. The intake would be located near to Pont y Garth Grade II listed bridge but it is expected to be outside the curtilage of the structure and thus unlikely to be affected by the operation of this scheme.

The scheme is within Snowdonia National Park and as such has the potential for an adverse landscape and visual effect on the designated landscape. As the operational above ground works relate to a new pumping station and ancillaries and new WTW intake tanks, this is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA009a Pen-y-Bont WTW Bankside Storage (8MI)	Construction	-	-	0	0	0	-	-	0	0	-	0	--
	Operation	0/?	0	+	+	0	-	0	0	0	-	0	--

Construction

This option would involve the construction of a non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of Pen-y-Bont under dry weather/peak demand conditions when run-of-river abstraction may not supply sufficient inflow to the WTW. The reservoir would be sized at 8 MI to provide short-term buffer, and would require an increase in licensed abstraction volumes.

The proposed reservoir site is not affected by any designated nature conservation sites. The nearest designated site to the proposed scheme is Broadwater SSSI, although at circa 1.5km to the north west no construction-related impacts on this SSSI are predicted. The proposed reservoir would be located on fields to the east of Pen-y-Bont WTW and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has therefore been identified in respect of biodiversity.

Construction of the reservoir would result in the loss of approximately 0.3ha of greenfield land which has been assessed as having a negative effect on geology and soils.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The development site is not within Flood Zones 2 or 3 and works would be unlikely to result in increased flooding elsewhere. The option has therefore been assessed as having a neutral effect on flood risk.

Construction of the scheme would result in the emission of 187 tonnes of CO₂e and the option has therefore been assessed as having a minor negative effect on climate change.

Construction activity could result in noise and air quality impacts on residential receptors to the immediate south and east of the site; however, reflecting the site's rural location, the number of receptors likely to be affected in the immediate vicinity of the site would be very small. The site is circa 360m from Bryn-Crug village and several holiday parks/caravan sites, the amenities of which could be affected during construction and particularly by associated HGV movements; however, any impacts would be short term and temporary. Overall, this option has been assessed as having a minor negative effect on health.

During construction, associated HGV movements may cause some disruption to local roads including the A493 and B4405, although any impacts would be temporary. The capital expenditure of the scheme is unlikely to generate significant economic benefits. On balance, this option has been assessed as having a neutral effect on wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency.



Raw materials would be required for the construction of the reservoir which, together with energy use and waste generation, has been assessed as having a minor negative effect with respect to waste and resources.

The proposed reservoir site does not contain, and is not in close proximity to, any designated heritage assets. There are several listed buildings within Bryn-Crug with the nearest asset being Grave of Mary Jones Grade II Listed Building 400m to the north west of the development site. However, given the distance of the development site to these assets and presence of existing trees/buildings, it is considered unlikely that construction activity would have an effect on the settings of these assets.

The proposed reservoir site is within Snowdonia National Park and therefore construction could have a temporary but significant adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme and its proximity to an existing WTW, no significant impacts in this regard are predicted. Overall, a significant negative effect has been identified with respect to landscape.

Operation

The operation of the reservoir would provide a buffer raw water supply and improve resilience of Pen-y-Bont under dry weather/peak demand conditions when run-of-river abstraction may not supply sufficient inflow to the WTW. The HRA highlights that the Lley Peninsula and the Sarnau SAC is the main downstream receptor of the Afon Fathew, from which the abstraction would presumably be made; however, the nature of the abstraction (periodic, to provide refill for short term buffering) would be unlikely to affect this site, although further information on scheme operation would be required should the option be taken forward. The features of the coincident downstream sites (e.g. West Wales Marine cSAC; Northern Cardigan Bay pSPA) are not particularly sensitive to the likely effects of the scheme. Overall, the option has therefore been assessed as having a neutral effect on biodiversity at this stage, although some uncertainty remains.

There would be no operational effects on soils/land use.

No operational effects on the Afon Fathew are predicted; however, there is the potential for positive impacts on the waterbody if the reservoir's operation reduces reliance on the river abstraction at times of low flow. This has been assessed as having a positive effect on water quality and water quantity, although some uncertainty remains.

As noted above, the reservoir site is not within Flood Zones 2 or 3 and the operation of the scheme would be unlikely to result in increased flooding elsewhere. The option has therefore been assessed as having a neutral effect on flood risk.

Operational energy demand for this scheme would be 113 tonnes of CO₂e. This has been assessed as having a minor negative effect on climate change.

The operation of the scheme would help secure water supplies during dry weather/peak demand, although the gain (0.44 Ml/d) would be very minor. Overall, the option has therefore been assessed as having a neutral effect on health and wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water resources.

The operation of this option would not involve additional infrastructure or resources; however, there would be a requirement for ongoing energy usage which has been assessed as having a minor negative effect on waste and resources.

There would be no operational effects on designated cultural heritage assets.

As noted above, the proposed reservoir site is within Snowdonia National Park and therefore there is the potential for significant adverse effects on this designated landscape. The presence of the reservoir may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme and its proximity to an existing WTW, no significant impacts in this regard are predicted. Overall, a significant negative effect has therefore been identified with respect to landscape.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA009b Pen-y-Bont WTW Bankside Storage (35MI)	Construction	-	-	0	0	0	-	-	0	0	-	0	--
	Operation	0/?	0	+	+	0	-	0	0	0	-	0	--

Construction

This option would involve the construction of a non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of Pen-y-Bont under dry weather/peak demand conditions when run-of-river abstraction may not supply sufficient inflow to the WTW. The reservoir would be sized at 35 MI to provide longer-term dry period buffer, and would require an increase in licensed abstraction volumes.

The proposed reservoir site is not affected by any designated nature conservation sites. The nearest designated site to the proposed scheme is Broadwater SSSI, although at circa 1.5km to the north west no construction-related impacts on this SSSI are predicted. The proposed reservoir would be located on fields to the east of Pen-y-Bont WTW and construction may therefore result in the localised loss of/disturbance to habitats and species. A minor negative effect has therefore been identified in respect of biodiversity.

Construction of the reservoir would result in the loss of approximately 1.2ha of greenfield land which has been assessed as having a negative effect on geology and soils.

It is not expected that construction would affect water quality or water resources, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The development site is not within Flood Zones 2 or 3 and works would be unlikely to result in increased flooding elsewhere. The option has therefore been assessed as having a neutral effect on flood risk.

Construction of the scheme would result in the emission of 379 tonnes of CO₂e and the option has therefore been assessed as having a minor negative effect on climate change.

Construction activity could result in noise and air quality impacts on residential receptors to the immediate south and east of the site; however, reflecting the site's rural location, the number of receptors likely to be affected in the immediate vicinity of the site would be very small. The site is circa 360m from Bryn-Crug village and several holiday parks/caravan sites, the amenities of which could be affected during construction and particularly by associated HGV movements; however, any impacts would be short term and temporary. Overall, this option has been assessed as having a minor negative effect on health.

During construction, associated HGV movements may cause some disruption to local roads including the A493 and B4405, although any impacts would be temporary. The capital expenditure of the scheme is unlikely to generate significant economic benefits. On balance, this option has been assessed as having a neutral effect on wellbeing.



This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency.

Raw materials would be required for the construction of the reservoir which, together with energy use and waste generation, has been assessed as having a minor negative effect with respect to waste and resources.

The proposed reservoir site does not contain, and is not in close proximity to, any designated heritage assets. There are several listed buildings within Bryn-Crug with the nearest asset being Grave of Mary Jones Grade II Listed Building 400m to the north west of the development site. However, given the distance of the development site to these assets and presence of existing trees/buildings, it is considered unlikely that construction activity would have an effect on the settings of these assets.

The proposed reservoir site is within Snowdonia National Park and therefore construction could have a temporary but significant adverse effect on this designated landscape. Works may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme and its proximity to an existing WTW, no significant impacts in this regard are predicted. Overall, a significant negative effect has been identified with respect to landscape.

Operation

The operation of the reservoir would provide a buffer raw water supply and improve resilience of Pen-y-Bont under dry weather/peak demand conditions when run-of-river abstraction may not supply sufficient inflow to the WTW. The HRA highlights that the Lley Peninsula and the Sarnau SAC is the main downstream receptor of the Afon Fathew, from which the abstraction would presumably be made; however, the nature of the abstraction (periodic, to provide refill for longer-term dry period buffering) would be unlikely to affect this site, although further information on scheme operation would be required should the option be taken forward. The features of the coincident downstream sites (e.g. West Wales Marine cSAC; Northern Cardigan Bay pSPA) are not particularly sensitive to the likely effects of the scheme. Overall, the option has therefore been assessed as having a neutral effect on biodiversity at this stage, although some uncertainty remains.

There would be no operational effects on soils/land use.

No operational effects on the Afon Fathew are predicted; however, there is the potential for positive impacts on the waterbody if the reservoir's operation reduces reliance on the river abstraction at times of low flow. This has been assessed as having a positive effect on water quality and water quantity, although some uncertainty remains.

As noted above, the reservoir site is not within Flood Zones 2 or 3 and the operation of the scheme would be unlikely to result in increased flooding elsewhere. The option has therefore been assessed as having a neutral effect on flood risk.

Operational energy demand for this scheme would be 113 tonnes of CO₂e. This has been assessed as having a minor negative effect on climate change.

The operation of the scheme would help secure water supplies during dry weather/peak demand, although the gain (0.44 Ml/d) would be very minor. Overall, the option has therefore been assessed as having a neutral effect on health and wellbeing.

This option is not a leakage reduction or water efficiency option and would have no impact on water resources.

The operation of this option would not involve additional infrastructure or resources; however, there would be a requirement for ongoing energy usage which has been assessed as having a minor negative effect on waste and resources.

There would be no operational effects on designated cultural heritage assets.

As noted above, the proposed reservoir site is within Snowdonia National Park and therefore there is the potential for significant adverse effects on this designated landscape. The presence of the reservoir may also affect the visual amenity of recreational and residential receptors, although given the rural location of the scheme and its proximity to an existing WTW, no significant impacts in this regard are predicted. Overall, a significant negative effect has therefore been identified with respect to landscape.

Feasible Leakage Reduction Options

Pembrokeshire Resource Zone

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM AR All Mains Schemes	Construction	-/?	0	0	0	0	-/?	-	++/-/?	0	-/?	0	-
	Operation	0	0	+	0	0	+/?	+/?	+/?	++/?	+/?	0	0

Construction

This option involves the replacement and renewal of trunk mains, communication pipes (running from the trunk main to a property boundary), and Customer Supply Pipes (CSP) (from the property boundary to inside the property). Trunk mains replacement would involve larger scale works than communication pipes and CSPs. The replacement of trunk mains, communication pipes and CSPs would take place on up to 573km of pipeline, depending on the scale of replacement that takes place.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the potential length of pipeline replacement and large area affected by the works under this option, a negative effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the replacement of trunk mains, communication pipes and CSPs is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The location of trunk mains, communication pipes and CSPs to be replaced is not yet known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.



There would be carbon emissions as a result of pipeline replacement, arising from embodied carbon associated with new pipelines and emissions from plant and vehicle movements. The carbon emissions associated with this option are estimated to be a maximum of 52,472 tCO₂ (depending on the length of pipeline replaced) which has been assessed as having a significant negative effect on climate change, although some uncertainty remains.

Replacement of trunk mains, communication pipes and CSPs would require excavation and construction work, with renewal of mains likely to involve larger scale works in highways. Vehicle movements and the operation of plant associated with pipeline replacement may affect local air quality and generate noise/vibration disturbance, although any impacts would be temporary. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed. Overall, a negative effect has therefore been identified in respect of health.

Depending on the extent of pipeline replacement, capital expenditure associated with this option could be significant and may generate positive economic effects such as jobs creation and supply chain benefits. However, during replacement works, there is the potential for localised disruption to traffic, particularly along any sections of pipeline requiring work along or across roads. Overall, this option is considered to have a mixed significant positive and negative effect with respect to wellbeing, although some uncertainty remains.

During construction, this option would not affect leakage or water efficiency.

Depending on the extent of pipeline replacement, there could be a substantial increase in resource use and waste. A significant negative effect on resource use and waste has therefore been identified.

Construction associated with the replacement of trunk mains, communication pipes and CSPs may involve carrying out works in the curtilage or grounds of heritage assets; however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Replacement works under this option could involve extensive construction work across a wide area, which is expected to give rise to landscape and visual effects. However, any impacts would be temporary with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a minor negative effect has been identified in respect of landscape.

Operation

Once mains, communication pipes and CSPs have been replaced, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings of up to 5.3 Ml/d as a result of reduced leakage which would lower demand for water abstraction. Consistent with the definitions of significance, this has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

The operation of this option would result in a decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water. The estimated reduction in greenhouse gas emissions associated with this option is up to 727 tCO₂ per annum which has been assessed as having a positive effect with respect to climate change, although some uncertainty remains.

Water savings of up to 5.3 Ml/d would have a positive effect on human health by helping to secure drinking water supply. A positive effect has also been identified in respect of wellbeing.

This option would result in substantial reduced leakage from trunk mains, communication pipes and CSPs which is assessed as having a significant positive effect on the sustainable use of water resources, although some uncertainty remains.

A minor positive effect with respect to waste and resources is anticipated as a result of energy and resource savings due to reduced water treatment.

No effects on heritage assets or landscape are expected during the operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM AR Comms and CSP Schemes	Construction	0	0	0	0	0	--/?	-	++/-/?	0	--/?	0	0
	Operation	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0

Construction

This option involves the replacement and renewal of communication pipes (running from the trunk main to a property boundary) and Customer Supply Pipes (CSP) (from the property boundary to inside the property). The option excludes the replacement of trunk mains, and typically involves smaller scale works than mains replacements.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and works would be carried out in close proximity to/within property curtilages. Further, it is also expected that any adverse effects would be reduced where possible using best practice construction techniques. Overall, this option has been assessed as having a neutral effect on biodiversity.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the replacement of communication pipes and CSPs is not expected to have any effect on river flows or groundwater levels, or on water quality.

The location of communication pipes and CSPs to be replaced is not yet known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of pipeline replacement, arising from embodied carbon associated with new pipelines and emissions from plant and vehicle movements. The carbon emissions associated with this option are not known (and will depend on length of pipelines replaced); however, they could be significant. Overall, the option has been assessed as having a significant negative effect on climate change, although some uncertainty remains.

Replacement of communication pipes and CSPs would require excavation and construction work between trunk mains and properties. Vehicle movements and the operation of plant associated with pipeline replacement may affect local air quality and generate noise/vibration disturbance which could affect sensitive receptors, particularly given the proximity of works to properties. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed. Overall, the option has therefore been assessed as having a negative effect on health.



Depending on the extent of pipeline replacement, capital expenditure associated with this option could be significant and may generate positive economic effects such as jobs creation and supply chain benefits. However, during replacement works, there is the potential for localised disruption to traffic, particularly along any sections of pipeline requiring work along or across roads. Overall, this option is considered to have a mixed significant positive and negative effect with respect to wellbeing, although some uncertainty remains.

During construction, this option would not affect leakage or water efficiency.

During construction there would be an increase in resource use for new pipelines and construction waste along with fuel usage for vehicles and plant which could be substantial. A significant negative effect on resource use and waste has therefore been identified, with some uncertainty remaining.

Construction associated with the replacement of communication pipes and CSPs may involve carrying out works in the curtilage or grounds of heritage assets; however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Replacement works under this option could give rise to landscape and visual effects. However, works would take place in close proximity to existing properties and any impacts would be temporary. Overall, a neutral effect has been identified in respect of landscape.

Operation

Once communication pipes and CSPs have been replaced, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings of up to 2.9 Ml/d as a result of reduced leakage which would lower demand for water abstraction. Consistent with the definitions of significance, this has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

The operation of this option would result in a decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water. The estimated reduction in greenhouse gas emissions associated with this option is up to 568 tCO₂ per annum which has been assessed as having a positive effect with respect to climate change, although some uncertainty remains.

Water savings of up to 2.9 Ml/d would have a positive effect on human health by helping to secure drinking water supply. A positive effect has also been identified in respect of wellbeing, although some uncertainty remains.

This option would result in reduced leakage from trunk mains, communication pipes and CSPs which is assessed as having a positive effect on the sustainable use of water resources as well as waste and resources.

No effects on heritage assets or landscape are expected during the operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM AR Mains and Comms Schemes	Construction	-/?	0	0	0	0	--/?	-	++/-/?	0	--/?	0	-
	Operation	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0

Construction

This option involves the replacement and renewal of trunk mains and communication pipes (running from the trunk main to a property boundary). Trunk mains replacement would involve larger scale works than communication pipes. The replacement of trunk mains and communication pipes would take place on up to 545km of pipeline, depending on the scale of replacement that takes place. This option excludes replacement of Customer Supply Pipes (CSP) (from the property boundary to inside the property).

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the potential length of pipeline replacement and large area affected by the works under this option, a negative effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the replacement of trunk mains and communication pipes is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The location of trunk mains and communication pipes to be replaced is not yet known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of pipeline replacement, arising from embodied carbon associated with new pipelines and emissions from plant and vehicle movements. The carbon emissions associated with this option are estimated to be a maximum of 50,112 tCO₂ (depending on the length of pipeline replaced) which has been assessed as having a significant negative effect on climate change, although some uncertainty remains.



Replacement of trunk mains and communication pipes would require excavation and construction work, with renewal of mains likely to involve larger scale works in highways. Vehicle movements and the operation of plant associated with pipeline replacement may affect local air quality and generate noise/vibration disturbance, although any impacts would be temporary. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed. Overall, a negative effect has therefore been identified in respect of health.

Depending on the extent of pipeline replacement, capital expenditure associated with this option could be significant and may generate positive economic effects such as jobs creation and supply chain benefits. However, during replacement works, there is the potential for localised disruption to traffic, particularly along any sections of pipeline requiring work along or across roads. Overall, this option is considered to have a mixed significant positive and negative effect with respect to wellbeing, although some uncertainty remains.

During construction, this option would not affect leakage or water efficiency.

Depending on the extent of pipeline replacement, there could be a substantial increase in resource use and waste. A significant negative effect on resource use and waste has therefore been identified.

Construction associated with the replacement of trunk mains and communication pipes may involve carrying out works in the curtilage or grounds of heritage assets; however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Replacement works under this option could involve extensive construction work across a wide area, which is expected to give rise to landscape and visual effects. However, any impacts would be temporary with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a minor negative effect has been identified in respect of landscape.

Operation

Once trunk mains and communication pipes have been replaced, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings of up to 4.1 Ml/d as a result of reduced leakage which would lower demand for water abstraction. Consistent with the definitions of significance, this has been identified as a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

The operation of this option would result in a decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water. The estimated reduction in greenhouse gas emissions associated with this option is up to 731 tCO₂ per annum which has been assessed as having a positive effect with respect to climate change, although some uncertainty remains.

Water savings of up to 4.1 Ml/d would have a positive effect on human health by helping to secure drinking water supply. A positive effect has also been identified in respect of wellbeing.

This option would result in reduced leakage from trunk mains and communication pipes which is assessed as having a positive effect on the sustainable use of water resources as well as waste and resources.

No effects on heritage assets or landscape are expected during the operation of this option.



Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM Trunk Main Renewal	Construction	-/?	0	0	0	0	--/?	-	++/-/?	0	--/?	0	-
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves identification and replacement of leaking sections of trunk mains. The replacement of trunk mains would take place on up to 86km of pipeline, depending on the scale of replacement that takes place.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the potential length of pipeline replacement and large area affected by the works under this option, a negative effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the replacement of trunk mains is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The location of trunk mains to be replaced is not yet known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of trunk mains replacement, arising from embodied carbon associated with new pipeline and emissions from plant and vehicle movements to find and replace leaking mains. The carbon emissions associated with this option are estimated to be a maximum of 7,905 tCO₂ (depending on the length of pipeline replaced) which has been assessed as having a significant negative effect on climate change, although some uncertainty remains.

Trunk mains replacement may involve larger scale construction work than repair options, with more substantive excavations of longer duration. Vehicle movements and the operation of plant associated with mains replacement may affect local air quality and generate noise/vibration disturbance, although any impacts would be temporary. Overall, a negative effect has therefore been identified in respect of health.

Depending on the extent of pipeline replacement, capital expenditure associated with this option could be significant and may generate positive economic effects such as jobs creation and supply chain benefits. However, during replacement works, there is the potential for localised disruption to traffic, particularly along any sections of pipeline requiring work along or across roads. There may also be



disruption to water supply; however, such impacts would be temporary and are likely to be managed. Overall, this option is considered to have a mixed significant positive and negative effect with respect to wellbeing, although some uncertainty remains.

During construction, this option would not affect leakage or water efficiency.

Depending on the extent of pipeline replacement, there could be a substantial increase in resource use and waste. A significant negative effect on resource use and waste has therefore been identified, although some uncertainty remains.

Construction associated with replacement of trunk mains may involve carrying out works in the curtilage or grounds of heritage assets, however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Replacement works under this option could involve extensive construction work across a wide area, which is expected to give rise to landscape and visual effects. However, any impacts would be temporary with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a minor negative effect has been identified in respect of landscape.

Operation

Once trunk mains have been replaced, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings as a result of reduced leakage which would lower demand for water abstraction. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a small decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water, however the scale of reduction (up to 16 tCO₂) would have a negligible effect on climate change.

Water savings up to 0.14 Ml/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage from trunk mains, which is assessed as having a minor positive effect on the sustainable use of water resources.

No additional resources or energy would be required once trunk mains are replaced.

No effects on heritage assets or landscape are expected during operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM Trunk Main Repair	Construction	0/?	0	0	0	0	0	0	0	0	-	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves leak detection to identify leaks on trunk mains and the repair of leaks where found. The identification and repair of leaks would take place on up to 86km of pipeline, depending on the scale of leak identification and repair that takes place. The option does not involve the replacement of pipelines.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. As repair works are expected to be of relatively small scale compared to pipeline replacement, a neutral effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the repair of trunk mains is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The location of trunk mains to be repaired is not yet known and therefore it cannot be determined whether pipeline leaks would be located in areas at risk of flooding. However, it is assumed that minor repair works could be scheduled to avoid periods of flooding. Construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of leakage repair, arising from embodied carbon associated with repair materials and emissions from plant and vehicle movements to find and fix leaks. The carbon emissions associated with this option are estimated to be a maximum of 6 tCO₂ (depending on the length of pipeline repaired) and are therefore assessed as having a neutral effect on climate change.

Repair of leaks may affect local air quality and generate noise/vibration disturbance; however, any works would be small scale and of short duration such that any effects on human health would be limited. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed.

Capital expenditure associated with the repairs is assessed as insufficient to have a substantive effect on the local economy and local employment creation. The repair of infrastructure may result in short term and temporary adverse impacts on the road network, however this is expected to affect a very localised area at any time such that the effect on wellbeing is considered neutral.



During construction, this option would not affect leakage or water efficiency.

Depending on the extent of pipeline repair, there could be an increase in resource use and waste. A minor negative effect on resource use and waste has therefore been identified.

Construction associated with fixing leaks may involve carrying out works in the curtilage or grounds of heritage assets; however this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Repair works under this option could give rise to landscape and visual effects. However, any impacts would be temporary and small scale with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once a leak has been repaired, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings as a result of reduced leakage which would lower demand for water abstraction. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a small decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water, however the scale of reduction (up to 11 tCO₂) would have a negligible effect on climate change.

Water savings up to 0.10 Ml/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage from trunk mains, which is assessed as having a minor positive effect on the sustainable use of water resources.

No additional resources or energy would be required once leaks are repaired.

No effects on heritage assets or landscape are expected during operation of this option.



Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM ALC Leakage Reduction Options	Construction	0/?	0	0	0	0	-/?	-/?	++/-/?	0	-/?	0	0
	Operation	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0

Construction

This option involves Active Leakage Control (ALC), which is a leakage detection and repair scheme utilising various investigation techniques in order to reduce and maintain leakage at a defined level. The scope and extent of leakage reduction is currently unknown at this stage.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected would have previously been disturbed during the initial installation of pipework, and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the potentially smaller scale of work under this option, a neutral effect on biodiversity is assumed likely although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take. Furthermore, all excavated soil would be reinstated following the construction period thus any disruption would be temporary. Consequently, this option has been assessed as having a neutral effect on geology and soils.

It is not expected that construction would affect river flows or groundwater levels, or on water quality provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The locations of pipelines requiring repair/replacement are not currently known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. Notwithstanding, it is assumed that works could be scheduled to avoid periods of flooding, and works are not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of leakage identification and reduction, arising from embodied carbon in addition to emissions from plant and vehicle movements throughout the investigative and construction period. The carbon emissions associated with this option are estimated to be a maximum of 295 tCO₂ per year (depending on the intensity of movement throughout the WRZ and the length of pipeline targeted for leakage reduction) which has been assessed as having a minor negative effect on climate change, although some uncertainty remains.



