Hafren Dyfrdwy: Drought Plan 2020 - 2025 SEA Screening Statement

Final Report for Hafren Dyfrdwy

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1 Introduction

Strategic Environmental Assessment (SEA) became a statutory requirement following the adoption of Directive 2001/42/EC (the SEA Directive) on the assessment of effects of certain plans and programmes on the environment as transposed into national legislation by the SEA Regulations. This was transposed into legislation on 20 July 2004 as Statutory Instrument 2004 No 1633 – The Environmental Assessment of Plans and Programmes Regulations 2004.

The objective of SEA, according to Article I 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 with a view to promoting sustainable development.'

The SEA Directive requires plans and programmes to undergo environmental assessment, and suggests that, among other factors, human health, population and water should be considered as criteria.

Article 2(b) of the SEA Directive defines 'environmental assessment' as:

- the preparation of an Environmental Report documenting the likely significant environmental effects of the plan, including reasonable alternatives.
- undertaking consultation on the draft plan and accompanying Environmental Report.
- taking into account of the Environmental Report and the results of the consultations in decision-making, and
- providing information when the plan is adopted and showing how the results of the SEA have been taken into account.

Article 2(c) of the SEA Directive defines an 'Environmental Report' as '*the part of the plan or programme documentation containing the information required in Article 5 and Annex I*'.

The UK Government has produced generic SEA guidance that sets out the stages of the SEA process - the "Practical Guide"[1]. UKWIR has produced specific guidance for undertaking SEA and Habitats Regulations Assessment (HRA) of Drought Plans. Natural Resources Wales (NRW) issued its Water Company Drought Plan Technical Guideline[2] in August 2017 for water companies wholly or mainly in Wales. This guidance includes the expectation to carry out SEA on drought plans and that all stages of the SEA process are likely to be required where implementation of drought management measures are likely to result in significant impacts on the environment. The guidelines also identify the requirement to consider all obligations in relation to the Environment (Wales) Act 2016 and the Well-being of Future Generations (Wales) Act 2015 in developing Drought Plans.

As responsible authorities under the SEA Regulations, water companies must themselves determine if its Drought Plan falls within the scope of the SEA Directive. The Office of Deputy Prime Minister (ODPM) Practical Guide, from which **Figure 1** is adapted, provides directions as to how the requirement for SEA should be determined.

It is important that when considering the potential effects of drought management actions to concentrate on effects resulting from the implementation of drought management actions rather than the 'natural' impacts of drought which are considered as the environmental baseline conditions.

Boxes and arrows highlighted in red in **Figure 1** identify the decision-making process which has determined that Hafren Dyfrdwy's Drought Plan 2019 does not require SEA. This is described in more detail below.

[1] Office of the Deputy Prime Minister (2005) A Practical Guide to the Strategic Environmental Assessment Directive.
[2] Natural Resources Wales (2017) Water Company Drought Plan Technical Guideline, August 2017.