Depending on the scale of construction and excavation works, there may be temporary noise/vibration disturbance, air quality impacts (dust) and loss of amenity due to vehicle movements and the operation of plant. Consequently, this option has been assessed as having a negative effect with some uncertainty with respect to human health.

Capital expenditure associated with this option could be significant, depending on the scale and nature of works. This may generate positive economic effects such as jobs creation and supply chain benefits together with spend by construction workers and contractors. Pipeline works may be routed along or across roads which could result in increased localised congestion and disruption throughout the construction phase. On balance, this option has been assessed as having a mixed significant positive effect and minor negative effect on wellbeing, although some uncertainty remains.

The option would not affect water efficiency.

During the investigative and construction period, there could be an increase in resource use and waste, depending on the extent of pipeline works. Consequently, a negative effect on resource use and waste has been identified.

Pipelines targeted for investigation and subsequent repair/replacement may be within or immediately adjacent to the curtilage or grounds of scheduled monuments and listed buildings, which could result in the temporary loss of visual amenity to the settings of these assets. Notwithstanding, these sites would have been previously disturbed during the initial installation of the pipelines and therefore it is assumed that any effects could be managed through appropriate mitigation. Overall, this option has been assessed as having a neutral effect on cultural heritage.

The locations and length of pipeline targeted under this option are not currently known, but could give rise to landscape and visual effects, however, any impacts would be temporary with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once the specified leakage level has been reached, continued maintenance on targeted pipelines may result in periodic disturbance and/or nuisance to local wildlife, however effects on biodiversity are expected to be negligible.

Once the repair/replacement of leaking pipelines is complete, it is considered unlikely that that operation of the scheme would result in any adverse effects on soils/land use.

Operation of the option is expected to increase water supply by reducing and maintaining leakage to a pre-determined amount, with savings of up to 3.7 Ml/d. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water. The estimated decrease in greenhouse gas emissions associated with this option of up to 587 tCO₂ per annum has been assessed as having a positive effect with respect to climate change, although some uncertainty remains.

Continued maintenance on targeted pipelines could result in temporary disturbance and/or nuisance, however effects on human health are expected to be negligible. Overall, water savings of up to 3.7 Ml/d may help ensure a continual supply of clean drinking water, which has been assessed as having a minor positive effect on health. A positive effect has also been identified in respect of wellbeing, although some uncertainty remains.

This option would result in reduced leakage (3.7 Ml/d) which has been assessed as having a positive effect on the sustainable use of water resources, as well as waste and resources, although some uncertainty remains.

No effects on heritage assets or landscape are expected during the operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM Policy Minimum Leakage Detection	Construction	0/?	0	0	0	0	-/?	0	0	0	-/?	0	0
	Operation	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0

Construction

This option involves a leakage detection and repair scheme which would utilise various investigation techniques in order to reduce leakage levels to the policy minimum. The scope and extent of leakage reduction is currently unknown at this stage; however, it is assumed that leakage identification and pipeline repair work would be relatively small scale.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected would have previously been disturbed during the initial installation of pipework, and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, a neutral effect on biodiversity is assumed likely although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take. Furthermore, all excavated soil would be reinstated following the construction period thus any disruption would be temporary. Consequently, this option has been assessed as having a neutral effect on geology and soils.

It is not expected that construction would affect river flows or groundwater levels, or on water quality provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The locations of pipelines requiring repair/replacement are not currently known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. Notwithstanding, it is assumed that works could be scheduled to avoid periods of flooding, and works are not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of leakage identification and reduction, arising from embodied carbon associated with new pipeline in addition to emissions from plant and vehicle movements throughout the investigative and construction period. The carbon emissions associated with this option are estimated to be a maximum of 141 tCO₂ (depending on the intensity of movement throughout the WRZ and the length of pipeline targeted for leakage reduction) which has been assessed as having a minor negative effect on climate change, although some uncertainty remains.

Depending on the scale of construction and excavation works, there may be temporary noise/vibration disturbance, air quality impacts (dust) and loss of amenity due to vehicle movements and the operation of plant. However, any works would be small scale and of short duration in any particular location, and as a result an effect on human health is not anticipated. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed.



Capital expenditure is considered insufficient to have a substantive effect on the local economy and local employment creation. Pipeline works may be routed along or across roads which could result in increased localised congestion and disruption throughout the construction phase, however this is expected to be temporary and small in scale. Overall, this option has been assessed as having a neutral effect on wellbeing.

The option would not affect water efficiency.

During the investigative and construction period, there could be an increase in resource use and waste. Consequently, a negative effect on resource use and waste has been identified.

Pipelines targeted for investigation and subsequent repair/replacement could be within or immediately adjacent to the curtilage or grounds of scheduled monuments and listed buildings which could result in the temporary loss of visual amenity to the settings of these assets. Notwithstanding, these sites would have been previously disturbed during the initial installation of the pipelines and therefore it is assumed that any effects could be managed through appropriate mitigation. Overall, this option has been assessed as having a neutral effect on cultural heritage.

The locations and length of pipeline targeted under this option are not currently known, but could give rise to landscape and visual effects, however, any impacts would be temporary with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once the repair/replacement of leaking pipelines is complete, it is considered unlikely that that operation of the scheme would result in any adverse effects on biodiversity or soils/land use.

Operation of the option is expected to increase water supply by reducing leakage to policy minimum, with savings of up to 2.4 Ml/d. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water. The estimated decrease in greenhouse gas emissions associated with this option of up to 443 tCO₂ per annum has been assessed as having a minor positive effect with respect to climate change, although some uncertainty remains.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, water savings of up to 2.4 Ml/d may help ensure a continual supply of clean drinking water, which has been assessed as having a minor positive effect on health. A positive effect has also been identified in respect of wellbeing.

This option would result in reduced leakage to policy minimum levels (saving 2.4 Ml/d) which has been assessed as having a positive effect on the sustainable use of water resources, as well as waste and resources.

No effects on heritage assets or landscape are expected during the operation of this option.



Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM Leakage Automation	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option would involve the below ground installation of acoustic loggers within the DMA water network which would, following a period of calibration, detect and pinpoint any emerging leakages within the network in order to reduce detection costs, leak run times and safety hazards for personnel.

Construction activity associated with this option would be very minor and is not expected to have a discernible effect on biodiversity.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction activity is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The potential locations of the acoustic loggers are not currently known and therefore it cannot be determined whether works would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of logger installation arising from embodied carbon within the loggers and emissions from plant and vehicle movements. The carbon emissions are estimated at a maximum of 3.22 tCO₂ (note, this does not include embodied carbon within acoustic loggers), dependent on the number of loggers installed. Given the anticipated low level of emissions, this option has been assessed as having a neutral effect on climate change.

Due to the scale of works, it is considered unlikely that this option would result in any adverse effects on human health.

The scale of capital expenditure associated with this option would be very small and any economic impacts are therefore likely to be negligible.

The option would not affect water efficiency.

During the construction period, there would be an increase in resource use for acoustic logger installation and construction waste along with fuel usage for vehicles and plant. However, in view of the scale of works, a neutral effect on resource use and waste has been identified.

Given the anticipated scale of works under this option, no effects on cultural heritage or landscape are predicted.



Operation

Once loggers have been installed, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings of up to 0.057 Ml/d (depending on the number of loggers installed) as a result of improved leakage detection. Consistent with the definitions of significance, this has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

The operation of this option would result in a decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water. However, the estimated reduction in greenhouse gas emissions associated with this option (up to 4.88 tCO₂ per annum) is very small and has been assessed as having a neutral effect with respect to climate change and waste and resource use.

Water savings associated with this option would be very small and therefore effects on human health and wellbeing have been assessed as neutral.

As noted above, improved leakage detection would generate water savings which has been assessed as having a positive effect on the sustainable use of water resources.

No effects on heritage assets or landscape are expected during the operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
PEM Pressure Management Schemes	Construction	0	0	0	0	0	-/?	0	0	0	-/?	0	0
	Operation	0	0	+	0	0	+/?	+/?	+/?	+	+/?	0	0

Construction

This option would involve the implementation of pressure management schemes within the pressure management areas (PMAs) characterised as having daily high pressure variance. This would regulate and/or reduce high pressure variations across the area in order to reduce the risk of leakage, and furthermore, reduce water breakout should leakage occur within the network.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, a neutral effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with this option is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

It is not expected that the implementation of pressure management schemes would have an impact on river flows or groundwater levels, or on water quality, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The potential locations for the installation of new PRVs in addition to the sites currently supporting existing PRVs and ancillary infrastructure are not currently known thus flood risk cannot accurately be assessed at this time. Notwithstanding, it is assumed that works could be scheduled to avoid periods of flooding, and furthermore, works are not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of the implementation of pressure management schemes. The carbon emissions for this option are not currently known and will depend on the number of schemes implemented; however, they are unlikely to be significant. Overall, a negative effect has been identified in respect of climate change although some uncertainty remains.

Due to the scale of works, it is considered unlikely that this option would result in any adverse effects on human health.



The scale of capital expenditure associated with this option would be small and any economic impacts are therefore likely to be negligible. The installation of pressure management schemes may result in short term and temporary adverse impacts on the road network (e.g. as a result of increased vehicle movements, road closures/diversions etc) although such impacts would be temporary.

The option would not affect water efficiency.

During the construction period, there would be an increase in resource use associated with installation works and construction waste along with fuel usage for vehicles and plant. Consequently, a minor negative effect on resource use and waste has been identified.

Construction associated with this option may involve carrying out works in the curtilage or grounds of heritage assets; however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Given the small scale and short term nature of works under this option and focus on underground infrastructure, together with the assumption that appropriate mitigation would be adopted during construction, it is expected that effects on landscape would be neutral.

Operation

Once pressure management schemes have been implemented, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings of up to 1.7 Ml/d (depending on the number of schemes implemented) through a reduction of leakage and water breakout via regulation and/or reduction of high pressure within the network. Consistent with the definitions of significance, this has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

The operation of this option would result in a decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water. The estimated reduction in greenhouse gas emissions associated with this option is up to 102 tCO₂ per annum which has been assessed as having a positive effect with respect to climate change, although some uncertainty remains.

Water savings of up to 1.7 Ml/d would have a positive effect on human health by helping to secure drinking water supply. Further, pressure management schemes are likely to reduce disruption due to mains failure. A positive effect has also been identified in respect of wellbeing.

As noted above, leakage reduction would generate water savings which has been assessed as having a positive effect on the sustainable use of water resources as well as waste and resources.

No effects on heritage assets or landscape are expected during the operation of this option.

Tywyn Aberdyfi Resource Zone

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA AR All Mains Schemes	Construction	0/?	0	0	0	0	--/?	0	+/?	0	--/?	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves the replacement and renewal of trunk mains, communication pipes (running from the trunk main to a property boundary), and Customer Supply Pipes (CSP) (from the property boundary to inside the property). Trunk mains replacement would involve larger scale works than communication pipes and CSPs. The replacement of trunk mains, communication pipes and CSPs would take place on up to 12km of pipeline, depending on the scale of replacement that takes place.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the relatively small length of pipeline replacement under this option, a neutral effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the replacement of trunk mains, communication pipes and CSPs is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The location of trunk mains, communication pipes and CSPs to be replaced is not yet known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of pipeline replacement, arising from embodied carbon associated with new pipelines and emissions from plant and vehicle movements. The carbon emissions associated with this option are estimated to be a maximum of 1,063 tCO₂ (depending on the length of pipeline replaced) which has been assessed as having a significant negative effect on climate change, although some uncertainty remains.



Replacement of trunk mains, communication pipes and CSPs would require excavation and construction work, with renewal of mains likely to involve larger scale works in highways. Vehicle movements and the operation of plant associated with pipeline replacement may affect local air quality and generate noise/vibration disturbance; however, as the option involves the replacement of a short distance of pipeline, an effect on human health is not anticipated. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed.

Depending on the extent of pipeline replacement, capital expenditure associated with this option could have positive economic effects such as jobs creation and supply chain benefits. During replacement works, there is the potential for localised disruption to traffic, particularly along any sections of pipeline requiring work along or across roads. However, any adverse effects would be temporary and small in scale. Overall, this option is considered to have a positive effect with respect to wellbeing, although some uncertainty remains.

During construction, this option would not affect leakage or water efficiency.

Depending on the extent of pipeline replacement, there could be an increase in resource use and waste. A significant negative effect on resource use and waste has therefore been identified.

Construction associated with the replacement of trunk mains, communication pipes and CSPs may involve carrying out works in the curtilage or grounds of heritage assets; however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Replacement works under this option could give rise to landscape and visual effects. However, any impacts would be temporary and small scale with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once mains, communication pipes and CSPs have been replaced, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings as a result of reduced leakage which would lower demand for water abstraction. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a small decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water; however, the scale of reduction (<1 tCO₂) would have a negligible effect on climate change.

Water savings up to 0.02 Ml/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage from trunk mains, communication pipes and CSPs which is assessed as having a minor positive effect on the sustainable use of water resources.

No additional resources or energy would be required once pipelines are replaced.

No effects on heritage assets or landscape are expected during operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA AR Comms and CSP Schemes	Construction	0	0	0	0	0	-/?	0	0	0	-/?	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves the replacement and renewal of communication pipes (running from the trunk main to a property boundary) and Customer Supply Pipes (CSP) (from the property boundary to inside the property). The option excludes the replacement of trunk mains, and typically involves smaller scale works than mains replacements.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and works would be carried out in close proximity to/within property curtilages. Further, it is also expected that any adverse effects would be reduced where possible using best practice construction techniques. Overall, this option has been assessed as having a neutral effect on biodiversity.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the replacement of communication pipes and CSPs is not expected to have any effect on river flows or groundwater levels, or on water quality.

The location of communication pipes and CSPs to be replaced is not yet known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of pipeline replacement, arising from embodied carbon associated with new pipelines and emissions from plant and vehicle movements. The carbon emissions associated with this option are not known (and will depend on length of pipelines replaced); however, in this zone, they are considered unlikely to be significant (reflecting the anticipated scale of works). Overall, the option has been assessed as having a negative effect on climate change, although some uncertainty remains.

Replacement of communication pipes and CSPs would require excavation and construction work between trunk mains and properties. Vehicle movements and the operation of plant associated with pipeline replacement may affect local air quality and generate noise/vibration disturbance which could affect sensitive receptors, particularly given the proximity of works to properties. However, as the option would be likely to involve the replacement of a short distance of pipeline, an effect on human health is not anticipated. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed.



Capital expenditure associated with this option would be relatively small and in consequence, a neutral effect has been identified with respect to wellbeing.

During construction, this option would not affect leakage or water efficiency.

During construction there would be a small increase in resource use for new pipelines and construction waste along with fuel usage for vehicles and plant. A negative effect on resource use and waste has therefore been identified, with some uncertainty remaining.

Construction associated with the replacement of communication pipes and CSPs may involve carrying out works in the curtilage or grounds of heritage assets; however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Replacement works under this option could give rise to landscape and visual effects. However, works would take place in close proximity to existing properties and any impacts would be temporary. Overall, a neutral effect has been identified in respect of landscape.

Operation

Once communication pipes and CSPs have been replaced, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings as a result of reduced leakage which would lower demand for water abstraction. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are expected.

Operation of this option would result in a small decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water; however, the scale of reduction (up to 2.7 tCO₂) would have a negligible effect on climate change.

Water savings up to 0.02 Ml/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage from communication pipes and CSPs which is assessed as having a minor positive effect on the sustainable use of water resources.

No additional resources or energy would be required once pipelines are replaced.

No effects on heritage assets or landscape are expected during operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA Trunk Main Renewal	Construction	0/?	0	0	0	0	-/?	0	++/?	0	-/?	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves identification and replacement of leaking sections of trunk mains. The replacement of trunk mains would take place on up to 6km of pipeline, depending on the scale of replacement that takes place.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the relatively small length of pipeline replacement under this option, a neutral effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the replacement of trunk mains is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The location of trunk mains to be replaced is not yet known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. However, it is assumed that works could be scheduled to avoid periods of flooding and construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of trunk mains replacement, arising from embodied carbon associated with new pipeline and emissions from plant and vehicle movements to find and replace leaking mains. The carbon emissions associated with this option are estimated to be a maximum of 517 tCO₂ (depending on the length of pipeline replaced) which has been assessed as having a minor negative effect on climate change, although some uncertainty remains.

Trunk mains replacement may involve larger scale construction work than repair options, with more substantive excavations of longer duration. Vehicle movements and the operation of plant associated with mains replacement may affect local air quality and generate noise/vibration disturbance; however, as the option involves the replacement of a short distance of trunk main, an effect on human health is not anticipated. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed.



Depending on the extent of pipeline replacement, capital expenditure associated with this option could be significant and may generate positive economic effects such as jobs creation and supply chain benefits. During replacement works, there is the potential for localised disruption to traffic, particularly along any sections of pipeline requiring work along or across roads. However, any adverse effects would be temporary and small in scale. Overall, this option is considered to have a significant positive effect with respect to wellbeing, although some uncertainty remains.

During construction, this option would not affect leakage or water efficiency.

Depending on the extent of pipeline replacement, there could be a minor increase in resource use and waste. A minor negative effect on resource use and waste has therefore been identified.

Construction associated with replacement of trunk mains may involve carrying out works in the curtilage or grounds of heritage assets, however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Replacement works under this option could give rise to landscape and visual effects. However, any impacts would be temporary and small scale with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once trunk mains have been replaced, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings as a result of reduced leakage which would lower demand for water abstraction. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a small decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water, however the scale of reduction (<1 tCO₂) would have a negligible effect on climate change.

Water savings up to 0.04 MI/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage from trunk mains, which is assessed as having a minor positive effect on the sustainable use of water resources.

No additional resources or energy would be required once trunk mains are replaced.

No effects on heritage assets or landscape are expected during operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA Trunk Main Repair	Construction	0/?	0	0	0	0	0	0	0	0	0	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves leak detection to identify leaks on trunk mains and the repair of leaks where found. The identification and repair of leaks would take place on up to 6km of pipeline, depending on the scale of leak identification and repair that takes place. The option does not involve the replacement of pipelines.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected will have been previously disturbed and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. As repair works are expected to be of relatively small scale compared to pipeline replacement and extent of pipeline repair is small, a neutral effect on biodiversity is assumed likely, although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take; any soil displaced through excavation would be returned following the completion of works. Effects on geology and soils are therefore expected to be negligible.

Construction work associated with the repair of trunk mains is not expected to have any effect on river flows or groundwater levels, or on water quality provided best practices are adhered to.

The location of trunk mains to be repaired is not yet known and therefore it cannot be determined whether pipeline leaks would be located in areas at risk of flooding. However, it is assumed that minor repair works could be scheduled to avoid periods of flooding. Construction work is not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of leakage repair, arising from embodied carbon associated with repair materials and emissions from plant and vehicle movements to find and fix leaks. The carbon emissions associated with this option would be very small and are estimated to be a maximum of 18 tCO₂ (depending on the length of pipeline repaired). This has been assessed as having a neutral effect on climate change.

Repair of leaks may affect local air quality and generate noise/vibration disturbance; however, any works to repair leaks would be small scale and of short duration in any particular location. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed. As a result an effect on human health is not anticipated.



Capital expenditure associated with the repairs is assessed as insufficient to have a substantive effect on the local economy and local employment creation. The repair of infrastructure may result in short term and temporary adverse impacts on the road network, however this is expected to affect a very localised area at any time such that the effect on wellbeing is considered neutral.

During construction, this option would not affect leakage or water efficiency.

Depending on the extent of pipeline repair, there could be an increase in resource use and waste. However, in view of the length of pipeline to be repaired, any effects on resource use and waste are expected to be negligible.

Construction associated with fixing leaks may involve carrying out works in the curtilage or grounds of heritage assets, however, this would be temporary and would only affect previously disturbed land. It is also assumed that any effects could be managed through appropriate mitigation.

Repair works under this option could give rise to landscape and visual effects. However, any impacts would be temporary and small scale with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once a leak has been repaired, the option is not expected to have any effects on biodiversity or geology and soils.

Operation of the option would result in water savings as a result of reduced leakage which would lower demand for water abstraction. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a small decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water; however, the scale of reduction (<1 tCO₂) would have a negligible effect on climate change.

Water savings up to 0.03 Ml/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage from trunk mains, which is assessed as having a minor positive effect on the sustainable use of water resources.

No additional resources or energy would be required once leaks are repaired.

No effects on heritage assets or landscape are expected during operation of this option.



Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA ALC Leakage Reduction Options	Construction	0/?	0	0	0	0	0	0	0	0	-	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves Active Leakage Control (ALC), which is a leakage detection and repair scheme utilising various investigation techniques in order to reduce and maintain leakage at a defined level. The scope and extent of leakage reduction is currently unknown at this stage; however, it is assumed that leakage identification and pipeline repair/maintenance would be minor.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected would have previously been disturbed during the initial installation of pipework, and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the potentially small scale of work under this option, a neutral effect on biodiversity is assumed likely although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take. Furthermore, all excavated soil would be reinstated following the construction period thus any disruption would be temporary. Consequently, this option has been assessed as having a neutral effect on geology and soils.

It is not expected that construction would affect river flows or groundwater levels, or on water quality provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The locations of pipelines requiring repair/replacement are not currently known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. Notwithstanding, it is assumed that works could be scheduled to avoid periods of flooding, and works are not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of leakage identification and reduction, arising from embodied carbon associated in addition to emissions from plant and vehicle movements throughout the investigative and construction period. The carbon emissions associated with this option are estimated to be a maximum of 8 tCO₂ per year (depending on the intensity of movement throughout the WRZ and the length of pipeline targeted for leakage reduction) which has been assessed as having a neutral effect on climate change.

Depending on the scale of construction and excavation works, there may be minor and temporary noise/vibration disturbance, air quality impacts (dust) and loss of amenity due to vehicle movements and the operation of plant. Due to the assumed small scale of construction, this option has been assessed as having a negligible effect on human health.



Capital expenditure associated with this option is considered insufficient to have a substantive effect on the local economy and local employment creation. Pipeline works may be routed along and/or utilise roads which could result in congestion and disruption throughout the construction phase, however this is expected to affect a very localised area at any time. As a result, this option has been assessed as having a neutral effect on wellbeing.

The option would not affect water efficiency.

During the investigative and construction period, there could be a minor increase in resource use and waste. Consequently, a minor negative effect on resource use and waste has been identified.

Pipelines targeted for investigation and subsequent repair/replacement could be within or immediately adjacent to the curtilage or grounds of scheduled monuments and listed buildings which could result in the temporary loss of visual amenity to the settings of these assets. Notwithstanding, these sites would have been previously disturbed during the initial installation of the pipelines and therefore it is assumed that any effects could be managed through appropriate mitigation. Overall, this option has been assessed as having a neutral effect on cultural heritage.

The locations and length of pipeline targeted under this option are not currently known, but could give rise to landscape and visual effects, however, any impacts would be temporary with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once the specified leakage level has been reached, continued maintenance on targeted pipelines may result in periodic disturbance and/or nuisance to local wildlife, however effects on biodiversity are expected to be negligible.

Once the repair/replacement of leaking pipelines is complete, it is considered unlikely that that operation of the scheme would result in any adverse effects on soils/land use.

Operation of the option is expected to increase water supply by reducing and maintaining leakage to a pre-determined amount, with small savings of up to 0.004 Ml/d. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a minor decrease in demand for water abstraction; however, the ongoing maintenance of leakage levels would result in carbon emissions of 4 tCO₂ per annum. This is assessed as having a negligible effect on climate change.

Continued maintenance on targeted pipelines could result in temporary disturbance and/or nuisance, however effects on human health are expected to be negligible. Overall, water savings of up to 0.004 Ml/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage (0.004 Ml/d) which has been assessed as having a positive effect on the sustainable use of water resources.

No additional resources or energy would be required once leaks are repaired.

No effects on heritage assets or landscape are expected during the operation of this option.

Option	Stage	1. Biodiversity	2. Geology and Soils	3. Water Quantity	4. Water Quality	5. Flood Risk	6. Climate Change	7. Health	8. Wellbeing	9. Water Resource	10. Waste and Resources	11. Cultural Heritage	12. Landscape
TYA Policy Minimum Leakage Detection	Construction	0/?	0	0	0	0	0	0	0	0	-	0	0
	Operation	0	0	+	0	0	0	0	0	+	0	0	0

Construction

This option involves a leakage detection and repair scheme which would utilise various investigation techniques in order to reduce leakage levels to the policy minimum. The scope and extent of leakage reduction is currently unknown at this stage; however, it is assumed that leakage identification and pipeline repair work would be small scale.

Construction activity associated with this option is generally not expected to significantly affect biodiversity. It is possible that works would be undertaken within or in close proximity to locations important for biodiversity (including designated sites) which may impact on priority habitats and protected species (through short term, temporary disturbance caused by excavation) in these instances. However, areas affected would have previously been disturbed during the initial installation of pipework, and it would be expected that adverse effects would be reduced where possible using best practice construction techniques. Overall, given the potentially small scale of work under this option, a neutral effect on biodiversity is assumed likely although some uncertainty remains.

Construction activity would take place on existing infrastructure and thus would not require new land take. Furthermore, all excavated soil would be reinstated following the construction period thus any disruption would be temporary. Consequently, this option has been assessed as having a neutral effect on geology and soils.

It is not expected that construction would affect river flows or groundwater levels, or on water quality provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

The locations of pipelines requiring repair/replacement are not currently known and therefore it cannot be determined whether replacement work would be located in areas at risk of flooding. Notwithstanding, it is assumed that works could be scheduled to avoid periods of flooding, and works are not expected to cause or exacerbate flooding elsewhere.

There would be carbon emissions as a result of leakage identification and reduction, arising from embodied carbon associated with new pipeline in addition to emissions from plant and vehicle movements throughout the investigative and construction period. The carbon emissions associated with this option are estimated to be a maximum of 3 tCO₂ (depending on the intensity of movement throughout the WRZ and the length of pipeline targeted for leakage reduction) which has been assessed as having a neutral effect on climate change.

Depending on the scale of construction and excavation works, there may be minor and temporary noise/vibration disturbance, air quality impacts (dust) and loss of amenity due to vehicle movements and the operation of plant. Due to the assumed small scale of construction, this option has been assessed as having a negligible effect on human health. There may also be disruption to water supply; however, such impacts would be temporary and are likely to be managed.



Capital expenditure associated with this option is considered insufficient to have a substantive effect on the local economy and local employment creation. Pipeline works may be routed along and/or utilise roads which could result in temporary congestion and disruption throughout the construction phase, however this is expected to affect a very localised area at any time. As a result, this option has been assessed as having a neutral effect on wellbeing.

The option would not affect water efficiency.

During the investigative and construction period, there could be a minor increase in resource use and waste. Consequently, a minor negative effect on resource use and waste has been identified.

Pipelines targeted for investigation and subsequent repair/replacement could be within or immediately adjacent to the curtilage or grounds of scheduled monuments and listed buildings which could result in the loss of visual amenity to the settings of these assets. Notwithstanding, these sites would have been previously disturbed during the initial installation of the pipelines and therefore it is assumed that any effects could be managed through appropriate mitigation. Overall, this option has been assessed as having a neutral effect on cultural heritage.

The locations and length of pipeline targeted under this option are not currently known, but could give rise to landscape and visual effects, however, any impacts would be temporary with land likely to be returned to a pre-development state within a year (depending on the timing of works). Overall, a neutral effect has been identified in respect of landscape.

Operation

Once the repair/replacement of leaking pipelines is complete, it is considered unlikely that that operation of the scheme would result in any adverse effects on biodiversity or soils/land use.

Operation of the option is expected to make a small contribution to the continuity of water supply through leakage reduction to policy minimum, with savings of up to 0.005 Ml/d. This has been assessed as having a minor positive effect on water quantity.

No operational effects on water quality or flood risk are anticipated.

Operation of this option would result in a minor decrease in demand for water abstraction and may therefore help reduce greenhouse gas emissions associated with reduced treatment and pumping of water, however, the scale of reduction (<1 tCO₂) would have a negligible effect on climate change.

The scheme would not adversely affect human health by increased noise, nuisance or disruption nor would it affect opportunities for recreation. Overall, water savings of up to 0.005 Ml/d would be too low to make a meaningful contribution to human health and the wellbeing of the local community.

This option would result in reduced leakage to policy minimum levels (saving 0.005 Ml/d) which has been assessed as having a positive effect on the sustainable use of water resources.

No additional resources or energy would be required once leaks are repaired.

No effects on heritage assets or landscape are expected during the operation of this option.



Appendix D

Preferred Options Assessment Matrices



Pembrokeshire Resource Zone

Option PEM024b: Canaston Bridge – Upgrade Pumping Station

Option Summary

This option involves asset upgrades at Canaston Bridge raw water pumping station that would allow finer control of abstraction volumes from the Afon Cleddau. The abstraction licence requires that compensation releases from Llys y Fran reservoir match the maximum rate of abstraction, meaning that water is typically wasted due to the difference between the maximum rate of abstraction and the daily total abstraction. Once operational, the option would use a new bankside storage reservoir to attenuate the impact of the high-lift pump abstraction rate, such that the low lift pumps can pump at a constant rate equivalent to the total abstraction. This would allow water to be conserved within the Llys y Fran reservoir by matching compensation releases to actual abstraction. No changes to the abstraction licence would be required. The option requires a low-lift pump set which has extensive variability of pump rate between 30 MI/d and 55 MI/d, and may require additional raw water storage with a capacity of 30,000m³. The deployable output for this option is 0.66 MI/d.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity.	<p>Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?</p> <p>Will the option protect and enhance non-designated sites and local biodiversity?</p> <p>Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?</p> <p>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</p> <p>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</p>	-	0	<p>Effects of Construction</p> <p>The Canaston Bridge site is adjacent to Afonydd Cleddau / Cleddau Rivers SAC and the Afon Cleddau Dwyreiniol / Eastern Cleddau River SSSI. The SAC comprises of two main rivers (the Eastern Cleddau and the Western Cleddau) which meet in the Daugleddau Estuary. The abstraction and pumping station at Canaston Bridge are located on the Eastern Cleddau. The SAC supports a number of species including Sea Lamprey, River Lamprey, Brook Lamprey, Bullhead and Otter, which are all likely to use the river near or downstream of Canaston Bridge during their lifecycles.</p> <p>The option involves construction work close to the river, which has the potential to cause contamination of surface waters by site-derived pollutants and could affect marine ecology directly (if pollutants are toxic) or indirectly through effects on prey species or habitats. An area of woodland which is expected to contain SAC Alluvial forest immediately downstream of the pumping station may also be affected by exposure to pollutants. The physical disturbance of sensitive species (e.g. from site lighting, noise, vibration, etc.) may also arise, with Sea Lamprey and River Lamprey being particularly vulnerable during key migration periods. However, the HRA highlights that these risks can be avoided or controlled through the normal project</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option prevent the spread/introduction of invasive non-native species?</p> <p>Will the option maintain and enhance the green infrastructure network and the biodiversity it supports?</p> <p>Will the option contribute to the restoration of species that are currently not achieving management objectives?</p> <p>Will the option maintain and enhance ecosystem resilience?</p>			<p>planning process, such as timing works to avoid seasonal migrations, and standard best-practice construction measures. Any physical disturbance is also expected to be localised and short-term only.</p> <p>The development site is approximately 700m upstream of the Pembrokeshire Marine / Sir Benfro Forol SAC and the Milford Haven Waterway SSSI. They support estuaries, mudflats and sandflats and Atlantic salt meadows, in addition to species such as Sea Lamprey, River Lamprey, Allis Shad, Twaite Shad and Otter, which may be exposed to the effects of the option. As for the Afonydd Cleddau / Cleddau Rivers SAC, exposure to site-derived pollutants and the disturbance of species may occur, but can be avoided or controlled through normal project controls.</p> <p>The Pembrokeshire Bat Sites and Bosherton Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC comprise a series of functionally-linked bat roosts, the closest of which is the Slebech Stable Yard Loft, Cellars and Tunnels SSSI, approximately 3.7km west of Canaston Bridge. The option is within the typical foraging range of horseshoe bat species, and construction may therefore affect the bats due to permanent removal of important habitat features or temporary displacement effects e.g. due to site lighting. However, the HRA notes that works required for the option will be fairly restricted in scale and that significant habitat features (e.g. mature trees, linear features) which may be used by bat species could be avoided during construction through scheme-specific surveys and planning, and established best-practice.</p> <p>The western edge of the development site is bounded by ancient woodland (Ancient Semi Natural Woodland); however, construction work is not expected to affect this area.</p> <p>There are no other designated sites within or in the immediate vicinity of the development site. Construction of the new reservoir would, however, result in the loss of a relatively small area of greenfield land to the south of the existing site which may cause some localised loss of/disturbance to habitats and species.</p> <p>Overall, this option has been assessed as a minor negative effect on biodiversity.</p> <p>Effects of Operation</p> <p>No ecological international, national and locally designated sites would be affected by the operation of this option. The HRA notes that operation would result in 'less' water passing down the Afon Cleddau as the compensation releases match the</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>actual abstraction more closely; however, as the operation would be within the terms of the existing abstraction licence, effects on biodiversity are not anticipated.</p> <p>There is the potential for minor operational effects associated with the use of new variable speed abstraction pumps (e.g. entrainment); however, screens are currently in place to minimise effects and any variation would not be substantial.</p> <p>Overall, a neutral effect on biodiversity during operation has been identified.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Best practice construction measures should be implemented to avoid impacts on ecology. • In addition to normal project-level planning and best-practice, construction of the scheme should avoid the main migration period for lamprey species (late October – April) to minimise the risk of displacement or barrier effects due to noise, vibration or site-derived pollutants (unless scheme-specific analyses demonstrate that adverse effects will not arise). • Construction works should avoid removal of mature trees and linear features to prevent possible fragmentation of habitats which may be used by local bat populations, unless surveys establish that they are unlikely to be significant resources for bats. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural Resources Wales. • Bio-security measures should be implemented during construction and operational phases. <p>Assumptions</p> <ul style="list-style-type: none"> • It is assumed that the option would not involve construction work directly in the Eastern Cleddau river. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.
2. To ensure the appropriate and efficient use of land and	Will additional land be required for the development or implementation of the option or	-	0	Effects of Construction



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>protect and enhance soil quality and geodiversity.</p>	<p>will the option require below ground works leading to land sterilisation?</p> <p>Will the option utilise previously developed land?</p> <p>Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?</p> <p>Will the option minimise the loss of best and most versatile agricultural land?</p> <p>Will the option minimise conflict with existing land use patterns?</p> <p>Will the option minimise land contamination?</p>			<p>Construction of the reservoir would result in the loss of approximately 1ha of land. While much of this land would be within the boundary of the existing Canaston Bridge site, a small area of additional land would be required. This would be undeveloped land of predominantly Grade 4 ('Poor') agricultural land quality which has been assessed as having a minor negative effect on geology and soils.</p> <p>Active raised bogs are one of the interest features of the Afonydd Cleddau / Cleddau Rivers SAC; however, the bogs would be unaffected by construction as they are located upstream of the development site.</p> <p>No geologically protected sites would be adversely affected by this scheme.</p> <p>As development would be located at/adjacent to an existing site owned/operated by DCWW, the option is not expected to result in substantial conflict with existing land uses.</p> <p>Overall, a minor negative effect with respect to geology and soils has been identified.</p> <p>Effects of Operation</p> <p>Once construction is complete, no further effects would occur to land, soils or geology as a result of the operation of this scheme (the initial loss of land during construction has been assessed under construction).</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Appropriate construction methods should be employed to minimise the risk of contamination. • Spoil and topsoil should be retained on site during construction in case there are opportunities for reuse. <p>Assumptions</p> <ul style="list-style-type: none"> • It has been assumed that development areas are not contaminated. • It is assumed that excess spoil and topsoil will be removed from site on completion. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.</p>	<p>Will the option minimise the demand for water resources?</p> <p>Will the option result in changes to river flows?</p> <p>Will the option result in changes to groundwater levels?</p> <p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p>	<p>0</p>	<p>0/+</p>	<p>Effects of Construction</p> <p>The construction of this option would have no effects on river flows or groundwater levels. A neutral effect has therefore been identified in respect of this objective.</p> <p>Effects of Operation</p> <p>The optimisation of compensation releases would reduce the amount of water passing down the Afon Cleddau; however, this would within the terms of the existing abstraction licence and negligible adverse effects are therefore anticipated. The WFD Assessment also notes that the operation of the new pumps would not have a significant impact on waterbodies due to the fact that the volume of water abstracted will not be significantly increased.</p> <p>It is anticipated that the new reservoir would reduce the pressure on the need for abstraction during times of low flows in the river, which would have a minor positive effect on water quantity at these times.</p> <p>Overall, this option has been assessed as a mixed neutral and minor positive effect on water quantity.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Best practice design principles and construction techniques/methods would be required to avoid hydrological effects. <p>Assumptions</p> <ul style="list-style-type: none"> • It is assumed that abstraction volumes will not significantly increase. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.
<p>4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.</p>	<p>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</p> <p>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</p> <p>Will the option support the achievement of protected area objectives?</p>	<p>0</p>	<p>0</p>	<p>Effects of Construction</p> <p>The development site is located adjacent to the Eastern Cleddau river, and approximately 700m upstream of the Inner Milford Haven. The pump upgrades and clearance of the flood relief channel could introduce risks to the aquatic environment due to suspended sediment increase through exposure and run-off (which may cause smothering and reduction in light affecting fish, macrophytes/phytobenthos and invertebrates). There is also the potential for contaminated soil, fuels and other chemicals from plant machinery to be introduced to the waterbodies. However, provided best practice is adhered to and mitigation measures implemented to avoid release of pollutants into watercourses (such as dust suppression, soil containment</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p> <p>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</p>			<p>and emergency response procedures), construction of the option is not expected to affect water quality. In addition, the construction of the new reservoir and pipes would be set back from the river behind the current storage reservoir, reducing the risk of contaminants being released into the waterbody.</p> <p>Overall, this option has been assessed as having a neutral effect with respect to water quality.</p> <p>Effects of Operation</p> <p>As noted above, the operation of this option would be within the terms of the existing abstraction licence. No effects on water quality are anticipated.</p> <p>Mitigation</p> <ul style="list-style-type: none"> None identified. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.</p>	<p>Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?</p> <p>Will the option have the potential to help alleviate flooding in the catchment area now or in the future?</p> <p>Will the option be at risk of flooding now or in the future?</p> <p>Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?</p> <p>Will the option promote the use of sustainable drainage systems?</p>	<p>--</p>	<p>-</p>	<p>Effects of Construction</p> <p>The proposed reservoir site is located within Flood Zone 3 (an area at high risk of flooding, with 1% or greater annual probability of flooding), while the low-lift pumps would be situated within Flood Zone 2 (risk of flooding is up to 0.1% in any given year). In consequence, construction activity may be vulnerable to flooding (depending on the timing of works).</p> <p>Construction of the option is not expected to cause nor exacerbate flooding on the site or elsewhere.</p> <p>Overall, this option has been assessed as having a significant negative effect on flood risk at this stage.</p> <p>Effects of Operation</p> <p>The new pumps would be located within Flood Zone 2 and would therefore be at risk of inundation in the event of a flood, although as they would be within an existing</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option promote opportunities for collaborative working with other risk management authorities?</p> <p>Will the option affect the risk of flooding to people and/or property?</p> <p>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</p>			<p>operational site, flood defences may already be in place. The new reservoir would be situated within Flood Zone 3; however, this would not be significantly vulnerable to the effects of flooding.</p> <p>Operation of the option would neither cause nor exacerbate flooding on the site or elsewhere.</p> <p>Overall, this option has been assessed as a minor negative effect with respect to flood risk.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Appropriate flood alleviation measures should be incorporated into the design of the scheme such as bunding, elevation and locating power and electrical equipment above flood level where possible. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that an appropriate flood consequences assessment would be undertaken prior to construction of the option and appropriate mitigation measures implemented to ensure flood risk is minimised. <p>Uncertainty</p> <ul style="list-style-type: none"> None.
<p>6. To limit the causes and potential consequences of climate change and to adapt to future changes.</p>	<p>Will the option reduce or minimise greenhouse gas emissions?</p> <p>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</p> <p>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</p> <p>Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?</p> <p>Will coastal erosion have consequences on the operation of this option now or in the future, taking account of expected climate change sea level rise?</p>	-	+/-	<p>Effects of Construction</p> <p>The construction of this scheme would result in the emission of greenhouse gases, which would contribute to climate change. Emissions have been estimated at 379 tCO₂e and include those associated with the use of fossil fuels by construction plant, vehicle movements and the embodied carbon in construction materials.</p> <p>Overall, this option has been assessed as having a minor negative effect on climate change</p> <p>Effects of Operation</p> <p>Operation of the option would require ongoing energy use and associated carbon emissions due to pumping of water. The operational energy demand for this scheme has been estimated to result in carbon emissions of 113 tonnes of CO₂e.</p> <p>DCWW has identified that minimising the unnecessary release of compensation flows would improve the storage position in Llys y Fran reservoir at the end of a</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>drought, which has the potential to reduce vulnerability to the effects of climate change.</p> <p>Overall, this option has been assessed as having a mixed minor negative and minor positive effect on climate change.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>7. To ensure the protection and enhancement of human health.</p>	<p>Will the option ensure the continuity of a safe and secure drinking water supply?</p> <p>Will the option impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation?</p> <p>Will the option maintain surface water and bathing water quality within statutory standards?</p> <p>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</p> <p>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</p>	0	0	<p>Effects of Construction</p> <p>Construction activity including HGV movements has the potential to result in noise and air quality impacts; however, reflecting the development site's rural location, the number of receptors likely to be affected in the immediate vicinity of the site would be very small, with the closest residential dwellings being approximately 150m from the site.</p> <p>Access to or opportunities for outdoor recreation are not expected to be affected by construction of the option.</p> <p>Overall, this option has been assessed as having a neutral effect on health.</p> <p>Effects of Operation</p> <p>The scheme would not adversely affect human health due to increased noise, nuisance or disruption, nor would it affect opportunities for recreation</p> <p>The operation of the option would help increase water available for potable supply in Pembrokeshire; however, the DO gain would be very minor at 0.66 MI/d. This would be too low to make a contribution to human health.</p> <p>Overall, this option has been assessed as having a neutral effect with respect to health.</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>Mitigation</p> <ul style="list-style-type: none"> Dust/noise impacts from excavation and construction activities may be mitigated using considerate construction practices. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>8. To maintain and enhance the economic and social well-being of the local community.</p>	<p>Will the option ensure sufficient infrastructure is in place for predicted population increases?</p> <p>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</p> <p>Will the option help to meet the employment needs of local people?</p> <p>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</p> <p>Will the option improve access to local services and facilities (e.g. sport and recreation)?</p> <p>Will the option contribute to sustaining and growing the local and regional economy?</p> <p>Will the option avoid disruption through effects on the transport network?</p> <p>Will the option be resilient to future changes in resources (both financial and human)?</p> <p>Will the option improve opportunities for social interaction and community cohesion?</p>	<p>++</p>	<p>0</p>	<p>Effects of Construction</p> <p>Construction of the option would involve a significant capital spend. This is likely to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Whilst the degree to which this would benefit the local labour market and local businesses would depend on skills within the local labour market and the procurement policies of both DCWW and any subcontractors, benefits are expected to be substantial. Construction may also result in increased expenditure by workers in the local economy.</p> <p>The development site is located within the Pembrokeshire Coast National Park which is a popular tourist destination and it is noted that Bluestone Holiday Park is situated to the south of the site. However, the local tourist economy is not expected to be affected given that works would be temporary and largely confined to an existing site.</p> <p>Construction is not expected to affect recreational activities or cause substantial transport disruption.</p> <p>Overall, a significant positive effect has been identified in respect of wellbeing.</p> <p>Effects of Operation</p> <p>Operation of the option would help to secure water supplies for the Pembrokeshire WRZ, with a small DO gain of 0.66 Ml/d. This may make a very minor contribution to supporting economic growth, including supporting the local population and the influx of summer tourists.</p> <p>There are not anticipated to be any effects on employment over the long term.</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>Overall, the option has been assessed as having a neutral effect on wellbeing, as any gains associated with the additional supply are considered negligible.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Where possible, DCWW and any contractors should seek to utilise local labour, sub-contractors and locally sourced materials. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> The extent to which the construction of this option would benefit the local economy/local labour market is uncertain. However, given the scale of investment, benefits are expected to be significant.
<p>9. To ensure the sustainable and efficient use of water resources.</p>	<p>Will the option lead to reduced leakage from the supply network?</p> <p>Will the option improve efficiency in water consumption?</p>	0	+	<p>Effects of Construction</p> <p>This option is not a leakage reduction or water efficiency option and would therefore have no impact on the efficient use of water resources during construction.</p> <p>Effects of Operation</p> <p>This option is not a leakage reduction or water efficiency option. However, operation of the option would be expected to allow greater control of compensation releases, minimising wastage. In consequence, the option has been assessed as having a minor positive effect on water resources.</p> <p>Mitigation</p> <ul style="list-style-type: none"> None identified. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>10. To promote the efficient use of resources.</p>	<p>Will the option seek to minimise the demand for raw materials?</p>	-	-	<p>Effects of Construction</p> <p>Raw materials would be required for the replacement of pumps and the construction of the reservoir, in addition to energy usage. Waste would also be generated during construction, particularly as a result of reservoir excavation. Using the construction</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</p> <p>Will the option encourage the use of sustainable design and materials?</p> <p>Will the option reduce or minimise energy use?</p>			<p>carbon emissions (379 tonnes of CO₂e) as a proxy for resource use, this has been assessed as having a minor negative effect with respect to waste and resources.</p> <p>Effects of Operation</p> <p>The operation of this option would not involve additional infrastructure; however, there would be a requirement for ongoing energy usage associated with the use of the pumps. Using operational carbon emissions (113 tonnes of CO₂e) as a proxy for energy use, this has been assumed to be a minor energy requirement.</p> <p>Overall, this option has been assessed as having a minor negative effect on waste and resources.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Spoil and topsoil should be retained on site during construction of the reservoir in case there are opportunities for reuse. • Construction and operational wastes should be reused/recycled where possible. • Measures to reduce energy usage during construction should be considered including, for example, the use of low energy usage plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage. • The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. • The volume of waste generated under operation of this option is uncertain at this stage



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>11. To conserve and enhance the cultural, historic and industrial heritage resource.</p>	<p>Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings?</p> <p>Will the option avoid or minimise damage to archaeologically important sites?</p> <p>Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?</p> <p>Will the option affect public access to, or enjoyment of, features of cultural heritage?</p> <p>Will the option protect or enhance Welsh language and culture?</p>	<p>0</p>	<p>0</p>	<p>Effects of Construction</p> <p>Caneston Bridge is located within the Pembrokeshire Coast National Park The special qualities of the Pembrokeshire Coast National Park include 'rich historic environment and cultural heritage'. Construction associated with this option could affect the special qualities of the National Park. However, the Canaston Bridge site does not contain any designated cultural heritage assets. The Blackpool Iron Furnace Scheduled Monument is located approximately 0.5km from the site to the south. This monument comprises of an iron smelting works which operated for a short time in the early 17th century, and its visible remains include irregular earthworks. The Bush Inn Camp Scheduled Monument, which comprises of the remains of a defended Iron Age enclosure, is also situated approximately 1km from the development site to the north east whilst Castell Coch, Minewear Ringwork and Newton North Church are in excess of 1km to the south.</p> <p>Two Grade II* listed buildings (Blackpool Mill and Blackpool Bridge) are located approximately 0.5km from the development site to the south west, and three further Grade II listed buildings are situated approximately 1km from the site. These include a farmhouse, milepost and house/estate.</p> <p>Due to the distance of the development site from the heritage assets noted above, the presence of intervening vegetation, and as the construction works would be within/adjacent to an existing site, there is not predicted to be any effects on the settings of these assets.</p> <p>Excavation of the new reservoir poses the risk of affecting previously unknown archaeological assets; however, this is not certain at this stage.</p> <p>Overall, a neutral effect has been identified with respect to cultural heritage.</p> <p>Effects of Operation</p> <p>As noted above, new above ground infrastructure associated with this option would be within/adjacent to an existing site which benefits from moderate screening (trees). Taking into account the distance to proximate heritage assets and the presence of intervening vegetation, no effects on cultural heritage are predicted.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Consultations with the County Archaeologist could take place prior to construction works. <p>Assumptions</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> None. <p>Uncertainty</p> <ul style="list-style-type: none"> The presence of currently undiscovered archaeological assets is unknown at this stage.
<p>12. To conserve and enhance landscape character.</p>	<p>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</p> <p>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</p> <p>Will the option affect public access to existing landscape features?</p> <p>Will the option minimise adverse visual impacts?</p>	-	0	<p>Effects of Construction</p> <p>Canaston Bridge is located within the Pembrokeshire Coast National Park, which has diverse landscape features including mountains, moors, woodland and the coast. The special qualities of the Pembrokeshire Coast National Park include 'diversity of landscape, distinctive settlement character; and remoteness, tranquillity and wildness'. Construction associated with this option may cause adverse landscape and visual impacts which could affect the special qualities of the National Park as well as the visual amenity of proximate residential and recreational receptors. However, the works would be temporary and would take place within and adjacent to an existing and remote site. Taking into account the presence of existing screening (trees) and intervening vegetation (which should restrict long distance views to the development site), landscape and visual impacts are not expected to be significant.</p> <p>Overall, this option has been assessed as having a minor negative effect on landscape.</p> <p>Effects of Operation</p> <p>The 30,000m³ reservoir would represent new infrastructure within the Pembrokeshire Coast National Park. Given the scale of the reservoir, its location with/adjacent to an existing site which benefits from screening and the intervening vegetation (which should restrict long distance views to the development), landscape and visual impacts are not expected to be significant. It is expected that other equipment/infrastructure associated with this option would be very small in scale such that no landscape/visual impacts would be generated during operation.</p> <p>Overall, this option has been assessed as having a neutral effect on landscape.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Landscaping / screening measures should be utilised to minimise adverse landscape / visual amenity impacts. <p>Assumptions</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none">• None identified. Uncertainty <ul style="list-style-type: none">• None identified.