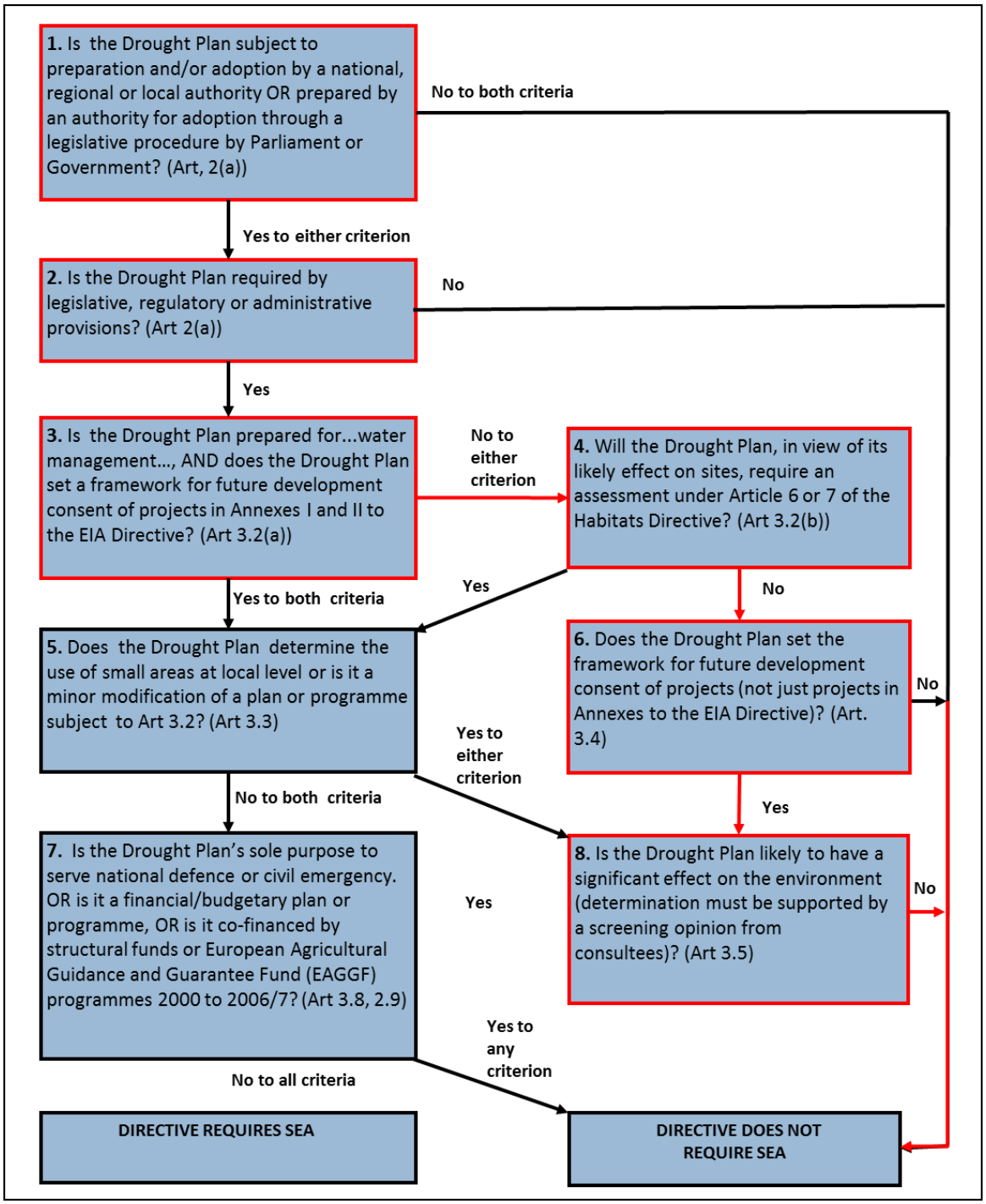
The “Responsible Authority” in relation to the SEA is Hafren Dyfrdwy. With reference to **Figure 1**, the Drought Plan 2019 can be assumed to reach Box 3, i.e. Drought Plans are prepared by an authority for adoption through legislative procedure (Box 1) and are required by statutory provision (Box 2).

If the Drought Plan 2019 neither requires Environmental Impact Assessment (EIA) development (Box 3), nor Appropriate Assessment under the Habitats Directive (Box 4), it reaches Box 6. If the Drought Plan 2019 contains no plans to develop water resources supply schemes, it may be that the Drought Plan can drop out of SEA requirement at this stage (Box 6). If the Drought Plan is considered to set a framework for development of projects, it reaches Box 8, in which case the water company is required to make a determination as to whether the plan will or will not have significant environmental effects, and hence whether it requires SEA. In doing so, the company must take into account the criteria specified in Schedule 1 to the SEA Regulations and consult NRW and Cadw. Following initial consultation with NRW in December 2018, the results of the screening process must be detailed in a Screening Statement, which must be made available for public scrutiny.

In relation to Boxes 4, 6 and 8 in **Figure 1**, the Hafren Dyfrdwy’s Drought Plan 2019 does not contain any plans which will affect a Natura (European) site, nor does it include any projects likely to have a significant effect on the environment. This has been evidenced through high level HRA screening and SEA screening. The proposed demand management actions in the Drought Plan are not likely to have a significant effect on any European designated sites or result in any significant effect on the environment as they relate to measures which will not require construction and in operation will help to reduce demand (or prevent increases to demand). Any works required in relation to these demand-side actions (e.g. leak repairs) are largely implemented within urban areas and of a scale that would not lead to likely significant effects on any European designated site or any significant effect on the environment.