Tywyn Aberdyfi Resource Zone

Option TYA004: New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont WTW) 3.2MI/d

Option Summary

This option allows Pen y Bont WTW to receive abstracted water from the Afon Dysynni directly via a new raw water transfer main. Due to topography, the supply would need to be pumped from source. The option requires the construction of a new intake, pumping station at Pont y Garth and the laying of approximately 6km of pipeline running alongside a road to the WTW at Pen y Bont. An abstraction licence is not currently in place for Afon Dysynni, and a new licence would be required. This option may also be supplemented with additional raw water storage as described in option TYA009a. The deployable output for this option is 0.44 MI/d.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity.</p>	<p>Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?</p> <p>Will the option protect and enhance non-designated sites and local biodiversity?</p> <p>Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?</p> <p>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</p> <p>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</p> <p>Will the option prevent the spread/introduction of invasive non-native species?</p>	-	0/?	<p>Effects of Construction</p> <p>The proposed intake, pumping station and pipeline lie beyond the boundaries of any nationally or internationally ecologically designated sites.</p> <p>A section of the rocky outcrop above the road where the pipeline would run is designated as Craig yr Aderyn (Bird's Rock) SPA and SSSI. This SPA rises from sea level to 250m and comprises of rocky crags, acid grassland, heath and bracken. The site is a traditional breeding and roosting site for chough, which are present throughout the year. Non-breeding birds roost during the summer and there are also high numbers outside the breeding season. The proposed pipeline route would not cross the SPA/SSSI; however, construction at the base of the outcrop has the potential to disturb birds in the protected area. The HRA notes that scheme-specific additional assessment and sensitive timings of works for the red-billed chough would be required, but that significant effects are not anticipated.</p> <p>The Afon Dysynni flows into Broadwater SSSI approximately 400m downstream of Pen y Bont WTW. Broadwater SSSI is a coastal habitat of considerable ecological interest that features saltmarsh, shingle spit, mudflats, pools, reedbeds and ditches. The site supports a number of locally uncommon species such as Wild Celery, Sharp Sea Rush, Yellow Horned Poppy and Little Terns. In addition to the Broadwater SSSI, the Lleyn Peninsula and the Sarnau SAC is also a downstream receptor of the Afon Dysynni. The SAC is designated as it supports a number of features including</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option maintain and enhance the green infrastructure network and the biodiversity it supports?</p> <p>Will the option contribute to the restoration of species that are currently not achieving management objectives?</p> <p>Will the option maintain and enhance ecosystem resilience?</p>			<p>sandbanks, estuaries, coastal lagoons, reefs, and shallow inlets. The site is also important for a number of species such as bottlenose dolphin, otter and grey seal. The route of the pipeline would follow a road and it is not expected that construction works associated with pipeline excavation (or development of the new intake and pumping station at Pont y Garth) would cause pollution to escape into the Afon Dysynni and cause harm to the Broadwater SSSI or the Lleyn Peninsula and the Sarnau SAC, assuming the use of standard best practice construction measures.</p> <p>Northern Cardigan Bay / Gogledd Bae Ceredigion SPA, a marine site downstream of the Afon Dysynni designated for its wintering population of red-throated diver, and the West Wales Marine / Gorllewin Cymru Forol cSAC, a downstream marine site designated for its population of harbour porpoise, are at low risk of contamination of surface waters by site-derived pollutants. Given the scale of the works, the HRA considers that this can be avoided or controlled through the normal project planning process and standard best-practice measures. Furthermore, any site-derived pollutants entering the river will be attenuated by the river flows and tidal flux.</p> <p>The wintering population of Greenland white-fronted geese in the Dyfi Estuary / Aber Dyfi SPA (an estuarine site approximately 7.8km south of the Afon Dysynni valley) may also experience disturbance and / or displacement from feeding or roosting sites due to construction activities. The HRA also notes that bats associated with Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC (a bat site located 7km from the abstraction at Pont y Garth), and salmon and otter in the Afon Eden - Cors Goch Trawsfynydd SAC (an unmodified river and peatland headwaters) have the potential for effects from the option, but these are assessed as a very low likelihood and low risk.</p> <p>No BAP habitats or species or ancient woodland have been identified as being affected by construction of the scheme.</p> <p>More generally, the pipeline works would have limited effects on terrestrial habitats since the route would be predominantly situated within the highway boundary, although there may be disturbance to roadside verges and hedges which can be rich habitats. There is also the potential for construction of the new intake and pumping station to result in the localised loss of/disturbance to habitats and species.</p> <p>Overall, a minor negative effect has been identified with respect to biodiversity.</p> <p>Effects of Operation</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>Craig yr Aderyn (Bird's Rock) SPA and SSSI would not be affected by the operation of this option.</p> <p>The Lleyn Peninsula and the Sarnau SAC is the main downstream receptor of the Afon Dysynni. The low-flow effects associated with the abstraction of up to 3.2MI/d from the Afon Dysynni have the potential to result in a flow regime that could result in negative effects on any abstraction-sensitive features downstream of the abstraction point. The scheme would require a new abstraction licence; however the Meirionnydd CAMS (2015) states that there is water available in this catchment. As water is available within the catchment, the normal licensing process (and associated HRA) are expected to be sufficient to ensure adverse effects do not occur on the SAC.</p> <p>The Northern Cardigan Bay / Gogledd Bae Ceredigion SPA and West Wales Marine / Gorllewin Cymru Forol cSAC would have limited exposure and sensitivity to the operational effects of the option, and the impacts on flows from the Afon Dysynni due to the abstraction would be negligible. As a result, operational effects on the interest features of these sites are not anticipated.</p> <p>The Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC and Afon Eden - Cors Goch Trawsfynydd SAC are not expected to be exposed to operational effects.</p> <p>It is anticipated that once operational, the option would enable closure of the Afon Fathew intake providing benefit to eel migration up the Afon Fathew, although this is not yet certain.</p> <p>Overall, this option has been assessed as having a neutral effect on biodiversity during operation, with some uncertainty remaining relating to localised effects on eels.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Given the proximity of the proposed works to a European site, this option is likely to be subject to the HRA process at the project stage. If this is the case, site-specific avoidance and mitigation measures during construction would be developed in order to address the specific needs of the proposals and the features of interest of the European site. The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural Resources Wales.</p> <ul style="list-style-type: none"> • Best practice construction measures should be implemented to avoid impacts on ecology. • As noted in the HRA, construction of the scheme should avoid the breeding period (March – August) to minimise the risk of disturbance to chough, unless scheme-specific surveys or analyses demonstrate that any effects associated with construction works can be avoided. • As noted in the HRA, construction of the scheme should avoid the winter period (October – March) to minimise the risk of disturbance to wintering Greenland white-fronted geese, unless scheme-specific surveys or analyses demonstrate that any effects associated with construction works can be avoided. • It is proposed that an eel screen will be installed at the point of abstraction. • Bio-security measures should be implemented during construction and operational phases. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • The final rate of abstraction from the Afon Dysinni is not certain, and has been assessed with respect to the maximum possible rate (3.2MI/d). • It is uncertain whether the Afon Fathew intake would be closed as part of the option, providing potential benefit to eel migration up the Afon Fathew.
<p>2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.</p>	<p>Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?</p> <p>Will the option utilise previously developed land?</p> <p>Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?</p>	-	0	<p>Effects of Construction</p> <p>A small area of undeveloped land (~25m²) would be required for the new intake and associated pumping station. However, this land would be of Grade 4 ('Poor') agricultural land quality and given the scale of works, no significant effects on existing land use patterns are anticipated.</p> <p>The pipeline would largely be routed along an existing local road in the Dysynni valley, which would not have an adverse effect on land use/soils. A short section would cross open ground; however, it is anticipated that any soils displaced during</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option minimise the loss of best and most versatile agricultural land?</p> <p>Will the option minimise conflict with existing land use patterns?</p> <p>Will the option minimise land contamination?</p>			<p>excavation associated with pipeline works would be replaced, supported by a revegetation scheme such that any adverse effects would be temporary.</p> <p>No geologically protected sites would be adversely affected by this scheme.</p> <p>Overall, this option has been assessed as having a minor negative effect with respect to geology and soils.</p> <p>Effects of Operation</p> <p>Once construction is complete, no further effects would occur to land use, soils or geology as a result of the operation of this scheme (the initial loss of land during construction has been assessed under construction).</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Appropriate construction methods should be employed to minimise the risk of contamination. <p>Assumptions</p> <ul style="list-style-type: none"> • It is assumed that the majority of the pipeline route would be wholly situated within the boundary of existing roads (excluding the route sections which cross undeveloped land). • It has been assumed that development sites are not contaminated. • It is expected that soils displaced during excavation associated with pipeline works would be replaced following the completion of construction activity. <p>Uncertainty</p> <ul style="list-style-type: none"> • The exact footprint of land required for the intake and pumping station is not known at this stage.
<p>3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.</p>	<p>Will the option minimise the demand for water resources?</p> <p>Will the option result in changes to river flows?</p> <p>Will the option result in changes to groundwater levels?</p> <p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p>	0	-	<p>Effects of Construction</p> <p>The construction of this option has the potential to impact on river flows principally associated with the impounding/over pumping works that would be necessary to install the pipeline that may cross small/minor drainage ditches. However, trenched watercourse crossings are likely to be installed within a very short timeframe, and are likely to only affect flow over in <100m section of the watercourse. Additionally any sediment removed in the trenching process would be reinstated on completion of the cable installation.</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>There is also the potential for effects on hydrology due to the increase in sediment through exposure and run-off during trenching through the catchment, which may add to flows or lead to changes in flows from obstructions. The WFD Assessment identifies these effects as minimal.</p> <p>Overall, it is considered that the effects on the flow regime during construction would be negligible.</p> <p>Effects of Operation</p> <p>The abstraction of up to 3.2Ml/d is likely to have an impact on the hydrological regime of the Afon Dysynni, especially in respect of the frequency and duration of low flows. This may result in a reduction in wetted perimeter and greater volumes of suspended sediment deposition in the depleted reach. Depending on the length of the depleted reach, this could lead to water-body scale effects on low flow morphology.</p> <p>The WFD Assessment also identifies that the new abstraction may result in flows downstream that could result in the deterioration of all WFD biological quality elements. However, the Meirionnydd Catchment Abstraction Management Strategy (CAMS, 2015) states that there is water available in this catchment.</p> <p>Based on the CAMS assessment and a new licence controlling abstractions from causing damage, any impact on water quantity is likely to be minor, although given the scale of abstraction, this needs to be confirmed as there will be localised impacts.</p> <p>Overall, a minor negative effect has been identified with respect to water quantity at this stage.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Best practice design principles and construction techniques/methods would be required to avoid hydrological effects. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • The final rate of abstraction from the Afon Dysynni is not certain, and has been assessed with respect to the maximum possible (3.2Ml/d). • Localised impacts relating to low flows downstream are currently uncertain.



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> Further investigation relating to the length of depleted reach is required.
<p>4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.</p>	<p>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</p> <p>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</p> <p>Will the option support the achievement of protected area objectives?</p> <p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p> <p>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</p>	-	0	<p>Effects of Construction</p> <p>This option would require several watercourse crossings. Trenching across a watercourse introduces several potential risks to the aquatic environment such as channel bed extraction and reinstatement, suspended sediment increase through exposure and run-off (which may cause smothering and reduction in light affecting fish, macrophytes/phytobenthos and invertebrates) and the potential for contaminated soil to be introduced to the watercourse and fuels and other chemicals from plant machinery.</p> <p>Direct effects, specifically on WFD chemical status, could occur as a result of accidental spillage or leakage of Polycyclic Aromatic Hydrocarbons (PAHs) associated with vehicle/machinery fuels and oils, or metals (from machinery itself) at or adjacent to the location of the trenched route or trenched watercourse crossings and at the site of the new intake and pumping station. Whilst standard best-practice construction methods/techniques are expected to manage the occurrence of such effects as far as practicable, small residual effects (e.g. slow/gradual leaks directly into or adjacent to the watercourse) cannot be discounted. However, considering the scale and duration of any effects in the context of WFD water body size, there is a high degree of confidence that the effects of localised and short duration changes in water quality would not have any effect on WFD water body status.</p> <p>Small indirect effects on water quality could also occur via the disturbance of contaminated sediments, either within the channel and/or on the river banks at the location of trenched pipeline watercourse crossing installations, or the disturbance of contaminated surface sediments where pipelines are trenched through the wider catchment. The disconnection of flow may also potentially affect the biological status of the watercourse. However, best construction practice and appropriate mitigation (such as dust suppression, spill containment, emergency response procedures), together with the fact that the watercourses are predominantly small tributaries, means that any impacts would only be localised and temporary.</p> <p>Overall, this option has been assessed as having a minor negative effect on water quality.</p> <p>Effects of Operation</p> <p>Impacts on hydrology at low flows could affect water quality both through decreases in the dilution of any discharges/runoff into the river and also through lower flows</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>potentially having an impact on elements such as dissolved oxygen. However, the Meirionnydd CAMS (2015) states that there is water available in this catchment. Based on this and a new licence controlling abstractions from causing damage, any impact on water quality is likely to be negligible.</p> <p>Overall, this option has been assessed as having a neutral effect on water quality.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Best practice construction measures (such as dust suppression, spill containment, emergency response procedures) should be implemented to avoid impacts on water quality. • Where construction works coincide with areas that have a history of contaminated land, the risk of contamination would be high. These areas should be identified and confirmed as part of ground investigation, and appropriate bespoke measures to mitigate any effects should be implemented before construction works begin. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • The final rate of abstraction from the Afon Dysynni is not certain, and has been assessed with respect to the maximum possible (3.2MI/d).
<p>5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.</p>	<p>Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?</p> <p>Will the option have the potential to help alleviate flooding in the catchment area now or in the future?</p> <p>Will the option be at risk of flooding now or in the future?</p> <p>Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?</p> <p>Will the option promote the use of sustainable drainage systems?</p>	<p>--</p>	<p>--</p>	<p>Effects of Construction</p> <p>The proposed pipeline would cross extensive areas of Flood Zone 3 (1% or greater annual probability of flooding) and the new pumping station and intake would also be located in Flood Zone 3. In consequence, construction activity may be vulnerable to flooding (depending on the timing of works).</p> <p>Construction of the option is not expected to cause nor exacerbate flooding on the site or elsewhere.</p> <p>Overall, this option has been assessed as having a significant negative effect on flood risk at this stage.</p> <p>Effects of Operation</p> <p>As noted above, the new pumping station would be located within Flood Zone 3 (1% or greater annual probability of flooding), and therefore would be at risk of flooding during its operation. Although it is possible to build in resilience and mitigation</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option promote opportunities for collaborative working with other risk management authorities?</p> <p>Will the option affect the risk of flooding to people and/or property?</p> <p>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</p>			<p>measures such as tanking, flood gates on doorways and elevated electricals, the pumping station may remain at risk of inundation.</p> <p>The pipeline would not be at risk from flooding as it would be underground and sealed.</p> <p>Operation of the option would neither cause nor exacerbate flooding on the site or elsewhere.</p> <p>Overall, a significant negative effect has been identified with respect to flood risk.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Appropriate measures to minimise flood risk in respect of the new pumping station (including site elevation and bunding, floodgates on doorways and locating power and electrical equipment above flood level) should be considered where possible. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that an appropriate flood consequences assessment would be undertaken prior to construction of the pumping station and appropriate mitigation measures implemented to ensure flood risk is minimised. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>6. To limit the causes and potential consequences of climate change and to adapt to future changes.</p>	<p>Will the option reduce or minimise greenhouse gas emissions?</p> <p>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</p> <p>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</p> <p>Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?</p> <p>Will coastal erosion have consequences on the operation of this option now or in the future,</p>	-	-	<p>Effects of Construction</p> <p>The construction of the scheme would result in the emission of greenhouse gases, which would contribute to climate change. Emissions have been estimated at 716 tonnes of CO₂e and include those associated with the use of fossil fuels by construction plant, vehicle movements and the embodied carbon in construction materials.</p> <p>Overall, this option has been assessed as having a minor negative effect on climate change.</p> <p>Effects of Operation</p> <p>Operation of the option would require ongoing energy use and associated carbon emissions due to the pumping of water. This has been estimated at 515 tCO₂e per year.</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	taking account of expected climate change sea level rise?			<p>The option is expected to operate under dry weather conditions. This has the potential to increase resilience to climate change by delivering additional water to customers during dry periods. While this would have a beneficial effect on resilience, the small gain associated with this option has been assessed as having a negligible effect on climate change.</p> <p>Overall, this option has been assessed as having a minor negative effect on climate change.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
7. To ensure the protection and enhancement of human health.	<p>Will the option ensure the continuity of a safe and secure drinking water supply?</p> <p>Will the option impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation?</p> <p>Will the option maintain surface water and bathing water quality within statutory standards?</p> <p>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</p> <p>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</p>	-	0	<p>Effects of Construction</p> <p>Construction activity including HGV movements has the potential to result in noise and air quality impacts which may affect human health. In particular, the route of the proposed pipeline is adjacent to a road which passes a number of scattered houses and farms and terminates at the Pen y Bont WTW. The pipeline would also be within 50-100m of residential properties in the village of Brynchrug. It is possible that there might be limited and short-term noise and dust effects experienced at these properties as a result of construction.</p> <p>There are trout fisheries in the River Dysynni, which have the potential to be affected during construction. Short-term effects on outdoor recreation opportunities may therefore occur; however, these are expected to be limited in scale and very localised.</p> <p>Overall, this option has been assessed as having a minor negative effect on health.</p> <p>Effects of Operation</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>The scheme would not adversely affect human health due to increased noise, nuisance or disruption, nor would it significantly affect opportunities for recreation</p> <p>The operation of the scheme would help secure water supplies during dry weather/peak demand and therefore increase water available for potable supply in the Tywyn Aberdyfi WRZ. However, the gain associated with this option (0.44 Ml/d) would be very minor.</p> <p>Overall, the option has been assessed as having a neutral effect on health.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Dust/noise impacts from excavation and construction activities may be mitigated by using considerate construction practices. Trout fisheries in the River Dysynni would need to be suitably protected from any construction effects. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>8. To maintain and enhance the economic and social well-being of the local community.</p>	<p>Will the option ensure sufficient infrastructure is in place for predicted population increases?</p> <p>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</p> <p>Will the option help to meet the employment needs of local people?</p> <p>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</p> <p>Will the option improve access to local services and facilities (e.g. sport and recreation)?</p> <p>Will the option contribute to sustaining and growing the local and regional economy?</p> <p>Will the option avoid disruption through effects on the transport network?</p>	-	0	<p>Effects of Construction</p> <p>Capital expenditure associated with the scheme is considered unlikely to generate sustained benefits in terms of the supply chain and local employment creation.</p> <p>The route of the proposed pipeline is part of National Cycle Network Route 82 and therefore there may be disruption and diversions to cyclists (and other recreational users such as horse riders etc.). Cyclists use National Cycle Routes for safety, amenity value etc., so this could have an adverse effect on recreation and tourism, particularly during the summer months.</p> <p>During construction there may be highway disruption along the chosen pipeline route, particularly as the narrow width of the road would make passing difficult whilst works take place. This may require extended road closure and diversions, which could have a minor adverse effect on local communities.</p> <p>The option is located within Snowdonia National Park, which attracts large numbers of tourists; however, the local tourist economy is not expected to be significantly</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option be resilient to future changes in resources (both financial and human)?</p> <p>Will the option improve opportunities for social interaction and community cohesion?</p>			<p>affected given that works would be temporary and impacts are likely to be managed/mitigated where possible using best practice.</p> <p>As noted above, there are trout fisheries in the River Dysynni which have the potential to be affected during construction, with possible short-term effects on recreation and tourism.</p> <p>Overall, this option has been assessed as having a minor negative effect with respect to wellbeing.</p> <p>Effects of Operation</p> <p>The operation of the scheme would help secure water supplies during dry weather/peak demand, although the gain (0.44 Ml/d) would be very minor. This may make a very minor contribution to supporting economic growth, including supporting the local population and the influx of summer tourists.</p> <p>There are not anticipated to be any effects on employment over the long term.</p> <p>Overall, the option has been assessed as having a neutral effect on wellbeing, as any gains associated with the additional supply are considered negligible.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • The avoidance of road closures during periods of peak tourist influx in summer months should be considered. • Trout fisheries in the River Dysynni would need to be suitably protected from any construction effects. • Where possible, DCWW and any contractors should seek to utilise local labour, sub-contractors and locally sourced materials. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>9. To ensure the sustainable and efficient use of water resources.</p>	<p>Will the option lead to reduced leakage from the supply network?</p> <p>Will the option improve efficiency in water consumption?</p>	0	0	<p>Effects of Construction</p> <p>This option is not a leakage reduction or water efficiency option and would have no impact on the efficient use of water resources.</p> <p>Effects of Operation</p> <p>This option is not a leakage reduction or water efficiency option and would have no impact on the efficient use of water resources.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • None identified. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.
<p>10. To promote the efficient use of resources.</p>	<p>Will the option seek to minimise the demand for raw materials?</p> <p>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</p> <p>Will the option encourage the use of sustainable design and materials?</p> <p>Will the option reduce or minimise energy use?</p>	-	-	<p>Effects of Construction</p> <p>Raw materials would be required for the construction of the new pumping station, intake and pipeline, in addition to energy use. Waste would also be generated during construction. Using the construction carbon emissions (716 tonnes of CO₂e) as a proxy for resource use, this has been assessed as having a minor negative effect with respect to waste and resources.</p> <p>Effects of Operation</p> <p>The operation of this option would not involve additional infrastructure; however, there would be a requirement for ongoing energy usage associated with the pumping of water. Using the estimated operational carbon emissions (515 tCO₂e per year) as a proxy for resource use, this has been assessed as having a minor negative effect with respect to waste and resources.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Measures to reduce energy usage during construction should be considered including, for example, the use of low energy usage plant.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage. The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. The volume of waste generated under operation of this option is uncertain at this stage
<p>11. To conserve and enhance the cultural, historic and industrial heritage resource.</p>	<p>Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings?</p> <p>Will the option avoid or minimise damage to archaeologically important sites?</p> <p>Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?</p> <p>Will the option affect public access to, or enjoyment of, features of cultural heritage?</p> <p>Will the option protect or enhance Welsh language and culture?</p>	<p style="text-align: center;">0</p>	<p style="text-align: center;">0</p>	<p>Effects of Construction</p> <p>The proposed intake and pumping station would be situated close to Pont y Garth which is a Grade II listed building (substantial double-span road bridge of 18th Century origin). The design and siting of the intake and pumping station would need to take this into consideration, although no adverse effects on the setting of this asset are anticipated from construction given the scale of works expected at this location.</p> <p>The proposed pipeline route passes near a number of Grade II listed buildings including buildings at Ty Coch, Perfeddnant, Cilcemaes and Glan-y-morfa. These include outbuildings, farm buildings and barns. Since construction works would be temporary, no adverse impacts are expected.</p> <p>Craig yr Aderyn Hillfort and Crop marks SE of Pen-y-Sarn, Bryn-Crug are Scheduled Monuments, but their distance from the pipeline route (over 250 m) means that they would be unlikely to be affected by the construction of this scheme.</p> <p>Overall, construction effects on cultural heritage assets are considered neutral.</p> <p>Effects of Operation</p> <p>No listed buildings or other designated heritage assets are expected to be affected by the operation of this scheme. As noted above, the proposed intake and pumping station would be located near to Pont y Garth Grade II listed bridge but they would</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>be outside the curtilage of the structure and their scale is such that effects on the setting of this asset are not predicted.</p> <p>Mitigation</p> <ul style="list-style-type: none"> The design and siting of the intake and pumping station would need to take the presence of the Grade II listed Pont y Garth into consideration. Consultations with the County Archaeologist should take place prior to construction works. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> The presence of currently undiscovered archaeological assets is unknown at this stage.
<p>12. To conserve and enhance landscape character.</p>	<p>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</p> <p>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</p> <p>Will the option affect public access to existing landscape features?</p> <p>Will the option minimise adverse visual impacts?</p>	<p>--</p>	<p>-</p>	<p>Effects of Construction</p> <p>All of the proposed works would be located within Snowdonia National Park. The special qualities of the Snowdonia National Park include <i>landscapes and townscapes which chart human interaction over centuries, from Neolithic times to the present day. This is evident in archaeological remains, place and field names, oral and written history and present day land management practices. Snowdonia's architectural heritage is reflected in the density of Listed Buildings and the wider historic environment</i> and the local area has notable landscape features including stone walls, clusters of Scots Pine and the Craig yr Aderyn (Bird's Rock). Construction associated with this option may therefore cause adverse landscape and visual impacts which could affect the special qualities of the National Park as well as the visual amenity of proximate residential and recreational receptors along the pipeline route. Whilst some sections of the pipeline route are screened by high hedges on both sides, the remainder of the route, as well as the intake/pumping station site, has a more open landscape.</p> <p>Overall, this option has been assessed as having a significant negative effect on landscape.</p> <p>Effects of Operation</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>As noted above, the scheme is located within Snowdonia National Park and as such, there is the potential for adverse landscape and visual effects on this designated landscape.</p> <p>The operational above ground infrastructure includes a new pumping station and intake. This would result in a permanent addition to the landscape, although the scale of the development would be relatively small. This is anticipated to have a minor negative effect on the landscape, depending on final design, location and mitigation.</p> <p>The pipeline would not have operational effects on landscape as it would be buried with any land likely to be returned to a pre-development state within one year (depending on when seeding takes place).</p> <p>Overall, the option has been assessed as having a minor negative effect on this objective.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • It is proposed that sympathetic design is considered to mitigate visual effects in the National Park. • Landscaping / screening measures should be utilised to minimise adverse landscape / visual amenity impacts. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • The final design, location and mitigation for the permanent above ground infrastructure is not know at this stage.

Option TYA009a: Pen-y-Bont WTW Bankside Storage (8MI)

Option Summary

This option would involve the construction of a non-impounding raw water reservoir adjacent to Pen-y-Bont WTW in order to provide a buffer raw water supply and improve the resilience of the Tywyn Aberdyfi system. The reservoir would be filled from the existing Afon Fathew source in winter (under existing licence volumes) and would be used to supply Pen y Bont WTW during periods of poor raw water conditions in other stream sources. The reservoir would be sized at 8 MI to provide short-term buffer. Pumping stations and pipelines connecting the reservoir to the WTW would also be required. The deployable output for this option is 0.44 MI/d.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity.</p>	<p>Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?</p> <p>Will the option protect and enhance non-designated sites and local biodiversity?</p> <p>Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?</p> <p>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</p> <p>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</p> <p>Will the option prevent the spread/introduction of invasive non-native species?</p> <p>Will the option maintain and enhance the green infrastructure network and the biodiversity it supports?</p>	-	0	<p>Effects of Construction</p> <p>There are no designated nature conservation sites within or in the immediate vicinity of this option. The nearest designated site to the proposed scheme is Broadwater SSSI, a coastal habitat of considerable ecological interest that features saltmarsh, shingle spit, mudflats, pools, reedbeds and ditches. The site supports a number of locally uncommon species such as Wild Celery, Sharp Sea Rush, Yellow Horned Poppy and Little Terns. At circa 1.5km to the north west of the proposed development site, no construction-related impacts on this SSSI are anticipated.</p> <p>Craig yr Aderyn (Bird's Rock) SPA, a rocky outcrop designated for the red-billed chough, is located 4km from the development site. While the distance of the development site to the SPA is too great for direct disturbance of birds, displacement is possible if birds make use of fields near the construction area for foraging. In this context, the HRA notes that the option may require additional assessment once the precise parameters of the project are clear, but that potential impacts are expected to be easily mitigated (e.g. by timing works to avoid the breeding season).</p> <p>Ecological features associated with the Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau SAC (a downstream receptor of the Afon Dysynni, designated for a number of features including sandbanks, coastal lagoons and reefs), the Northern Cardigan Bay / Gogledd Bae Ceredigion SPA (a marine site downstream of the Afon Dysynni designated for its wintering population of red-throated diver), and the West Wales Marine / Gorllewin Cymru Forol cSAC (a downstream marine site designated for its population of harbour porpoise) may be exposed to the effects of the option if site-derived pollutants are not appropriately controlled; however, these risks can be</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option contribute to the restoration of species that are currently not achieving management objectives?</p> <p>Will the option maintain and enhance ecosystem resilience?</p>			<p>avoided or controlled through the normal project planning process and standard best-practice measures. Additionally, construction would be short-term and any site-derived pollutants entering the river would be attenuated by river flows and tidal flux before reaching sensitive features.</p> <p>The HRA also notes that bats associated with Coedydd Derw a Safleoedd Ystumod Meirion / Meirionnydd Oakwoods and Bat Sites SAC (a bat site located 11km from the option), and salmon and otter in the Afon Eden - Cors Goch Trawsfynydd SAC (an unmodified river and peatland headwaters) have the potential for effects from the option, but these are assessed as a very low likelihood and low risk.</p> <p>Construction of the option would take place within fields to the east of Pen-y-Bont WTW, in close proximity to the Afon Fathew, which is a tributary of the Afon Dysynni. There is a risk that construction may result in localised disturbance to species (e.g. from site lighting, noise, vibration, etc.). Construction of the reservoir may also result in the loss of habitat which has the potential for adverse effects on local ecology. Contamination of surface waters by site-derived pollutants as a result of construction may also occur, including suspended sediment increase through exposure and run-off. However, best construction practice and appropriate mitigation (such as dust suppression, spill containment, emergency response procedures) means that any impacts would only be localised and temporary.</p> <p>No areas of ancient woodland have been identified as being affected by construction of the scheme.</p> <p>Overall, this option has been assessed as having a minor negative effect on biodiversity.</p> <p>Effects of Operation</p> <p>No designated nature conservation sites would be affected by the operation of this option.</p> <p>The HRA notes that chough at Craig yr Aderyn (Bird's Rock) SPA are not considered sensitive to the effects of water-resource permissions, and as such no effects are anticipated as a result of the scheme operation on this site. There would be a small loss of potential foraging habitat, but this is inconsequential given the habitat type (pasture), its location, and the wider availability of this resource locally.</p> <p>The scheme would operate within the terms of the existing licence and reservoir refill would occur in the winter period at high flows only. As a result, operational effects would not be expected on downstream designated sites.</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>None of the SAC bat habitats noted in the HRA would be affected by the proposals due to the distance and lack of impact pathways from the operational site.</p> <p>Overall, the option has been assessed as having a neutral effect on biodiversity during operation.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Best practice construction measures should be implemented to avoid impacts on ecology. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural Resources Wales. • Additional assessment regarding impacts on Craig yr Aderyn (Bird's Rock) SPA may be required once the precise parameters of the project are clear, but potential impacts are expected to be easily mitigated (e.g. by timing works to avoid the breeding season). • Bio-security measures should be implemented during construction and operational phases. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.
<p>2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.</p>	<p>Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?</p> <p>Will the option utilise previously developed land?</p> <p>Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?</p>	-	0	<p>Effects of Construction</p> <p>Construction of the reservoir would result in the loss of approximately 0.3ha of greenfield land including that which is classified as Grade 3 agricultural land. However, taking into account the relatively small scale of the proposed reservoir, no significant effects on soils or existing land use patterns are anticipated.</p> <p>No geologically protected sites would be adversely affected by this scheme.</p> <p>Overall, this option has been assessed as having a minor negative effect with respect to geology and soils.</p> <p>Effects of Operation</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option minimise the loss of best and most versatile agricultural land?</p> <p>Will the option minimise conflict with existing land use patterns?</p> <p>Will the option minimise land contamination?</p>			<p>Once construction is complete, no further effects would occur to land use, soils or geology as a result of the operation of this scheme (the initial loss of land during construction has been assessed under construction).</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Appropriate construction methods should be employed to minimise the risk of contamination. • Spoil and topsoil should be retained on site during construction in case there are opportunities for reuse. <p>Assumptions</p> <ul style="list-style-type: none"> • It has been assumed that development areas are not contaminated. • It is assumed that excess spoil and topsoil will be removed from site on completion. • It is assumed that the new pumps would be installed at the existing WTW site. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.
<p>3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.</p>	<p>Will the option minimise the demand for water resources?</p> <p>Will the option result in changes to river flows?</p> <p>Will the option result in changes to groundwater levels?</p> <p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p>	0	0	<p>Effects of Construction</p> <p>Construction of this option is not expected to affect water quantity or river flows. It is likely that small-scale shallow dewatering during construction would be discharged to a soakaway or into an adjacent watercourse; however, there would be no net export of water from the waterbody.</p> <p>Overall, a neutral effect has been identified with respect to water quantity.</p> <p>Effects of Operation</p> <p>No operational effects on the Afon Fathew are anticipated as the reservoir would utilise the current abstraction licence, and no new abstraction would occur.</p> <p>Revised information from DCWW indicates that the reservoir would be filled from the Afon Fathew source in winter and would generally be used to supply Pen y Bont WTW after periods of wet weather. As a result, beneficial effects related to reducing reliance on river abstraction at times of low flow are not expected.</p> <p>The option has been assessed as having a neutral effect on water quantity.</p> <p>Mitigation</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> Best practice design principles and construction techniques/methods should be employed to avoid hydrological effects. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that the option will not operate during times of low flow. <p>Uncertainty</p> <ul style="list-style-type: none"> None.
<p>4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.</p>	<p>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</p> <p>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</p> <p>Will the option support the achievement of protected area objectives?</p> <p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p> <p>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</p>	0	0	<p>Effects of Construction</p> <p>The development site is in close proximity to the Afon Fathew. Indirect effects on the existing baseline water quality could occur via the disturbance of contaminated sediments. However, taking into account the implementation of best-practice construction measures, any effects in this regard are likely to be localised and of short duration. The scale and duration of any effects in the context of waterbody size would also mean that any effects would be negligible.</p> <p>Where construction works coincide with areas that have a history of contaminated land, the risk of contamination would be high. These areas would be identified and confirmed as part of ground investigation and appropriate bespoke measures to mitigate any effects would be implemented before construction works begin.</p> <p>Overall, the construction of this option is not expected to have any notable effects on water quality, provided best practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).</p> <p>Effects of Operation</p> <p>No operational effects on the Afon Fathew are anticipated.</p> <p>As above, revised information from DCWW indicates that the reservoir would be filled from the Afon Fathew source in winter and would generally be used to supply Pen y Bont WTW after periods of wet weather. As a result, beneficial effects related to reducing reliance on river abstraction at times of low flow are not expected.</p> <p>A neutral effect on water quality has therefore been identified.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Best practice construction measures (such as dust suppression, spill containment, emergency response procedures) should be implemented to avoid impacts on water quality.



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> Where construction works coincide with areas that have a history of contaminated land the risk of contamination would be high. These areas should be identified and confirmed as part of ground investigation, and appropriate bespoke measures to mitigate any effects should be implemented before construction works begin. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that the option will not operate during times of low flow. <p>Uncertainty</p> <ul style="list-style-type: none"> None.
<p>5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.</p>	<p>Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?</p> <p>Will the option have the potential to help alleviate flooding in the catchment area now or in the future?</p> <p>Will the option be at risk of flooding now or in the future?</p> <p>Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?</p> <p>Will the option promote the use of sustainable drainage systems?</p> <p>Will the option promote opportunities for collaborative working with other risk management authorities?</p> <p>Will the option affect the risk of flooding to people and/or property?</p> <p>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</p>	<p style="text-align: center;">0</p>	<p style="text-align: center;">0</p>	<p>Effects of Construction</p> <p>The development site is situated just outside of Flood Zones 2 and 3 and so works would not be at significant risk of flooding. The adjacent existing WTW which would be connected to the new reservoir is located within Flood Zone 3 (an area at high risk of flooding, with 1% or greater annual probability of flooding), and as a result short distances of excavation works for connecting pipeline would cross this Flood Zone. However, given the very short distances involved, it is expected that works could be timed to avoid periods of flooding, such that any effects related to flood risk are considered negligible.</p> <p>The works would be unlikely to result in increased flooding elsewhere.</p> <p>Overall, the option has been assessed as having a neutral effect on flood risk.</p> <p>Effects of Operation</p> <p>As noted above, the proposed reservoir site is not within Flood Zones 2 or 3 and the operation of the scheme would be unlikely to result in increased flooding elsewhere. The short distances of connecting pipeline which enter Flood Zone 3 would be buried and not at risk of flooding.</p> <p>Overall, the option has been assessed as having a neutral effect on flood risk.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Pipeline construction should be timed to avoid periods of flooding. <p>Assumptions</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> It is assumed that an appropriate flood consequences assessment would be undertaken prior to construction of the option and appropriate mitigation measures implemented to ensure flood risk is minimised. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>6. To limit the causes and potential consequences of climate change and to adapt to future changes.</p>	<p>Will the option reduce or minimise greenhouse gas emissions?</p> <p>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</p> <p>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</p> <p>Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?</p> <p>Will coastal erosion have consequences on the operation of this option now or in the future, taking account of expected climate change sea level rise?</p>	-	-	<p>Effects of Construction</p> <p>Construction of the scheme would result in the emission of greenhouse gases, which would contribute to climate change. Emissions of 187 tonnes of CO₂e have been estimated to be released and include those associated with the use of fossil fuels by construction plant, vehicle movements and the embodied carbon in construction materials.</p> <p>Overall, this option has been assessed as having a minor negative effect on climate change.</p> <p>Effects of Operation</p> <p>There would be a small operational energy demand as a result of pumping water, which would result in the emission of greenhouse gases. It is estimated that 113 tonnes of CO₂e would be released each year.</p> <p>Overall, this option has been assessed as having a minor negative effect on climate change.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that there are no plans to include renewable energy or low carbon building materials within the design of this option. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>7. To ensure the protection and enhancement of human health.</p>	<p>Will the option ensure the continuity of a safe and secure drinking water supply?</p> <p>Will the option impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation?</p> <p>Will the option maintain surface water and bathing water quality within statutory standards?</p> <p>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</p> <p>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</p>	-	0	<p>Effects of Construction</p> <p>Construction activity including associated HGV movements could result in noise and air quality impacts on residential receptors to the immediate south and east of the development site. However, reflecting the site's rural location, the number of receptors likely to be affected in the immediate vicinity of the site would be very small.</p> <p>The site is circa 360m from Bryn-Crug village and several holiday parks/caravan sites, the amenities of which could be affected during construction and particularly by associated HGV movements; however, any impacts would be short term and temporary.</p> <p>Access to opportunities for outdoor recreation are not expected to be affected by construction of the option.</p> <p>Overall, this option has been assessed as having a minor negative effect on health.</p> <p>Effects of Operation</p> <p>The scheme would not adversely affect human health due to increased noise, nuisance or disruption, nor would it significantly affect opportunities for recreation.</p> <p>The operation of the scheme would help secure potable water supplies, although the gain (0.44 Ml/d) would be very minor. This would be too low to make a notable contribution to human health.</p> <p>Overall, the option has been assessed as having a neutral effect on health during operation.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Dust/noise impacts from excavation and construction activities may be mitigated by using considerate construction practices. Construction work should be timed to avoid peak tourism periods to reduce the number of receptors in the local area. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>8. To maintain and enhance the economic and social well-being of the local community.</p>	<p>Will the option ensure sufficient infrastructure is in place for predicted population increases?</p> <p>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</p> <p>Will the option help to meet the employment needs of local people?</p> <p>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</p> <p>Will the option improve access to local services and facilities (e.g. sport and recreation)?</p> <p>Will the option contribute to sustaining and growing the local and regional economy?</p> <p>Will the option avoid disruption through effects on the transport network?</p> <p>Will the option be resilient to future changes in resources (both financial and human)?</p> <p>Will the option improve opportunities for social interaction and community cohesion?</p>	<p>0</p>	<p>0</p>	<p>Effects of Construction</p> <p>Capital expenditure associated with the scheme is considered unlikely to generate sustained benefits in terms of the supply chain and local employment creation.</p> <p>The option is located within Snowdonia National Park, a popular tourist destination, and the development site has several holiday parks/caravan sites nearby. However, any impacts on tourism associated with construction works would be temporary and very small in scale, reflecting the scale of the scheme and its location adjacent to an existing WTW.</p> <p>During construction, associated HGV movements may cause some disruption to local roads including the A493 and B4405 for both local residents and tourists, although any impacts would be temporary and very minor in scale.</p> <p>Construction is not expected to affect recreational activities in the area.</p> <p>Overall, this option has been assessed as having a neutral effect on wellbeing.</p> <p>Effects of Operation</p> <p>The operation of the scheme would help secure water supplies for the Tywyn Aberdyfi WRZ, although the gain (0.44 MI/d) would be very small. This may make a very minor contribution to supporting economic growth, including supporting the local population and the influx of summer tourists.</p> <p>There are not anticipated to be any effects on employment over the long term.</p> <p>Overall, the option has been assessed as having a neutral effect on wellbeing, as any gains associated with the additional supply are considered negligible.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Construction work should be timed to avoid peak tourist influx in the summer months. • Where possible, DCWW and any contractors should seek to utilise local labour, sub-contractors and locally sourced materials. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>9. To ensure the sustainable and efficient use of water resources.</p>	<p>Will the option lead to reduced leakage from the supply network?</p> <p>Will the option improve efficiency in water consumption?</p>	0	0	<p>Effects of Construction</p> <p>This option is not a leakage reduction or water efficiency option and would have no impact on water efficiency.</p> <p>Effects of Operation</p> <p>This option is not a leakage reduction or water efficiency option and would have no impact on water resources.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • None identified. <p>Assumptions</p> <ul style="list-style-type: none"> • None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> • None identified.
<p>10. To promote the efficient use of resources.</p>	<p>Will the option seek to minimise the demand for raw materials?</p> <p>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</p> <p>Will the option encourage the use of sustainable design and materials?</p> <p>Will the option reduce or minimise energy use?</p>	-	-	<p>Effects of Construction</p> <p>Raw materials would be required for the construction of the reservoir, pipelines and pumps, in addition to energy use and the generation of waste. Using the construction carbon emissions (187 tonnes of CO₂e) as a proxy for resource use, this has been assessed as having a minor negative effect with respect to waste and resources.</p> <p>Effects of Operation</p> <p>The operation of this option would not involve additional infrastructure. There would be a requirement for ongoing energy usage associated with the pumping of water. Using the estimated operational carbon emissions (113 tCO₂e per year) as a proxy, this has been assessed as having a minor negative effect on waste and resources.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Spoil and topsoil should be retained on site during construction of the reservoir in case there are opportunities for reuse.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> Measures to reduce energy usage during construction should be considered including, for example, the use of low energy usage plant. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage. The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. The volume of waste generated under operation of this option is uncertain at this stage.
<p>11. To conserve and enhance the cultural, historic and industrial heritage resource.</p>	<p>Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings?</p> <p>Will the option avoid or minimise damage to archaeologically important sites?</p> <p>Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?</p> <p>Will the option affect public access to, or enjoyment of, features of cultural heritage?</p> <p>Will the option protect or enhance Welsh language and culture?</p>	<p style="text-align: center;">0</p>	<p style="text-align: center;">0</p>	<p>Effects of Construction</p> <p>The proposed reservoir site does not contain, and is not in close proximity to, any designated heritage assets. There are several listed buildings within Bryn-Crug with the nearest asset being Grave of Mary Jones Grade II Listed Building 400m to the north west of the development site. Other heritage assets within Bryn-Crug include mile markers, a water pump and cottages, in addition to farm buildings in the Woodlands Holiday Park to the north east of the site. These are all Grade II Listed Buildings within approximately 600m of the site.</p> <p>The closest Scheduled Monument to the site is Crop marks (revealed by aerial photography) SE of Pen-y-Sarn, Bryn-Crug, approximately 1km north west of the site. The monument comprises the prehistoric remains of an enclosed settlement of multiple hut circles.</p> <p>Direct effects on any of the heritage assets in the vicinity of the option are not expected. Given the distance of the development site to these assets and presence of existing trees/buildings, it is considered unlikely that construction activity would have an effect on the settings of these assets.</p> <p>Overall, the option has been assessed as having a neutral effect on cultural heritage.</p> <p>Effects of Operation</p> <p>No Scheduled Monuments, listed buildings or other designated heritage assets are expected to be affected by the operation of this option. The effect on cultural heritage has therefore been assessed as neutral.</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>Mitigation</p> <ul style="list-style-type: none"> Consultations with the County Archaeologist should take place prior to construction works. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> The presence of currently undiscovered archaeological assets is unknown at this stage.
<p>12. To conserve and enhance landscape character.</p>	<p>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</p> <p>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</p> <p>Will the option affect public access to existing landscape features?</p> <p>Will the option minimise adverse visual impacts?</p>	<p>--</p>	<p>-</p>	<p>Effects of Construction</p> <p>The proposed reservoir site is within Snowdonia National Park. The special qualities of the Snowdonia National Park include <i>landscapes and townscapes which chart human interaction over centuries, from Neolithic times to the present day. This is evident in archaeological remains, place and field names, oral and written history and present day land management practices. Snowdonia’s architectural heritage is reflected in the density of Listed Buildings and the wider historic environment</i> and therefore construction could have a temporary but adverse effect on this designated landscape and the identified special qualities. Whilst the reservoir construction site would be partially screened from the road by hedgerows, it would remain visible from the areas of higher surrounding land.</p> <p>Works may affect the visual amenity of recreational and residential receptors, particularly given the presence of the nearby village and numerous holiday parks. However, the works would be in close proximity to an existing WTW, which may reduce the overall impact on visual amenity.</p> <p>Overall, a significant negative effect has been identified with respect to landscape at this stage.</p> <p>Effects of Operation</p> <p>As noted above, the proposed reservoir site is within Snowdonia National Park and therefore there is the potential for adverse effects on this designated landscape. The presence of the reservoir may also affect the visual amenity of recreational and residential receptors. However, the reservoir would not constitute substantial new above ground infrastructure and it would be adjacent to an existing WTW so effects once operational are not considered likely to be significant. Landscaping is also likely to soften effects over time. Nonetheless, the option would result in minor</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>changes to the designated landscape, which has been assessed as having a minor negative effect on this objective.</p> <p>Mitigation</p> <ul style="list-style-type: none">• Landscaping / screening measures should be utilised to minimise adverse landscape / visual amenity impacts.• It is proposed that sympathetic design is considered to mitigate visual effects in the National Park. <p>Assumptions</p> <ul style="list-style-type: none">• None identified. <p>Uncertainty</p> <ul style="list-style-type: none">• The exact design of new infrastructure required under this option is unknown at this stage.



Vowchurch Resource Zone

Option 2a: Transfer from Hereford WRZ

Option Summary

Welsh Water has assessed the susceptibility of the Vowchurch Water Resource Zone (WRZ) to severe droughts and identified that the River Dore and associated gravel aquifer may not provide the required yield to meet customer demands during a 1 in every 200 years drought event. To address this resilience risk, this option involves the laying of a main between the Hereford and Vowchurch WRZs to allow some of the Vowchurch demand to be met from Broomy Hill water treatment works (WTW) when needed.

This option would require the installation of a circa 12km main between Broomy Hill WTW and Kingstone service reservoir (SR) together with an upgrade to Broomy Hill water pumping station (WPS) to supply 2.5 Ml/d to Kingstone SR. A total of 0.5 Ml/d would be supplied from Aconbury SR using an existing main.