The one supply-side measure included in the Drought Plan would not require construction of any new permanent infrastructure. Abstraction would be within the existing Lower Pen-y-Cae Reservoir abstraction licence limit but with the abstracted water being released to augment flows in the River Dee via the Trefechan Brook and Afon Eitha. From the HRA screening appraisal it is concluded that no Likely Significant Effects (LSE) are expected on the River Dee and Bala Lake SAC, the Berwyn and South Clwyd Mountains SAC/SPA or the Dee Estuary SAC/SPA/Ramsar as a result of the implementation of the augmentation of the River Dee with water abstracted from the Lower Pen-y-Cae Reservoir. Similarly, no significant effects to the environment are anticipated. The potential for effects to Lower Pen-y-Cae Reservoir, the Trefechan Brook and the Afon Eitha to the confluence with the Dee are considered short-term, temporary and reversible. However, it is noted that further monitoring is planned to be undertaken by Hafren Dyfrdwy to better understand the likely effects.

Figure 1 SEA Directive: Application to the Hafren Dyfrdwy's Drought Plan 2019



Given the above and taking account of the associated high level HRA screening report (and this SEA screening report) there is no requirement to undertake SEA under the Environmental Assessment of Plans and Programmes Regulations 2004, and European Directive 2001/42/EC.

1.1 Requirement for Screening

Hafren Dyfrdwy considers that its Drought Plan 2019 requires SEA screening and has arrived at this conclusion through the following reasoning (with reference to **Figure 1**):

- The Drought Plan is prepared by an authority for adoption through legislative procedure (***Box 1***) and is required by statutory provision (***Box 2***).
- The Drought Plan is prepared for water management but does not require EIA development (***Box 3***), therefore it moves to ***Box 4***.
- The Drought Plan will not require Appropriate Assessment under the Habitats Directive (***Box*** 4), therefore it moves to **Box 6**.
- The Drought Plan includes a supply-side measure therefore it is taken that it does set the framework for future development consent of projects, therefore it moves to **Box 8**.
- Therefore the process according to the SEA Regulations pertaining to **Box 8** has been followed.

As agreed with NRW during consultation meeting in December 2018, an updated assessment of the baseline environment of the Hafren Dyfrdwy's water supply area has been prepared as presented in this Report.

The process according to the SEA Regulations pertaining to ***Box 8*** requires Hafren Dyfrdwy to undertake screening of the Drought Plan to determine whether or not it has significant environmental effects. This screening process and results are reported in Section 5 following a review of relevant plans and policies (Section 3) and the environmental baseline of the area potentially affected by the Drought Plan (Section 4). The screening determination is set out in Section 7.

2 Hafren Dyfrdwy - Drought Planning

2.1 Hafren Dyfrdwy's Drought Plan

Responsible Authority: Hafren Dyfrdwy

Title of Plan: Drought Plan 2019

Purpose of Plan: Water companies in England and Wales are required to prepare and maintain Statutory Drought Plans under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003, which set out the management and operational steps a water company will take before, during and after a drought. The Water Industry Act 1991 defines a drought plan as 'a plan for how the water undertaker will continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water, with as little recourse as reasonably possible to drought orders or drought permits'.

The Drought Plan represents the fulfilment of Hafren Dyfrdwy's statutory responsibility to prepare, consult, publish and maintain a Drought Plan. Part of the Drought Plan includes consulting with Hafren Dyfrdwy's customers and other main stakeholders on how they propose to manage the service provided during a drought situation. Natural Resources Wales have published the 'Water Company Drought Plan Technical Guideline'[3] (DPTG) to provide a framework for the development and presentation of water company drought plans. It is produced in accordance with all relevant Drought Plan guidelines.

Frequency of updates: The Drought Direction (Wales) 2017 states that revised Drought Plans should be submitted according to the following schedule:

- if section 39B(6)(a) of the Act applies, within 6 months after the date on which the material change of circumstances occurs; and
- if section 39B(6)(c) of the Act(c) applies, no later than 4 years after the date on which its drought plan, or its last revised drought plan, is published.

Area covered: Hafren Dyfrdwy's supply area, covering parts of Mid and North East Wales, including Wrexham, as shown in **Figure 2**.