Assessment

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity.</p>	<p>Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?</p> <p>Will the option protect and enhance non-designated sites and local biodiversity?</p> <p>Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?</p> <p>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</p> <p>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</p>	-	+	<p>Effects of Construction</p> <p>The Broomy Hill site is circa 300m from the River Wye SAC/SSSI, which acts as an important wildlife corridor, an essential migration route, and a key breeding area for many nationally and internationally important species. However, works associated with the upgrade of the WPS in this location would be very small in scale and take place within an existing operational site such that no adverse effects on the SAC/SSSI associated with this component of the scheme are predicted.</p> <p>The route of the proposed pipeline between Broomy Hill WTW and Kingstone SR crosses the River Wye SAC/SSSI and in consequence, there is the potential for adverse effects on the habitats and species associated with the Wye (for example, white-clawed crayfish, lamprey and Atlantic salmon) due to disturbance arising from pipeline works and the release of pollutants into the watercourse. However, it is understood that the pipeline would be directed under the Wye and it is anticipated that standard best practice construction measures would be implemented to manage any potential impacts such that adverse effects on the SAC/SSSI are likely to be avoided. In this regard, the HRA concludes that the option would not have adverse effects (alone or in combination) on the River Wye SAC.</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option prevent the spread/introduction of invasive non-native species?</p> <p>Will the option maintain and enhance the green infrastructure network and the biodiversity it supports?</p> <p>Will the option contribute to the restoration of species that are currently not achieving management objectives?</p> <p>Will the option maintain and enhance ecosystem resilience?</p>			<p>The proposed pipeline route also crosses Cage Brook Valley SSSI, which comprises of two blocks of semi-natural woodland and small areas of unimproved neutral grassland. There is the potential for construction activity associated with the pipeline works in this location to directly affect the SSSI, although it is assumed that the pipeline would be re-routed to avoid this site and that any effects would be avoided or controlled through normal project controls.</p> <p>There are no other designated sites within, or in the immediate vicinity of, the option.</p> <p>Whilst the proposed pipeline is predominantly routed along roads, it would cross greenfield land. Works may therefore result in some localised loss of/disturbance to habitats and species.</p> <p>Overall, this option has been assessed as having a minor negative effect on biodiversity.</p> <p>Effects of Operation</p> <p>This option would not involve the abstraction of additional water beyond current licence limits (the Broomy Hill abstraction has been confirmed as being environmentally sustainable at full licence volume) and all transferred water would be treated. In consequence, no adverse effects on biodiversity associated with the operation of the option are predicted.</p> <p>Vowchurch has been subject to environmental investigations and DCWW is aware that the current abstraction licence is viewed by the Environment Agency as being at its limit of sustainability. In this context, the operation of the scheme will enable DCWW to reduce abstraction significantly from the Vowchurch boreholes and improve baseflow in the River Dore during periods of dry weather; this is likely to generate positive effects on the ecology supported by these sources.</p> <p>Overall, a positive effect on biodiversity during operation has been identified.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • Best practice construction measures should be implemented to avoid impacts on ecology. • Construction works should avoid removal of mature trees and linear features to prevent possible fragmentation of habitats. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural Resources Wales and Natural England.</p> <ul style="list-style-type: none"> Bio-security measures should be implemented during construction and operational phases. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that effects associated with pipeline works on the River Wye SAC/SSSI and Cage Brook Valley SSSI would be avoided or controlled through normal project controls. It is assumed that the proposed pipeline would be routed to avoid Cage Brook Valley SSSI. <p>Uncertainty</p> <ul style="list-style-type: none"> See above.
<p>2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.</p>	<p>Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?</p> <p>Will the option utilise previously developed land?</p> <p>Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?</p> <p>Will the option minimise the loss of best and most versatile agricultural land?</p> <p>Will the option minimise conflict with existing land use patterns?</p> <p>Will the option minimise land contamination?</p>	<p>0</p>	<p>0</p>	<p>Effects of Construction</p> <p>Works associated with the upgrade of the WPS at Broomy Hill would take place within an existing developed, operational site such that there would be no adverse effects on soils associated with this element of the scheme.</p> <p>The majority of the proposed pipeline route follows existing roads. Whilst a relatively short section of the pipeline would cross greenfield land (including that which is classified as 'best and most versatile' agricultural land), it is anticipated that any soils displaced during excavation would be replaced, supported by a revegetation scheme such that adverse effects on soils would be temporary and negligible.</p> <p>No geologically protected sites would be adversely affected by this scheme.</p> <p>As development would be located at an existing site owned/operated by DCWW and the proposed pipeline would largely follow existing roads, the option is not expected to result in substantial conflict with existing land uses.</p> <p>Overall, this option has been assessed as having a neutral effect on geology and soils.</p> <p>Effects of Operation</p> <p>Once construction is complete, no further effects would occur to land, soils or geology as a result of the operation of this scheme.</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>Mitigation</p> <ul style="list-style-type: none"> Appropriate construction methods should be employed to minimise the risk of contamination. <p>Assumptions</p> <ul style="list-style-type: none"> It has been assumed that development areas are not contaminated. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management.</p>	<p>Will the option minimise the demand for water resources?</p> <p>Will the option result in changes to river flows?</p> <p>Will the option result in changes to groundwater levels?</p> <p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p>	<p>0</p>	<p>+</p>	<p>Effects of Construction</p> <p>Construction of this option is not expected to affect water quantity or river flows. The option has therefore been assessed as having a neutral effect on this objective.</p> <p>Effects of Operation</p> <p>This option would not involve the abstraction of additional water beyond current licence limits (the Broomy Hill abstraction has been confirmed as being environmentally sustainable at full licence volume). In consequence, no adverse effects on water quantity associated with the operation of the option are predicted.</p> <p>As noted above, Vowchurch has been subject to environmental investigations and DCWW is aware that the current abstraction licence is viewed by the Environment Agency as being at its limit of sustainability. In this context, the operation of the scheme will enable DCWW to reduce abstraction significantly from the Vowchurch boreholes and improve baseflow in the River Dore during periods of dry weather. This has been assessed as having a positive effect on this objective.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Best practice design principles and construction techniques/methods would be required to avoid hydrological effects. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
<p>4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.</p>	<p>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</p> <p>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</p> <p>Will the option support the achievement of protected area objectives?</p> <p>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</p> <p>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</p>	<p>0</p>	<p>+</p>	<p>Effects of Construction</p> <p>The route of the proposed pipeline between Broomy Hill and Kingstone SR crosses the River Wye which is designated as a SAC/SSSI. However, it is understood that the pipeline would be directed under the River Wye such that no adverse effects on this waterbody are predicted.</p> <p>The proposed pipeline would additionally cross Cage Brook and as a result, there is the potential for contaminated soil, fuels and other chemicals from plant machinery to be introduced to this waterbody. However, provided best practice is adhered to and mitigation measures are implemented to avoid the release of pollutants into watercourses (such as dust suppression, soil containment and emergency response procedures), construction of the option is not expected to affect water quality.</p> <p>Overall, this option has been assessed as having a neutral effect with respect to water quality.</p> <p>Effects of Operation</p> <p>The operation of this option would be within the terms of the existing abstraction licence and all transferred water would be treated. No adverse effects on water quality are therefore anticipated.</p> <p>As noted above, Vowchurch has been subject to environmental investigations and DCWW is aware that the current abstraction licence is viewed by the Environment Agency as being at its limit of sustainability. In this context, the operation of the scheme will enable DCWW to reduce abstraction significantly from the Vowchurch boreholes and improve baseflow in the River Dore during periods of dry weather; in-turn, this expected to help maintain/enhance water quality during period of dry weather.</p> <p>Overall, the option has been assessed as having a positive effect on this objective.</p> <p>Mitigation</p> <ul style="list-style-type: none"> • None identified. <p>Assumptions</p> <ul style="list-style-type: none"> • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures).</p> <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.</p>	<p>Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?</p> <p>Will the option have the potential to help alleviate flooding in the catchment area now or in the future?</p> <p>Will the option be at risk of flooding now or in the future?</p> <p>Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?</p> <p>Will the option promote the use of sustainable drainage systems?</p> <p>Will the option promote opportunities for collaborative working with other risk management authorities?</p> <p>Will the option affect the risk of flooding to people and/or property?</p> <p>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</p>	<p>0</p>	<p>0</p>	<p>Effects of Construction</p> <p>The Broomy Hill site is located within Flood Zone 1 and therefore works to upgrade the WPS are not expected to affect, or be affected by, flooding.</p> <p>The proposed pipeline would cross Flood Zone 3 (an area at high risk of flooding, with 1% or greater annual probability of flooding) and in consequence, construction activity may be vulnerable to flood risk. However, given the relatively short distances involved, it is expected that works could be timed to avoid periods of flooding, such that any effects related to flood risk are considered negligible.</p> <p>Construction of the option is not expected to cause or exacerbate flooding on the development sites or elsewhere.</p> <p>Overall, this option has been assessed as having a neutral effect on flood risk at this stage.</p> <p>Effects of Operation</p> <p>The upgraded WPS at Broomy Hill would be located within Flood Zone 1 and is therefore not expected to be vulnerable to flooding.</p> <p>Operation of the option would neither cause nor exacerbate flooding on the site or elsewhere.</p> <p>Overall, this option has been assessed as having a neutral effect with respect to flood risk.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Construction activity should be timed so as to avoid periods of flood risk. <p>Assumptions</p> <ul style="list-style-type: none"> It is assumed that an appropriate flood consequences assessment would be undertaken prior to construction of the option and appropriate mitigation measures implemented to ensure flood risk is minimised.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty <ul style="list-style-type: none"> None.
6. To limit the causes and potential consequences of climate change and to adapt to future changes.	<p>Will the option reduce or minimise greenhouse gas emissions?</p> <p>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</p> <p>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</p> <p>Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?</p> <p>Will coastal erosion have consequences on the operation of this option now or in the future, taking account of expected climate change sea level rise?</p>	-	+	Effects of Construction <p>During the construction phase, the use of plant on-site and transportation of materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This has been assessed as having a negative effect on Objective 6.</p> Effects of Operation <p>Operation of the option would require energy use and generate associated carbon emissions due to the pumping and treatment of water. However, as this option would only be utilised on an infrequent basis (during periods of dry weather), operational emissions are expected to be negligible overall.</p> <p>This option would help to address the risk of severe drought in the Vowchurch WRZ through the transfer of water from the Hereford WRZ. This has the potential to reduce vulnerability to the effects of climate change.</p> <p>Overall, the operation of this option has been assessed as having a positive effect on climate change.</p> Mitigation <ul style="list-style-type: none"> Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. Assumptions <ul style="list-style-type: none"> None identified. Uncertainty <ul style="list-style-type: none"> None identified.
7. To ensure the protection and enhancement of human health.	<p>Will the option ensure the continuity of a safe and secure drinking water supply?</p> <p>Will the option impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation?</p>	-	+	Effects of Construction <p>Works associated with the upgrade of the WPS at Broomy Hill would be small in scale and take place within an existing operational site. In consequence, no adverse effects on health are predicted as a result of the construction of this component of the option.</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option maintain surface water and bathing water quality within statutory standards?</p> <p>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</p> <p>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</p>			<p>Construction activity associated with the pipeline works including HGV movements has the potential to result in noise and air quality impacts which may affect residential and other sensitive receptors (most notably two schools in Kingstone) along the pipeline route. However, any impacts in this regard would be short term and temporary.</p> <p>Access to opportunities for outdoor recreation are not expected to be significantly affected by construction of the option. However, pipeline works may temporarily affect some walking routes (for example, walking routes in the vicinity of Cage Brook).</p> <p>Overall, this option has been assessed as having a minor negative effect on health.</p> <p>Effects of Operation</p> <p>The operation of the option would not adversely affect human health due to increased noise, nuisance or disruption, nor would it affect opportunities for recreation.</p> <p>This option would enhance the resilience of supply to DCWW customers in the Vowchurch WRZ during periods of dry weather through the transfer of water (up to 3 Ml/d) from the Hereford WRZ. This will help to ensure the continuity of a safe and secure drinking water supply and help protect vulnerable customers. The option has therefore been assessed as having a positive effect on health.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Dust/noise impacts from excavation and construction activities may be mitigated using considerate construction practices. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>8. To maintain and enhance the economic and social well-being of the local community.</p>	<p>Will the option ensure sufficient infrastructure is in place for predicted population increases?</p> <p>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</p>	+/-	+	<p>Effects of Construction</p> <p>Construction of the option would involve a moderate capital spend. This is likely to generate some employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). This has been assessed as having a minor positive effect on this objective.</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
	<p>Will the option help to meet the employment needs of local people?</p> <p>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</p> <p>Will the option improve access to local services and facilities (e.g. sport and recreation)?</p> <p>Will the option contribute to sustaining and growing the local and regional economy?</p> <p>Will the option avoid disruption through effects on the transport network?</p> <p>Will the option be resilient to future changes in resources (both financial and human)?</p> <p>Will the option improve opportunities for social interaction and community cohesion?</p>			<p>Construction is not expected to affect tourism in the area of the proposed works.</p> <p>A large proportion of the proposed pipeline is routed along roads including Breinton Road, the B4348 and B4349. As a result, there is the potential for localised disruption to traffic on a temporary basis during the construction period; associated HGV movements may also result in localised congestion.</p> <p>Overall, this option has been assessed as having a mixed minor positive and minor negative effect in respect of wellbeing.</p> <p>Effects of Operation</p> <p>The operation of the option would enhance the resilience of supply to DCWW customers in the Vowchurch WRZ during periods of dry weather through the transfer of water (up to 3 Ml/d) from the Hereford WRZ. In turn, this will help to support economic and population growth.</p> <p>There are not anticipated to be any effects on employment over the long term.</p> <p>Overall, the option has been assessed as having a positive effect on wellbeing.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Where possible, DCWW and any contractors should seek to utilise local labour, sub-contractors and locally sourced materials. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> The extent to which the construction of this option would benefit the local economy/local labour market is uncertain.
<p>9. To ensure the sustainable and efficient use of water resources.</p>	<p>Will the option lead to reduced leakage from the supply network?</p> <p>Will the option improve efficiency in water consumption?</p>	0	0	<p>Effects of Construction</p> <p>This option is not a leakage reduction or water efficiency option and would therefore have no impact on the efficient use of water resources during construction.</p> <p>Effects of Operation</p> <p>This option is not a leakage reduction or water efficiency option and a neutral effect on water resources has been identified in respect of this objective.</p> <p>Mitigation</p> <ul style="list-style-type: none"> None identified.



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> None identified.
<p>10. To promote the efficient use of resources.</p>	<p>Will the option seek to minimise the demand for raw materials?</p> <p>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</p> <p>Will the option encourage the use of sustainable design and materials?</p> <p>Will the option reduce or minimise energy use?</p>	-	0	<p>Effects of Construction</p> <p>Raw materials would be required for pipeline works and upgrade to the WPS, in addition to energy usage. This option would also generate construction wastes which would include excavated soil and infrastructural waste, although this would be reused/recycled.</p> <p>Overall, this option has been assessed as having a negative effect on Objective 10.</p> <p>Effects of Operation</p> <p>The operation of this option would require additional resources such as chemicals used in the treatment of water. There would also be energy usage associated with the treatment and pumping of water. However, as this option would be implemented on an infrequent basis only (during periods of dry weather), resource use is expected to be negligible.</p> <p>Overall, this option has been assessed as having a neutral effect on waste and resources.</p> <p>Mitigation</p> <ul style="list-style-type: none"> Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. Construction wastes should be reused/recycled where possible. Measures to reduce energy usage during construction should be considered including, for example, the use of low energy usage plant. <p>Assumptions</p> <ul style="list-style-type: none"> None identified. <p>Uncertainty</p> <ul style="list-style-type: none"> Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage.

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none"> The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. The volume of waste generated under operation of this option is uncertain at this stage
<p>11. To conserve and enhance the cultural, historic and industrial heritage resource.</p>	<p>Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings?</p> <p>Will the option avoid or minimise damage to archaeologically important sites?</p> <p>Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?</p> <p>Will the option affect public access to, or enjoyment of, features of cultural heritage?</p> <p>Will the option protect or enhance Welsh language and culture?</p>	0	0	<p>Effects of Construction</p> <p>The Broomy Hill site includes the Water Tower Grade II Listed Building and is immediately adjacent to 86. Broomy Hill Grade II Listed Building. Due to the close proximity of these assets to the works, there is the potential for construction activity associated with the upgrade of Broomy Hill WPS to affect the settings of these assets. However, taking into account the scale of works in this location and their temporary nature, any effects in this regard are expected to be negligible.</p> <p>Broomy Hill Pumping Station (a Grade II* Listed Building) is situated circa 100m to the south of the site; however, given the scale of the works and intervening infrastructure, no effects on the setting of this asset are predicted.</p> <p>There is a very small number of listed buildings along the proposed pipeline route. Given the small number of assets that could be affected and the temporary nature of the pipeline works, effects associated with the construction of the scheme are expected to be negligible.</p> <p>Eaton Camp Scheduled Monument is located to the west of the proposed pipeline route. However, given the scale of works, their temporary nature and the presence of intervening vegetation (trees), no effects on the setting of this asset are predicted.</p> <p>Excavation associated with the proposed pipeline poses the risk of affecting previously unknown archaeological assets; however, this is uncertain at this stage.</p> <p>Overall, a neutral effect has been identified with respect to cultural heritage.</p> <p>Effects of Operation</p> <p>As noted above, the Broomy Hill site includes a Grade II Listed Building (Water Tower (Grade II Listed Building) and is immediately adjacent to 86. Broomy Hill Grade II Listed Building whilst Broomy Hill Pumping Station (a Grade II* Listed Building) is situated circa 100m to the south. Taking into account the nature of the WPS upgrade and its location within an existing site, no operational effects on these assets are predicted.</p>

Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<p>Mitigation</p> <ul style="list-style-type: none"> • Consultations with the County Archaeologist could take place prior to construction works. <p>Assumptions</p> <ul style="list-style-type: none"> • None. <p>Uncertainty</p> <ul style="list-style-type: none"> • The presence of currently undiscovered archaeological assets is unknown at this stage.
<p>12. To conserve and enhance landscape character.</p>	<p>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</p> <p>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</p> <p>Will the option affect public access to existing landscape features?</p> <p>Will the option minimise adverse visual impacts?</p>	-	0	<p>Effects of Construction</p> <p>The Broomy Hill site and proposed pipeline route are not affected by any landscape designations.</p> <p>As works associated with the upgrade of Broomy Hill WPS would be within an existing operational site, and taking into account their scale, no adverse landscape or visual impacts are predicted in respect of the construction of this element of the scheme.</p> <p>Pipeline works would largely follow existing linear features (roads), although works would temporarily affect greenfield land and there is the potential for construction activity to cause some short term impacts on the visual amenity of residential and recreational receptors along the proposed route.</p> <p>Overall, this option has been assessed as having a minor negative effect on landscape.</p> <p>Effects of Operation</p> <p>As noted above, the Broomy Hill site is not affected by any landscape designations. Given the scale and location of the upgraded WPS, no operational effects on landscape or visual amenity are predicted.</p> <p>It is expected that any planting and re-seeding would be likely to return greenfield land affected by pipeline works land to a pre-development state within a year depending on the season in which works are undertaken.</p> <p>Overall, this option has been assessed as having a neutral effect on landscape.</p> <p>Mitigation</p>



Objective	Key Questions	Relationship		Commentary
		Construction	Operation	
				<ul style="list-style-type: none">Landscaping / screening measures should be utilised to minimise adverse landscape / visual amenity impacts. <p>Assumptions</p> <ul style="list-style-type: none">None identified. <p>Uncertainty</p> <ul style="list-style-type: none">None identified.



Appendix E

Scoping and Environmental Report Consultation Responses



Dŵr Cymru Welsh Water Water Resources Management Plan Strategic Environmental Assessment: Scoping Report Consultation Response Summary

Introduction

Dŵr Cymru Welsh Water (Welsh Water) published a Strategic Environmental Assessment (SEA) Scoping Report as part of the initial stage of the SEA of the Draft Water Resources Management Plan (WRMP) for a consultation period of six weeks ending 21st April 2017. Responses were received to the consultation from the following organisations:

- ▶ Natural Resources Wales;
- ▶ Welsh Government;
- ▶ Cadw.

In support of the consultation, a meeting attended by Natural Resource Wales was also held on 5th April 2017. The purpose of this meeting was to seek initial feedback on the content of the SEA Scoping Report.

The following sections provide a summary of the comments received from the statutory consultees together with responses and actions taken in the SEA Environmental Report.

The SEA Assessment Framework has been amended as a result of this consultation. The changes to the Assessment Framework are shown in **Table E1.4**.



SEA Scoping Report Response Summary and Actions

The comments received from those organisations who responded to the SEA Scoping Report consultation are shown in Tables E1.1-E1.3 below, together with the corresponding responses and actions taken.

Table E1.1 Natural Resources Wales

Consultation Question	Section	Consultee Response	Response/Action
<p>Q1. Do you think that this scoping report sets out sufficient information to establish the context for the SEA of the Draft WRMP in terms of the review of plans and programmes and baseline evidence and analysis? If not, which areas do you think have been missed and where is information on these topics available from?</p>	General	We welcome the information identified as part of the review of relevant plans and programmes and the baseline evidence and analysis. However, we consider that there are some other baseline evidence, plans and programmes relevant to the WRMP and should therefore be considered as part of the review [these are set out below].	Comment noted.
	Section 2: Review of Plans and Programmes	<p>Climate change We recommend that you include reference to the UK Climate Change Risk Assessment (UK CCRA17) evidence report: https://www.theccc.org.uk/publication/climate-change-risk-assessment-ii-updated-projections-for-water-availability-for-the-uk/.</p>	<p>Comment noted. UK CCRA17 is not considered to be a plan or programme in the context of the SEA Directive and Regulations and in consequence, it has not been included in the review of plans and programmes. However, the findings of the report will be used in amending the baseline analysis for water (Section 3.4) and air quality and climate (Section 3.5).</p> <p>Reflecting comments received during the Scoping Report consultation meeting, the Water UK (2016) Water Resources Long Term Planning Framework will also be used to inform revisions to the baseline.</p>
	Section 3: Baseline Analysis	With regard to climate change projections, the projections used should be consistent with the projections used for the main supply forecasts in the company's WRMP (i.e. 2030s projections).	Comment noted. Long term (2080) information from the UKCP09 medium emissions scenario has been used to provide a clear indication of the likely climatic change trends. We note that Defra has commissioned a new set of climate projections for the UK and these will provide information on how the climate of the UK may change over the rest of this century. These new projections (UKCP18), if available, will be used to update the likely

Consultation Question	Section	Consultee Response	Response/Action
			evolution of the baseline as it relates to climate, in the subsequent Environmental Report.
	Section 3: Baseline Analysis	Fluvial Geomorphology We would recommend that you consider any potential changes to 'fluvial geomorphology' (for example sediment loading) from your WRMP options and therefore any potential impacts to WFD status.	Comment noted. Impacts on fluvial geomorphology will be considered during the assessment of WRMP options where appropriate.
	Section 3: Baseline Analysis	Fisheries/Biodiversity We would encourage you to consider more widely issues around salmonid fish spawning and recruitment in tributaries that can be influenced by reservoir releases. Therefore, consider how you may off-set any environmental impact of options relating to dams and reservoirs (e.g. loss of upstream habitats).	Comment noted. Impacts on salmonids will be considered during the assessment of WRMP options where appropriate.
	Section 2: Review of Plans and Programmes	With regard to page 140 of the Scoping Report, you should consider the NERC Act section 41 list in England. With regards to the Welsh sites, you should use the section 7 list of the Environment (Wales) Act 2016. We recommend under page 149 – Environment (Wales) Act that you should make direct reference to s6 Biodiversity Duty and s7 the list of priority habitats and species.	Agreed. The review of plans and programmes presented in Appendix B of the Scoping Report will be updated to reflect this response.
	Section 2: Review of Plans and Programmes	Geological On page 38, it would be helpful to also reference Geodiversity Action Plans (GAPs) as one of the key sources.	Agreed. The review of plans and programmes will be updated to include the UK Geodiversity Action Plan and reference will also be made to Local Geodiversity Actions Plans. Table 2.2 will be amended in response to this comment.
	Section 3: Baseline Analysis	Under Section 3.3, there is reference to 'Carboniferous Peat'. We believe it is not appropriate to include blanket bog under this section. Note with regards to Geoparks, there are only two in Wales i.e. Fforest Fawr and GeoMon. We note that Abberley and Malvern is not in Wales and is no longer a Geopark. The number of geological SSSI is around 300 and 480 individual Geological Conservation Review (GCR) sites. There are around 700 Regionally Important Geological/geomorphological Sites (RIGS) in Wales. More information is available in our 'State of Natural Resources Report (SoNaRR) 2016'.	Agreed. Section 3.3 will be reviewed to reflect this response and SoNaRR.
	Section 3: Baseline Analysis	Human impacts With regard to the section on Health (page 71), we recommend that you consider 'Healthy Life Expectancy' also in relation to inequalities – for example those in the most deprived areas have a lower healthy life expectancy. For more information here is a link with all the data: http://www.publichealthwalesobservatory.wales.nhs.uk/measuring-inequalities-2016-overview/ .	Agreed. Section 3.6 of the Scoping Report currently states that " <i>Generally, the incidence of fair/poor reported health status is higher in more southerly counties when compared to north wales counties; however, this is likely to reflect the legacy of employment in industries such as mining and steel working in communities, levels of deprivation and demography.</i> " Reflecting this comment, additional commentary will be included in this section on healthy life expectancy.

Consultation Question	Section	Consultee Response	Response/Action
	Section 3: Baseline Analysis	<p>It would be beneficial to see more reference made to Green Infrastructure (GI) opportunities within the SEA. We recognise that GI is mentioned in the Scoping Report, however it does not seem to have been put into context through the document. We recognise that GI should run as a thread through multiple subjects – e.g. in relation to Table 4.2 - it helps biodiversity, soils and geology, flood risk, climate change, human health and wellbeing, landscape, etc. Therefore, you should be more explicit about how the SEA offers opportunity to influence GI introduction.</p>	<p>Agreed. A specific sub-section on green infrastructure will be included in Section 3.2 highlighting the linkages across the baseline topics (to avoid unnecessary duplication). In addition, the following additional key sustainability issues will be listed in Table 3.24 (and the supporting text):</p> <ul style="list-style-type: none"> • The need to recognise the key role that green infrastructure plays in supporting (inter alia) biodiversity, landscape, wellbeing and climate change resilience. • The need to protect and enhance the green infrastructure network. <p>The following additional guide questions/amendments to existing guide questions will be included in the assessment framework:</p> <p>SEA Objective 1</p> <ul style="list-style-type: none"> • Will the option maintain and enhance the green infrastructure network and the biodiversity it supports? <p>SEA Objective 4</p> <ul style="list-style-type: none"> • Will the option help to minimise flood risk by maintaining and improving the green infrastructure network? <p>SEA Objective 6</p> <ul style="list-style-type: none"> • Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles? <p>SEA Objective 11</p> <ul style="list-style-type: none"> • Will the option protect and enhance landscape character, townscape, seascape <u>and green infrastructure</u>?
	Section 2: Review of Plans and Programmes	<p>Planning</p> <p>With regard to plans and programmes, it is worth acknowledging the Welsh Government's National Development Framework (NDF). We recognise that it is not expected to be published until March 2020. However, the Welsh Government will be consulting on main issues, options and preferred option, supported by environmental reports and assessments later this year.</p>	<p>Comment noted. The NDF is at an early stage of development, with a call for evidence and projects held from December 2016 to March 2017. At this stage, no documentation is in the public domain. Whilst undoubtedly an important strategic document, the review of plans and programmes refers primarily to adopted plans and programmes and in the absence of such similar information for the NDF, it is premature to include reference to the framework at this stage.</p>

Consultation Question	Section	Consultee Response	Response/Action
	Section 2: Review of Plans and Programmes	<p>Flood Risk In Table 2.2, the ‘Key Objectives and Policy Messages’ related to flood risk management is “<i>minimising flood risk and improving flood control infrastructure</i>”. The key sources listed is comprehensive and it appears to identify all key legislation, policies, plans and programmes.</p> <p>We acknowledge that reference is made to ‘Catchment Flood Management Plans (various) – this should read ‘Flood Risk Management Plans’. It’s not clear whether by citing the Floods Directive, this is intended to encompass the Flood & Water Management Act, under which there is a responsibility on Lead Local Flood Authorities (LLFAs) to prepare and maintain local level Flood Risk Management Strategies. This is captured for England under Annex B ‘Review of Plans and Programmes’ as part of the ‘Environment Agency (2011) National Flood and Coastal Erosion Risk Management Strategy for England’ but has not has been reflected within the SEA for Wales.</p>	<p>Agreed. Reference to Catchment Flood Management Plans will be amended to read Flood Risk Management Plans where appropriate.</p> <p>The Flood and Water Management Act 2010 has been reviewed as part of the Scoping Report but has been omitted from Table 2.1 in error. This will be addressed in the Environmental Report. Additionally, the 2011 National Strategy for Flood and Coastal Erosion Risk Management in Wales will be included.</p>
		<p>Annex B also makes reference to:</p> <ul style="list-style-type: none"> Reservoirs Act 1975. In April 2016 amendments to the Reservoirs Act were introduced for Wales. This may affect DCWW assets in Wales. Environmental Permitting (England and Wales) Regulations 2010. Since April 2016 certain flood risk activities are now regulated under the Environmental Permitting Regulations (formerly flood defence consents). Flood Risk Activity Permits may be required for DCWW activities/assets. There are slight variations between England and Wales. 	<p>Comment noted. The review of plans and programmes will be revised to reflect the amendments to the Reservoirs Act and Environmental Permitting (England and Wales) Regulations 2010.</p>
	Section 3: Baseline Analysis	<p>In terms of baseline evidence, there is no mention of the Flood Risk Maps. In Wales, the Flood Maps now also incorporate the Welsh Government’s Development Advice Map used for planning purposes. This is hosted by Natural Resources Wales for Wales: https://naturalresources.wales/our-evidence-and-reports/maps/flood-risk-map/?lang=en. In England, relevant information can be found via the following link: https://www.gov.uk/check-flood-risk.</p>	<p>Agreed. Reference to flood risk mapping will be included in Section 3.4.</p>
	Section 3: Baseline Analysis	<p>Landscape Note that DCWW are statutory undertakers who must have regard for the purposes of conserving and enhancing natural beauty in National Parks and Areas of Outstanding Natural Beauty (AONBs). Collectively we call these Designated Landscapes (DLs). We note that the DLs are referenced throughout the Scoping Report and would suggest the addition of reference to the DL’s Special Qualities when proposing enhancement to these areas. The Special Qualities are key features of the DL and should be agreed in collaboration with stakeholders.</p>	<p>Agreed. The following additional key sustainability issue will be listed in Table 3.24 (and the supporting text):</p> <ul style="list-style-type: none"> Ensure the special qualities of designated landscapes are protected. <p>The guide question under SEA Objective 11 (Landscape) will be revised as follows:</p> <ul style="list-style-type: none"> Will the option avoid adverse effects on, and enhance where possible, <u>the special qualities of protected/designated landscapes</u> (including woodlands) such as National Parks or AONBs?

Consultation Question	Section	Consultee Response	Response/Action
	Section 2: Review of Plans and Programmes	In Appendix B35 reference has been made to the Clwydian Range AONB. Please note the full title is now: Clwydian Range and Dee Valley AONB.	Comment noted. Reference to Clywdian Range AONB will be revised to read Clwydian Range and Dee Valley AONB.
Q2. Do you agree with the main economic, social and environmental issues identified are relevant to the SEA of the Draft WRMP? If not, which issues do you think need to be included or excluded?	Section 3: Baseline Analysis	We welcome how you are incorporating your duties in relation to the Environment (Wales) Act and considering the Well-being of Future Generations (Wales) Act within the SEA Scoping. We consider that those main issues identified are relevant to the SEA of the Draft WRMP. However, there are some additional issues relevant to the WRMP that should be considered as part of your review [these are set out below].	Comment noted.
	Section 3: Baseline Analysis	We support the list of 'Key Economic, Social and Environmental Issues' for the Air Quality and Climate Change section which encompasses the issues we would expect to be covered by the SEA. In terms of the key sustainability issues relevant to the your Draft WRMP, we recommend that climate change is also referenced in relation to its impacts on biodiversity, the human environment, landscape etc.	Comment noted. Climate change is already captured under biodiversity, water, air quality and climate, the human environment and landscape and townscape. No change.
	Section 3: Baseline Analysis	Under Table NTS.1, Topic Area 'Water' it is stated that there is a need to "ensure the continued risk of flooding is mitigated effectively." This is repeated in Section 3.4 under the heading 'Key Sustainability Issues Relevant to the WRMP'. Ideally the WRMP should also consider how the risk of flooding can be reduced as well as mitigated.	Agreed. The key issue will be amended to read: <ul style="list-style-type: none"> The need to ensure <u>that</u> the continued risk of flooding is <u>reduced or where this is not possible, mitigated effectively.</u>
	Section 3: Baseline Analysis	Under the heading 'Climate' (pages 63-65), increased river and urban flooding has been identified and there are links to increased pressure on the sewerage system. Page 85 also makes reference to climate change and the risks this may pose on the sewer and drainage network. However, it is not clearly identified in the SEA that pressure on the sewerage/drainage system also poses a risk of more frequent localised flooding (as a result of non-capacity).	Agreed. Reference to localised flooding as a result of pressures on the sewerage network will be included in Section 3.7 and Section 3.5.
Q3. Do you agree that the draft objectives for the SEA cover a sufficient range of environmental, social and economic topics to allow an assessment of the draft WRMP? If not, which objectives should be amended and which other	Section 4: Approach to the Assessment	We agree with the majority of the draft objectives for the SEA. We recommend that there are some changes that could be incorporated within your framework [these are set out below].	Comment noted.

Consultation Question	Section	Consultee Response	Response/Action
objectives do you believe should be included?			
	Section 4: Approach to the Assessment	We recommend adding to the Wellbeing Goals column that landscape also contributes significantly to a 'Prosperous Wales'. We would also suggest that you remove townscape and add in Green Infrastructure.	<p>Agreed. Reference to a 'Prosperous Wales' will be included against SEA Objective 11 (Landscape).</p> <p>It is not considered appropriate to remove reference to townscape in the guide questions supporting SEA Objective 11 given the potential for WRMP options to result in changes to townscape character. However, reference to green infrastructure will be included, as follows:</p> <ul style="list-style-type: none"> Will the option protect and enhance landscape character, townscape, seascape and <u>green infrastructure</u>?
	Section 4: Approach to the Assessment	We acknowledge that you included the well-being goals as one of the columns. We recommend that you include a column for the Environment (Wales) Act 2016, particularly in relation to section 6 and 7- i.e. the biodiversity duty (s6) and the list of habitats and species of priority importance for biodiversity (s7).	<p>Comment noted. The following additional guide question will be included under SEA Objective 1 (Biodiversity):</p> <ul style="list-style-type: none"> Will the option maintain and enhance ecosystem resilience?
	Section 4: Approach to the Assessment	Under biodiversity, you should consider whether the WRMP options will contribute to restoration of species that are currently not achieving management objectives. For example, stocks of salmon and trout are in poor condition in most rivers in Wales. Although there are extrinsic factors (e.g. marine climate change affecting marine survival of salmon) there are also constraints in freshwater that arguably include matters related to the DCWW business (flows, nutrients, BOD etc.).	<p>Agreed. The following additional guide question will be included under SEA Objective 1 (Biodiversity):</p> <ul style="list-style-type: none"> Will the option contribute to the restoration of species that are currently not achieving management objectives?
	Section 4: Approach to the Assessment	Under Geology and Soils, we recommend that that you consider " <i>Will the option protect and enhance sites designated for their geological interest (GCR sites, SSSI & RIGS) and features of wider geodiversity interest</i> ".	<p>Agreed. The guide question referred to in this response under SEA Objective 2 (Geology and Soils) will be amended to read:</p> <ul style="list-style-type: none"> Will the option protect and enhance protected sites designated for their geological interest (<u>GCR sites, SSSI and RIGS</u>) and features of wider geodiversity interest?
	Section 4: Approach to the Assessment	To ensure the protection and enhancement of human health, we suggest changing the wording of first guide question to " <i>Will the option impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation?</i> "	<p>Agreed. The guide question referred to in this response under SEA Objective 6 (Health) will be amended to read:</p> <ul style="list-style-type: none"> Will the option <u>impact on physical health and mental well-being by affecting opportunities for informal outdoor recreation</u>?

Consultation Question	Section	Consultee Response	Response/Action
	Section 4: Approach to the Assessment	Under human health, we also recommend adding the following question: - " <i>Will the option affect public access to, or enjoyment of, local green/blue space?</i> "	Agreed. The following additional guide question will be included under SEA Objective 6 (Health): <ul style="list-style-type: none"> Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?
	Section 4: Approach to the Assessment	To maintain and enhance the economic and social well-being of the local community, we recommend adding the following questions: - " <i>Will the option improve opportunities for social interaction and community cohesion?</i> " - " <i>Will the option increase or decrease opportunities for volunteering?</i> "	Comment noted. The following additional guide question will be included under SEA Objective 7 (Social and Economic Well-Being): <ul style="list-style-type: none"> Will the option improve opportunities for social interaction and community cohesion? <p>With regard to the proposed guide question '<i>Will the option increase or decrease opportunities for volunteering?</i>', this is likely to be outside the scope of effects that could arise from the WRMP options and in consequence, it has not been included in the assessment framework.</p>
	Section 4: Approach to Assessment	We recognise that the scoping document incorporates all the requirements of a SEA. However, we believe that there is an opportunity to push forward integrated thinking, in line with Sustainable Management of Natural Resources (SMNR) principles. The new legislative framework in Wales provides an opportunity to consolidate consideration of impacts on natural resources with impacts on wellbeing. Therefore, reflecting on the integrating nature of landscape, which represents the interconnection of man's impacts upon and benefits from the natural environment. Ideally you should gather information on the benefits / services of natural resources in a landscape context.	Comment noted. The comment concerns the approach to the assessment and the potential to recognise new opportunities and benefits. Table 4.2 of the Scoping Report maps the relationship between the SEA objectives, the well-being goals and SMNR objectives. The high degree of complementarity indicates that the wider potential benefits can be identified through the framework and which will be reflected in commentary in the subsequent Environmental Report, where appropriate.
	Section 4: Approach to the Assessment	Under landscape, we would recommend adding: - " <i>Will the option enhance the benefits from or services of integrated natural resources?</i> "	Comment noted. As noted above, Table 4.2 of the Scoping Report maps the relationship between the SEA objectives, the well-being goals and SMNR objectives. The high degree of complementarity indicates that the wider potential benefits of natural resources can be identified through the framework and which will be reflected in commentary in the subsequent Environmental Report, where appropriate. No change.
	Section 4: Approach to the Assessment	Under 'Water – flood risk', the objective is " <i>To reduce the risk of flooding</i> ". We believe the SEA could go further and have an objective which is to reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.	Agreed. SEA Objective 4 (Flood Risk) will be amended to read: <ul style="list-style-type: none"> To reduce the risk of flooding, <u>promote the use of sustainable drainage and identify opportunities for</u>

Consultation Question	Section	Consultee Response	Response/Action
			<p><u>collaborative working with other risk management authorities.</u></p>
	<p>Section 4: Approach to the Assessment</p>	<p>Under 'Climate Change' the guide question "<i>Will the option increase environmental resilience to the effects of climate change?</i>" could be expanded to identify impacts on flood risk/water quality.</p>	<p>In addition, the following guide questions will be included:</p> <ul style="list-style-type: none"> • Will the option promote the use of sustainable drainage systems? • Will the option promote opportunities for collaborative working with other risk management authorities? <p>Agreed. The guide question will be amended to read:</p> <ul style="list-style-type: none"> • Will the option increase environmental resilience to the effects of climate change <u>including to impacts on flood risk and water quality?</u>
	<p>Section 4: Approach to the Assessment</p>	<p>The proposed guide questions under 'Human – Environmental Health' and 'Human Environment – Social and Economic Well-Being' could capture the impacts /consequences of flood risk. For example: -<i>Will the option affect the risk of flooding to people and /or property?</i> -<i>Will the option help to mitigate/reduce the risk of flooding to people/property?</i></p>	<p>Comment noted. It is considered that flood risk is captured under SEA Objective 4 and inclusion under SEA Objective 6 (Health) and SEA Objective 7 (Social and Economic Well-Being) would result in unnecessary duplication. However, the following guide questions will be included under SEA Objective 4:</p> <ul style="list-style-type: none"> • Will the option affect the risk of flooding to people and /or property? • Will the option help to mitigate/reduce the risk of flooding to people/property?

Table E1.2 Welsh Government

Consultation Question	Section	Consultee Response	Response/Action
Q1. Do you think that this scoping report sets out sufficient information to establish the context for the SEA of the Draft WRMP in terms of the review of plans and programmes and baseline evidence and analysis? If not, which areas do you think have been missed and where is information on these topics available from?	General	The Scoping Report is very comprehensive and should lead to a robust assessment/iteration of the WRMP.	Comment noted.
	Section 2: Review of Plans and Programmes	The list of plans and programmes include the English Biodiversity 2020 strategy which is fine for context, but as a devolved matter, the Welsh Government (WG) Nature Recovery Plan 2015 is more relevant. The Nature Recovery Plan and the WG Natural Resource Policy Statement (which is picked up in the list), emphasise the new approach to natural resource management introduced in the 2016 Environment Act Wales.	Agreed. The Nature Recovery Plan for Wales will be included in the review of plans and programmes.
Q3. Do you agree that the draft objectives for the SEA cover a sufficient range of environmental, social and economic topics to allow an assessment of the draft WRMP? If not, which objectives should be amended and which other objectives do you believe should be included?	Section 4: Approach to the Assessment	<p>The new approach significantly includes a more pro-active approach to maintain and enhance the resilience of ecosystems by taking account the following aspects:</p> <ul style="list-style-type: none"> -diversity between and within ecosystems; -the connections between and within ecosystems; -the scale of ecosystems; -the condition of ecosystems; -the adaptability of ecosystems. <p>This approach will be strengthened in the forthcoming Natural Resource Policy. You may wish to consider how this could play into the SEA objectives at this stage.</p>	<p>Comment noted. The following additional guide question will be included under SEA Objective 1 (Biodiversity):</p> <ul style="list-style-type: none"> • Will the option maintain and enhance ecosystem resilience?

Table E1.3 Cadw

Consultation Question	Section	Consultee Response	Response/Action
<p>Q1. Do you think that this scoping report sets out sufficient information to establish the context for the SEA of the Draft WRMP in terms of the review of plans and programmes and baseline evidence and analysis? If not, which areas do you think have been missed and where is information on these topics available from?</p>	<p>Section 3: Baseline Analysis</p>	<p>Our only comment is that the Scoping Report states at page 91 that there are 6 World Heritage Sites in Wales. There are in fact 3 World Heritage Sites, as Caernarfon, Harlech, Beaumaris and Conwy Castles form part of the Castles and Town Walls of King Edward in Gwynedd World Heritage Site.</p>	<p>Agreed. The reference to World Heritage Sites in Section 3.8 will be amended to reflect this response.</p>

Revised SEA Assessment Framework

Amendments to the SEA Assessment Framework made as a result of the consultation process are shown in **Table E1.4** below. Amendments to the assessment framework are shown in **red text**.

Table E1.4 Amendments to the SEA Assessment Framework following Consultation on the Scoping Report

Topic Area	Proposed SEA Objective	Proposed Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
Biodiversity	1. To protect and enhance biodiversity, key habitats and species ecological functions, capacity and habitat connectivity	<i>Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?</i>	A prosperous Wales A resilient Wales A healthier Wales A globally responsible Wales	Yes	Biodiversity, Flora and Fauna
		<i>Will the option protect and enhance non-designated sites and local biodiversity?</i>			
		<i>Will the option provide opportunities for new habitat creation or restoration and/or link existing habitats?</i>			
		<i>Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?</i>			
		<i>Will the option protect, and enhance where appropriate, coastal and marine habitats and species?</i>			
		<i>Will the option prevent the spread/introduction of invasive non-native species?</i>			
		<i>Will the option maintain and enhance the green infrastructure network and the biodiversity it supports?</i>			
		<i>Will the option contribute to the restoration of species that are currently not achieving management objectives?</i>			
		<i>Will the option maintain and enhance ecosystem resilience?</i>			
Geology and Soils	2. To ensure the appropriate and efficient use of land and protect and enhance soil quality and geodiversity.	<i>Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?</i>	A prosperous Wales A resilient Wales A globally responsible Wales	Yes	Soils, Material Assets
		<i>Will the option utilise previously developed land?</i>			
		<i>Will the option protect and enhance protected sites designated for their geological interest (GCR sites, SSSI and RIGS) and features of wider geodiversity interest?</i>			

Topic Area	Proposed SEA Objective	Proposed Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<p><i>Will the option minimise the loss of best and most versatile agricultural land?</i></p> <p><i>Will the option minimise conflict with existing land use patterns?</i></p> <p><i>Will the option minimise land contamination?</i></p>			
Water – Quantity and Quality	3. To protect and enhance surface and ground water levels and flows and ensure sustainable water resource management. the quantity and quality of surface and groundwater resources and the ecological status of water bodies.	<p><i>Will the option minimise the demand for water resources?</i></p> <p><i>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</i></p> <p><i>Will the option result in changes to river flows?</i></p> <p><i>Will the option result in changes to groundwater levels?</i></p> <p><i>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</i></p> <p><i>Will the option support the achievement of protected area objectives?</i></p> <p><i>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</i></p> <p><i>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</i></p>	A prosperous Wales A resilient Wales A healthier Wales	Yes	Water, Biodiversity, Flora, Fauna
Water – Quality	4. To protect and enhance the quality of surface and groundwater resources and the ecological status of water bodies.	<p><i>Will the option protect and improve surface, groundwater, estuarine and coastal water quality?</i></p> <p><i>Will the option prevent the deterioration of Water Framework Directive (WFD) waterbody status (or potential)?</i></p> <p><i>Will the option support the achievement of protected area objectives?</i></p> <p><i>Will the option support the achievement of environmental objectives set out in River Basin Management Plans?</i></p> <p><i>Will the option ensure a new activity or new physical modification does not prevent the future achievement of good status for a water body?</i></p>	A prosperous Wales A resilient Wales A healthier Wales	Yes	Water, Biodiversity, Flora, Fauna

Topic Area	Proposed SEA Objective	Proposed Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
Water – Flood Risk	5. To reduce the risk of flooding, promote the use of sustainable drainage and identify opportunities for collaborative working with other risk management authorities.	<i>Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?</i>	A prosperous Wales A resilient Wales A healthier Wales A Wales of cohesive communities A globally responsible Wales	Yes	Human health, Climatic Factors
		<i>Will the option have the potential to help alleviate flooding in the catchment area now or in the future?</i>			
		<i>Will the option be at risk of flooding now or in the future?</i>			
		<i>Will the option help to minimise flood risk by maintaining and improving the green infrastructure network?</i>			
		<i>Will the option promote the use of sustainable drainage systems?</i>			
		<i>Will the option promote opportunities for collaborative working with other risk management authorities?</i>			
		<i>Will the option affect the risk of flooding to people and/or property?</i>			
		<i>Will the option help to mitigate/reduce the risk of flooding to people and/or property?</i>			
Climate Change	6. To limit the causes and potential consequences of climate change and to adapt to future changes.	<i>Will the option reduce or minimise greenhouse gas emissions?</i>	A prosperous Wales A resilient Wales A healthier Wales A Wales of cohesive communities A globally responsible Wales	Yes	Climatic Factors.
		<i>Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?</i>			
		<i>Will the option reduce vulnerability to the effects of climate change by appropriate adaptation?</i>			
		<i>Will the option increase environmental resilience to the effects of climate change including to impacts on flood risk and water quality?</i>			
		<i>Will coastal erosion have consequences on the operation of this option now or in the future, taking account of expected climate change sea level rise?'</i>			
Human Environment - Health	7. To ensure the protection and enhancement of human health.	<i>Will the option ensure the continuity of a safe and secure drinking water supply?</i>	A prosperous Wales	Yes	Population, Human Health.
		<i>Will the option impact on physical health and mental well-being by affecting affect opportunities for informal outdoor recreation and physical activity?</i>			

Topic Area	Proposed SEA Objective	Proposed Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
		<p><i>Will the option maintain surface water and bathing water quality within statutory standards?</i></p> <p><i>Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?</i></p> <p><i>Will the option maintain and improve public access to, and enjoyment of, green and blue infrastructure and in doing so help promote healthy lifestyles?</i></p>	<p>A globally responsible Wales</p> <p>A resilient Wales</p> <p>A healthier Wales</p> <p>A more equal Wales</p>		
Human Environment -Social and Economic Well-Being	8. To maintain and enhance the economic and social well-being of the local community.	<p><i>Will the option ensure sufficient infrastructure is in place for predicted population increases?</i></p> <p><i>Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?</i></p> <p><i>Will the option help to meet the employment needs of local people?</i></p> <p><i>Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?</i></p> <p><i>Will the option improve access to local services and facilities (e.g. sport and recreation)?</i></p> <p><i>Will the option contribute to sustaining and growing the local and regional economy?</i></p> <p><i>Will the option avoid disruption through effects on the transport network?</i></p> <p><i>Will the option be resilient to future changes in resources (both financial and human)?</i></p> <p><i>Will the option improve opportunities for social interaction and community cohesion?</i></p>	<p>A prosperous Wales</p> <p>A globally responsible Wales</p> <p>A resilient Wales</p> <p>A healthier Wales</p> <p>A more equal Wales</p> <p>A Wales of cohesive communities</p> <p>A Wales of vibrant culture and thriving Welsh language</p>	Yes	Population, Human Health, Material Assets.
Material Assets and Resource Use - Water Resources	9. To ensure the sustainable and efficient use of water resources.	<p><i>Will the option lead to reduced leakage from the supply network?</i></p> <p><i>Will the option improve efficiency in water consumption?</i></p>	<p>A prosperous Wales</p> <p>A resilient Wales</p> <p>A globally responsible Wales</p>	Yes	Water, Material Assets.

Topic Area	Proposed SEA Objective	Proposed Guide Questions	Welsh Government Well-being Goal(s)	Relevant to the Objective for SMNR?	SEA Directive Topic(s)
Material Assets and Resource Use – Waste and Resource Use	10. To promote the efficient use of resources.	<i>Will the option seek to minimise the demand for raw materials?</i>	A prosperous Wales A resilient Wales A globally responsible Wales	Yes	
		<i>Will the option promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill?</i>			
		<i>Will the option encourage the use of sustainable design and materials?</i>			
		<i>Will the option reduce or minimise energy use?</i>			
Cultural Heritage	11. To conserve and enhance the cultural, historic and industrial heritage resource.	<i>Will the option conserve or enhance the historic environment, including heritage assets such as historic buildings, conservation areas, features, places and spaces, and their settings</i>	A prosperous Wales A Wales of vibrant culture and thriving Welsh language	Yes	Cultural Heritage
		<i>Will the option avoid or minimise damage to archaeologically important sites?</i>			
		<i>Will the option avoid damage to important wetland areas with potential for paleoenvironmental deposits?</i>			
		<i>Will the option affect public access to, or enjoyment of, features of cultural heritage?</i>			
		<i>Will the option protect or enhance Welsh language and culture?</i>			
Landscape	12. To conserve and enhance landscape character.	<i>Will the option avoid adverse effects on, and enhance where possible, the special qualities of protected/designated landscapes (including woodlands) such as National Parks or AONBs?</i>	A resilient Wales A Wales of cohesive communities A healthier Wales	Yes	Landscape
		<i>Will the option protect and enhance landscape character, townscape, seascape and green infrastructure?</i>			
		<i>Will the option affect public access to existing landscape features?</i>			
		<i>Will the option minimise adverse visual impacts?</i>			



Environmental Report Consultation

Dŵr Cymru Welsh Water (Welsh Water) published a Strategic Environmental Assessment (SEA) Environmental Report as part of the public consultation on the Draft Water Resources Management Plan (WRMP) that ran from the 16th March to 8th of June 2018 for 12 weeks.

Responses were received to the consultation from the following organisations:

- ▶ Natural Resources Wales; and
- ▶ Environment Agency.

The following tables (E1.4 and E1.5) provide a summary of the comments received from the statutory consultees together with responses and actions taken.

Table E1.4 Natural Resources Wales

Consultation Topic	Consultee Response	Response/Action
<p>Option PEM024b: Canaston Bridge - bankside attenuation</p>	<p>In the context of the SEA, our main concern relating to PEM24b is that the new bankside storage reservoir site is likely to be in flood zone C2 of the Development Advice Map (which the company has acknowledged within the SEA). We agree with the company that this would require a Flood Consequences Assessment (FCA) to be undertaken (prepared in accordance with TAN15) and the company would also need to apply for a Flood Risk Activity Permit (FRAP).</p>	<p>Comment noted.</p> <p>The SEA identified that the proposed reservoir site for PEM24b is located within Flood Zone 3 (an area at high risk of flooding, with 1 per cent or greater annual probability of flooding), while the low-lift pumps would be situated within Flood Zone 2 (risk of flooding is up to 0.1 per cent in any given year). In consequence, construction activity may be vulnerable to flooding (depending on the timing of works). Overall, the option was assessed as having a significant negative effect on flood risk (SEA Objective 5). The SEA considered that project level mitigation, informed by a Flood Consequences Assessment (FCA), would be likely to manage adverse effects in this regard.</p> <p>Welsh Water will ensure that the planning and development of the scheme will be in accordance with the requirements of TAN15.</p>
<p>Option TY004 and TY009a: New abstraction from Afon Dysynni at Pont y Garth (transfer to Pen y Bont water treatment works (WTW) (DO gain 0.44 MI/d); and Pen-y-Bont WTW Bankside Storage (8MI)</p>	<p>The SEA acknowledges that for this option, given the location of the proposed pumping station in flood zone 3 (1% flood outline) even with resilience measures in place the pumping station may be at risk of inundation. Whilst the SEA identifies no impact to third parties as a result of construction/operational activities, a FCA must be undertaken (prepared in accordance with TAN15) and will require an application for a FRAP.</p> <p>At this stage, without further detail for these preferred options (in form of site specific FCA) we are unable to advise the determining authority whether the proposal would be compliant with planning policy TAN15.</p>	<p>Comment noted.</p> <p>The SEA identified the proposed pipeline as part of TYA004 would cross extensive areas of Flood Zone 3 (1 per cent or greater annual probability of flooding) and the new pumping station and intake would also be located in Flood Zone 3. In consequence the construction phase of the scheme was identified as having a significant negative effect with respect to flood risk (SEA Objective 5). The SEA considered that project level mitigation, informed by a Flood Consequences Assessment (FCA), would be likely to manage adverse effects in this regard.</p> <p>For TYA009a, the SEA identified that the development site would be situated just outside of Flood Zones 2 and 3 and so works would not be at significant risk of flooding. The adjacent existing WTW which would be connected to the new reservoir is located within Flood Zone 3 (an area at high risk of flooding, with 1% or greater annual probability of flooding), and as a result short distances of excavation works for connecting pipeline would cross this Flood Zone. However, given the very short distances involved, it is expected that works could be timed to avoid periods of flooding, such that any effects related to flood risk are considered negligible. The SEA did not consider it likely that the proposed work would result in increased flooding elsewhere. Overall, the option was assessed as having a neutral effect on flood risk.</p>



Consultation Topic	Consultee Response	Response/Action
Landscape	<p>We are pleased to note that majority of our previous comments provided in the scoping stage of the SEA in relation to Landscape have been reflected in the environment report, including reference to the Special Qualities of Designated Landscapes (DL) and Green Infrastructure considerations. We note that Dŵr Cymru Welsh Water has agreed to include an assessment of the impact of proposals upon Special Qualities of, in this case, two National Parks within the SEA. However, this has not been included in the main body of the report in section 7 or detailed commentary of Appendix D Preferred Options Assessment Matrices. Without setting out the relevant Special Qualities and exploring the likely impacts it is difficult to ascertain whether all of the likely significant effects have been identified.</p> <p>It is also difficult to assess mitigation and enhancement in light of this omission, especially since the detailed commentary of Appendix D also does not address many of the Key Questions set out throughout the Appendix such as public access and enhancement of Special Qualities.</p> <p>We recommend that the SEA sets out the Special Qualities in Appendix D and explore the impacts during construction and operation phases if not earlier in the environment report. It may be helpful to collaborate with the relevant National Park Authorities (NPA) to discuss mitigation and enhancement measures where 'likely significant effects' have been identified</p>	<p>Welsh Water will ensure that the planning and development of the scheme will be in accordance with the requirements of TAN15.</p> <p>Comment noted.</p> <p>Following NRW scoping stage comments, the SEA was amended to include reference to the Special Qualities of Designated Landscapes (DL) and green infrastructure considerations in the revised sustainability issues (Table 3.24 (and the supporting text). Guide questions under SEA Objective 1 (Biodiversity) and SEA Objective 11 (Landscape) were also amended to include reference to DLs and green infrastructure.</p> <p>In consequence, the SEA does include assessment of these additional features. For example, in Section 6 of the Environmental Report which contains the summary of the SEA of the Preferred Options, the following is stated in terms of TYA004: <i>"All of the proposed works would be located within Snowdonia National Park and the local area has notable landscape features including stone walls, clusters of Scots Pine and the Craig yr Aderyn (Bird's Rock). Construction associated with this option may therefore cause adverse landscape and visual impacts which could affect the special qualities of the National Park as well as the visual amenity of proximate residential and recreational receptors along the pipeline route."</i> Similar text is included in Appendix D of the Environmental Report which contains the assessment of the option.</p> <p>As noted in Section 6.6 of the Environmental Report, <i>"the preferred options will be subject to project-level environmental assessment ... it is also expected that a landscape and visual impact assessment would be undertaken at the project stage as part of any EIA"</i>.</p> <p>Section 7 of the Environmental Report contained the proposed indicators for monitoring the significant environmental effects of the WRMP including effects on designated landscapes.</p> <p>For the revised Environmental Report, the detailed assessments of the preferred options have been amended to include, where relevant, reference to the Special Qualities of the DLs (Appendix D). Please note however, these do not affect the overall assessment conclusion, which was to identify significant negative effects against landscape for options TYA004 and TYA009a.</p>

Consultation Topic	Consultee Response	Response/Action
Climate Change	<p>In terms of the potential effects of the options in relation to climate change the SEA correctly sets out that 'Demand and leakage reductions may in-turn reduce greenhouse gas emissions and energy use associated with reduced treatment and pumping of water and lower energy use from heating water in the home'.</p> <p>The preferred supply side options proposed would result (as set out in the environment report) in significant negative effects on greenhouse gas (GHG) emissions, waste and resource use during operation largely related to the pumping and treatment of water. While the proposed options will provide greater resilience to the water supply network within the Pembrokeshire and Tywyn Aberdyfi resource zones, in terms of climate change the cumulative impacts will be clearly negative for both the construction and operational phases. In the summary table given that two of the preferred options will have negative impacts on GHG emissions, we recommend that the cumulative effects should be summarised as negative '-' rather than '+/-' in relation to the operational phase.</p> <p>There is a need to reduce GHG arising from implementation of the WRMP. Therefore, we acknowledge that the SEA report does refer to Dŵr Cymru Welsh Water's work on reducing GHG emissions and ensuring that high efficiency low energy use pumping should be introduced to minimise operation emissions (and costs). We recommend in the construction phase of implementing their preferred options, that the use of a carbon management planning tool such as the Environment Agency's ERIC tool is undertaken. This would ensure that GHG emissions and embedded carbon are minimised. The tool is available here: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/571707/LIT_7067.pdf. With regards to the monitoring climate change effect (increased GHG emissions), we welcome that this will form part of the company's corporate reporting. Therefore, we have no specific concerns in relation to monitoring climate change effects (GHG emissions).</p>	<p>The proposed monitoring indicators contained in Section 7 of the Revised Environmental Report have been revised to include the following measure 'Loss or damage to Special Qualities of Designated Landscapes (DL) arising from new water resource infrastructure, implemented as result of Welsh Water's WRMP19'.</p> <p>Welsh Water will consult with the relevant bodies, when planning and developing the schemes in the WRMP19 to ensure that the loss or damage to Special Qualities of DL are identified and assessed, and where relevant, that the appropriate mitigation and enhancement measures are discussed.</p> <p>Comment noted.</p> <p>The SEA uses criteria to inform the determination of likely significant effects (Appendix B of the Environmental Report). Against SEA Objective 6 (Climate Change) a significant effect is one that "would result in major or long term increases in greenhouse gas emissions (>1000 tonnes CO₂e) and the option would not increase resilience/decrease vulnerability to climate change effects". A minor positive effect is one that "would result in a sustained decrease in greenhouse gas emissions (100-999 tonnes CO₂e/a) and would increase resilience/decrease vulnerability to climate change effects".</p> <p>For construction of the preferred options the SEA notes that "The Draft WRMP would give rise to the emission of greenhouse gases resulting from embodied carbon (in, for example, construction materials) in addition to plant operation and vehicle movements. Together, the construction of the preferred options would generate a total of 1,282 tonnes of carbon dioxide equivalent (tCO₂e) which has been assessed as having a significant negative effect on climate change (SEA Objective 6)."</p> <p>For operation of the preferred options, the SEA notes "The improved storage position in Llys y Fran reservoir associated with Option PEM024b has the potential to reduce vulnerability to the effects of climate change (drought), generating a positive effect on this objective. However, the release of greenhouse gases associated with all of the preferred options (a total of 741 tCO₂e) has been assessed as having an overall minor negative effect on climate change".</p> <p>Taking into account the criteria for significance and the quantification of embodied and operational carbon, it is not</p>



Consultation Topic	Consultee Response	Response/Action
		<p>proposed to amend the scores as it is considered that they appropriate reflect the range of cumulative effects.</p> <p>Welsh Water will use appropriate tools such as the EA's ERIC and reference to the Inventory of Carbon and Energy (ICE),</p>
Flood risk	<p>We are pleased that the implementation of the draft WRMP seeks to reduce risk of flooding where possible and where it's not, undertake appropriate mitigation to ensure no significant negative impacts. With regards to flood risk, we also note that climate change impacts are taken into consideration and the need to build in resilience.</p> <p>The SEA identifies need for a Flood Consequence Assessment (FCA) to inform appropriate mitigation to manage any adverse impacts from implementing the preferred options. The SEA also notes that a FCA would be undertaken to identify what measures will be required to address flood risks, particularly to the essential infrastructure so that it remains operational.</p> <p>With regards to monitoring, we welcome the proposal to record the number of Sustainable Urban Drainage Systems (SUDs) and Green Infrastructure (GI) installed. We would be interested in this data for future S18 Reporting (as required under the Flood and Water Management Act 2010). Section 7.3 notes that the proposals may need to be licenced by NRW where they involve any abstraction from surface waters or groundwaters. The SEA should also identify that DCWW is classed as a 'protected undertaking' under the Environmental Permitting Regulations 2016 and this legislation should be referenced in the SEA as some activities, may require a Flood Risk Activity Permit from NRW (for example crossing a watercourse). Land drainage consents may also be required under the Land Drainage Act 1991. These would be obtained from the relevant Lead Local Flood Authority (LLFA).</p>	<p>Comments noted.</p> <p>Reference is made to Environmental Permitting (England and Wales) Regulations 2016 in the review of plans and programmes (Table 2.1 and Appendix B of the Environmental Report).</p> <p>Welsh Water will ensure that all appropriate assessments and consents are gained for the planning and development of the schemes with respect to flood risk.</p>
Water Quality	<p>We would like to raise some general comments in relation to 'pollution prevention methods' for during the construction phase of the preferred options. We recommend that the company provides a thorough method statement detailing pollution prevention strategies. This should address the following:</p> <ul style="list-style-type: none">• Oils from machinery. i.e. all fuel used as part of the works must be stored in a locked and bunded area and spill kits should be made available for any fuel spillages.• Erosion due to access and rutting from vehicles. Wet land is easily churned and destroyed by heavy machinery. Damaged soils lose physical integrity, making them highly vulnerable to run off. Steps should be taken to mitigate soil damage such as using lighter machinery, only working in dryer conditions, or make use of a temporary track.• Sediment catching and preventing it from entering the watercourse, and if it does enter the watercourse how will they mitigate the impact. i.e. spill kits and straw bales and know how they work and how to use them (training staff adequately) <p>Managing runoff is the most important aspect of the method statement and daily checks.</p> <ul style="list-style-type: none">• Waste generating minimisation efforts and disposal (waste transfer notes, permits, because of duty of care etc). Waste arising will be considered controlled waste and subject to all relevant legislation.• Any restoration they will need to do and how will they do that.• Further advise is provided from GPP5 : <p>http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf?utm_source=website&utm_medium=social&utm_campaign=GPP5%2027112017</p>	<p>Comments noted.</p> <p>Welsh Water will adopt all appropriate and up to date methods when planning and developing the schemes. This will include reference to relevant guidance, regulator advice and consent, permit and/or licence requirements.</p>



Consultation Topic	Consultee Response	Response/Action
	<ul style="list-style-type: none">• During the construction phase of the proposals, any waste material which is to be removed from the site should be done so via a registered waste carrier. The waste must be taken to a facility which holds an appropriate exemption or environmental permit to accept the specified waste.• Any waste material which is removed from the site should be carried out in accordance with the duty of care requirements. All appropriate paperwork and documentation should be completed by the parties involved. Details of all waste carriers, permitted and exempt sites can be found electronically via the public registers section of our website www.naturalresourceswales.gov.uk or by contacting our customer contact centre on 0300 065 3000.• Any work which is to take place should be done so with pollution prevention in mind. Pollution prevention advice and guidance can be found via this link http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/.• Works and maintenance in or near water should be taken into account and also PPG6, Working at construction and demolition sites: https://www.sepa.org.uk/media/60125/ppg-6-working-at-construction-and-demolition-sites.pdf• Should any pollution occur during the operational phase that affects Wales, Natural Resources Wales should be notified via the incident hotline – 03000 65 3000.	



Table E1.5 Environment Agency

Consultation Topic	Section	Consultee Response	Response/Action
Demonstrate that the Vowchurch option will improve resilience to a drought	Section 5.30 and 7.10 of the Draft WRMP	<p>The Draft WRMP has identified that the Vowchurch WRZ is not resilient to a 1 in 200 year drought event and as such a resilience option has been developed. The Draft WRMP proposes to lay a main between the Hereford and Vowchurch WRZs to allow some of the Vowchurch demand to be met from Broomy Hill WTW when needed.</p> <p>This option does not appear to have been included in the SEA and we are uncertain of its environmental feasibility.</p>	<p>Comment noted.</p> <p>An assessment of the resilience option for Vowchurch WRZ has been completed and is included in this revised Environmental Report (Appendix D).</p>

Appendix F

Quality Assurance Checklist

The Government's Guidance on SEA¹⁷⁵ contains a quality assurance checklist to help ensure that the requirements of the SEA Directive are met. The checklist is reproduced below, indicating where this Environmental Report meets the requirements.

Quality Assurance Checklist	
Objectives and Context	
The plan's or programme's purpose and objectives are made clear.	The purpose of the WRMP is set out in Section 1.5 of this Environmental Report. The objectives of the WRMP are set out in Section 1.5 .
Environmental issues and constraints, including international and EC environmental protection objectives, are considered in developing objectives and targets.	Key sustainability issues identified through a review of relevant plans and programmes (see Section 2 and Appendix A of this report) and analysis of baseline conditions (see Section 3) have informed the development of the assessment framework presented in Section 4.3 .
SEA objectives, where used, are clearly set out and linked to indicators and targets where appropriate.	SEA objectives and guide questions are set out in Section 4.3 of this report. Indicators are set out in Section 7.4 of this report.
Links with other related plans, programmes and policies are identified and explained.	Links are identified in Section 2 and Appendix A .
Conflicts that exist between SEA objectives, between SEA and plan objectives and between SEA objectives and other plan objectives are identified and described.	Conflicts between the SEA objectives and the feasible and preferred options put forward by Welsh Water have been identified in the appraisal matrices included in Appendix C and Appendix D .
Scoping	
Consultation Bodies are consulted in appropriate ways and at appropriate times on the content and scope of the Environmental Report.	The SEA Scoping Report was consulted upon and responses to this are included in this Environmental Report (see Appendix E).
The assessment focuses on significant issues.	The scope of the assessment reflects the geographic extent of the Welsh Water area and provides a comprehensive approach to assessment (reflecting the large number of interactions dependent on the continued supply of water). This enables the assessment to determine which impacts will be considered significant.
Technical, procedural and other difficulties encountered are discussed; assumptions and uncertainties are made explicit.	General difficulties and assumptions are set out in Section 4.7 of this report, with issues related to specific feasible and preferred options set out in the assessment sections of this report (Appendix C and Appendix D). Baseline data limitations are discussed in Section 3.11 .
Reasons are given for eliminating issues from further consideration.	The proposed scope of the assessment is set out in Section 4.2 . Justification for scoping the Air Quality topic out of the assessment is provided in this section.
Alternatives	
Realistic alternatives are considered for key issues, and the reasons for choosing them are documented.	All feasible options were assessed as set out in Section 5 and Appendix C of this report.
Alternatives include 'do minimum' and/or 'business as usual' scenarios wherever relevant.	A 'do minimum' and/or 'business as usual' scenario is not appropriate for the WRMP due to the need to provide sufficient water to customers.

¹⁷⁵ Office of the Deputy Prime Minister (2005) *A Practical Guide to the Strategic Environmental Assessment Directive*.

Quality Assurance Checklist	
The environmental effects (both adverse and beneficial) of each alternative are identified and compared.	This is included in Section 5 and Appendix C of this report.
Inconsistencies between the alternatives and other relevant plans, programmes or policies are identified and explained.	No inconsistencies were identified.
Reasons are given for selection or elimination of alternatives.	This is set out in Section 6.7 of this report.
Baseline Information	
Relevant aspects of the current state of the environment and their likely evolution without the plan or programme are described.	Section 3 of this report characterises the current environmental baseline conditions, along with how these are likely to change in the future.
Environmental characteristics of areas likely to be significantly affected are described, including areas wider than the physical boundary of the plan area where it is likely to be affected by the plan.	The environmental characteristics of the Welsh Water area are described in Section 3 .
Difficulties such as deficiencies in information or methods are explained.	Baseline data limitations are discussed in Section 3.11 . Further difficulties and limitations are set out in Section 4.6 .
Prediction and Evaluation of Likely Significant Environmental Effects	
Effects identified include the types listed in the Directive (biodiversity, population, human health, fauna, flora, soil, water, air, climate factors, material assets, cultural heritage and landscape), as relevant; other likely environmental effects are also covered, as appropriate.	The potential effects of the feasible options are identified in Section 5 and Appendix C . The potential effects of the preferred options are described in Section 6 and Appendix D .
Both positive and negative effects are considered, and the duration of effects (short, medium or long-term) is addressed.	The nature and duration of potential effects has been set out in the detailed appraisal matrices contained in Appendix C and Appendix D of this report.
Likely secondary, cumulative and synergistic effects are identified where practicable.	Information on secondary, cumulative and synergistic effects is set out in Section 6.4 . Where identified, effects are also set out in the detailed appraisal matrices contained in Appendix C and Appendix D of this report.
Inter-relationships between effects are considered where practicable.	These relationships are identified where appropriate in the detailed appraisal matrices contained in Appendix C and Appendix D of this report.
The prediction and evaluation of effects makes use of relevant accepted standards, regulations, and thresholds.	Relevant standards have been used where appropriate in undertaking the assessment.
Methods used to evaluate the effects are described.	Information on the methods used for evaluation of potential effects is included in Section 4 and in the detailed appraisal matrices contained in Appendix C and Appendix D of this report. The definitions of significance used in the assessment are set out in Appendix B .
Mitigation Measures	
Measures envisaged to prevent, reduce and offset any significant adverse effects of implementing the plan or programme are indicated.	Mitigation measures for potential negative effects are set out in Section 6.6 and in the commentary to the matrices in Appendix D .
Issues to be taken into account in project consents are identified.	Issues to be taken into account in project consents are included in the appraisal matrices in Appendix D .
The Environmental Report	
Is clear and concise in its layout and presentation.	We believe the report is clear and concise.

Quality Assurance Checklist	
Uses simple, clear language and avoids or explains technical terms.	The report uses accessible language wherever possible.
Uses maps and other illustrations where appropriate.	Maps and illustrations have been utilised in the report.
Explains the methodology used.	The method used is set out in the report in Section 4 .
Explains who was consulted and what methods of consultation were used.	Appendix E of this report outlines the consultation that has been carried out.
Identifies sources of information, including expert judgement and matters of opinion.	Sources of information are included throughout the report.
Contains a non-technical summary covering the overall approach to the SEA, the objectives of the plan, the main options considered, and any changes to the plan resulting from the SEA.	A Non-Technical Summary has been included as part of the report.
Consultation	
The SEA is consulted on as an integral part of the plan-making process.	The previously issued SEA Scoping Report and Draft WRMP Environmental Report were consulted upon and responses are included in this Final Environmental Report (see Appendix E).
Consultation Bodies and the public likely to be affected by, or having an interest in, the plan or programme are consulted in ways and at times which give them an early and effective opportunity within appropriate time frames to express their opinions on the draft plan and Environmental Report.	Consultation on the Draft WRMP and accompanying Environmental Report was undertaken by Welsh Water.
Decision-making and Information on the Decision	
The Environmental Report and the opinions of those consulted are taken into account in finalising and adopting the plan or programme.	Consultation responses and the findings of the Environmental Report have been taken into account in preparing the Final WRMP.
An explanation is given of how they have been taken into account.	This information is set out in the Post Adoption Statement.
Reasons are given for choosing the plan or programme as adopted, in the light of other reasonable alternatives considered.	The reasons for the selection of preferred options within the Final WRMP are set out in Section 6.7 .
Monitoring Measures	
Measures proposed for monitoring are clear, practicable and linked to the indicators and objectives used in the SEA.	The report sets out the indicators that Welsh Water will use in Section 7.3 .
Monitoring is used, where appropriate, during implementation of the plan or programme to make good deficiencies in baseline information in the SEA.	Monitoring indicators are included in Section 7.3 of the report. Monitoring will take place following implementation WRMP.
Monitoring enables unforeseen adverse effects to be identified at an early stage. (These effects may include predictions which prove to be incorrect.)	The monitoring proposals made in Section 7.3 are for Welsh Water to act on, with monitoring taking place following implementation of the WRMP.
Proposals are made for action in response to significant adverse effects.	Mitigation methods are outlined for the preferred options in Section 6.7 of this report and Appendix D .