Summary of the Plan:

The Drought Plan sets out the short-term operational steps a company will take before, during and after a drought. It focuses on the actions that would be taken if a drought was to occur under present circumstances. It shows how Hafren Dyfrdwy would operate in a range of drought scenarios and presents sufficient information to customers and partners to show the decision-making processes that will be made in a drought event. Broadly speaking the Drought Plan encompasses a number of drought management actions that will only be implemented if and when required. It is noted that each drought is different in terms of its severity, season, location and duration; each combination of these factors may require a different combination of actions to be implemented.

The Drought Plan is comprised of five key elements:

- **Drought triggers** - a specific event which prompts a drought management action, Hafren Dyfrdwy drought triggers relate to how much water is available in the Dee Storage System and groundwater sources in the Llandinam and Llanwrin Water Resources Zone (WRZ).
- **Drought scenarios** - a means by which the effectiveness of drought triggers are tested. The scenario is also used to demonstrate how drought management actions would be implemented given a combination of increased demands and drought conditions.

[3] Natural Resource Wales (2017) Water Company Drought Plan Technical Guideline. Available from https://naturalresources.wales/media/682496/wc-dpg-2017-consultation.pdf.

- **Drought management actions** - a reaction to a drought trigger and is an action which is taken to reduce demand (demand side) or to increase supply (supply side). The action must be consistent with Hafren Dyfrdwy's level of service, one in forty-year Temporary Use Ban (TUB), which is set out in the Hafren Dyfrdwy's Water Resources Management Plan (WRMP).
- **Environmental impacts** - an assessment has to be made as to the likely environmental impacts, in particular on European sites. For this reason, a Habitats Regulation Assessment (HRA) is carried out, this and the identification of potential for other significant environmental effects determine if a SEA is required.
- **Drought communications and management** - part of the Drought Plan is the communications plan, this details how Hafren Dyfrdwy will communicate our drought actions effectively to implement demand side actions and minimise the impact on the environment. The Communication Plan should align with the drought triggers and detail the stakeholders who will be targeted and how.

Following a drought, monitoring will continue to assess the impact of the drought, which can then be fed back into the Drought Plan.

Objectives of the Plan: The primary objective of the Drought Plan is to ensure that Hafren Dyfrdwy will "continue during a period of drought, to discharge its duties to supply adequate quantities of wholesome water, with as little recourse as reasonably possible to drought orders or drought permits"[4].

2.2 Hafren Dyfrdwy's Drought Plan Actions

There are several actions Hafren Dyfrdwy can take to manage the effects of a drought. These are broadly split these into two groups: demand-side and supply-side. The demand-side actions are ones that reduce the demand from customers for water during a drought. Supply side actions are those that increase the availability of water within the system. As described above, Hafren Dyfrdwy only have one supply side option, the augmentation of the River Dee with water from Lower Pen-y-Cae Reservoir via the Trefechan Brook and Afon Eitha. As the status of the Dee Storage System moves from developing drought to drought Hafren Dyfrdwy would start augmenting the river with 0.4Ml/d of water, this is trigger 3. On trigger 4, as the status of the system moves from drought to severe drought we would increase the augmentation from 0.4Ml/d to 0.8Ml/d.

There are five demand side drought actions included in the Drought Plan, these are described below:

- **Water Efficiency Measures -** During normal operational conditions Hafren Dyfrdwy's ask their customers to try and reduce the amount of water they use through various efficiency measures, these include: fitting a cistern displacement device, reducing the time spent in the shower, and turning off the tap whilst cleaning their teeth etc. Hafren Dyfrdwy's also carry out water efficiency property surveys and education within schools. Hafren Dyfrdwy would intensify their water efficiency promotion as the Dee Storage System moves from a developing drought to a drought, this is trigger 3.
- **Increased leakage management -** An additional action that Hafren Dyfrdwy can take to reduce the demand for water during a drought, is to increase leakage management activities. This would involve increasing the number of resources that are allocated to finding and fixing leaks. Hafren Dyfrdwy would increase the number of resources allocated to finding and fixing leaks as the Dee Storage System moves from a developing drought to a drought (trigger 3).
- **Voluntary use restriction -** As a drought becomes more severe Hafren Dyfrdwy would ask their customers to make voluntary use restrictions, these primarily include not using a hosepipe or sprinkler. A voluntary use restriction is not compulsory. Hafren Dyfrdwy would implement voluntary use restrictions as the Dee Storage System moves from a drought to a severe drought, this is trigger 4.

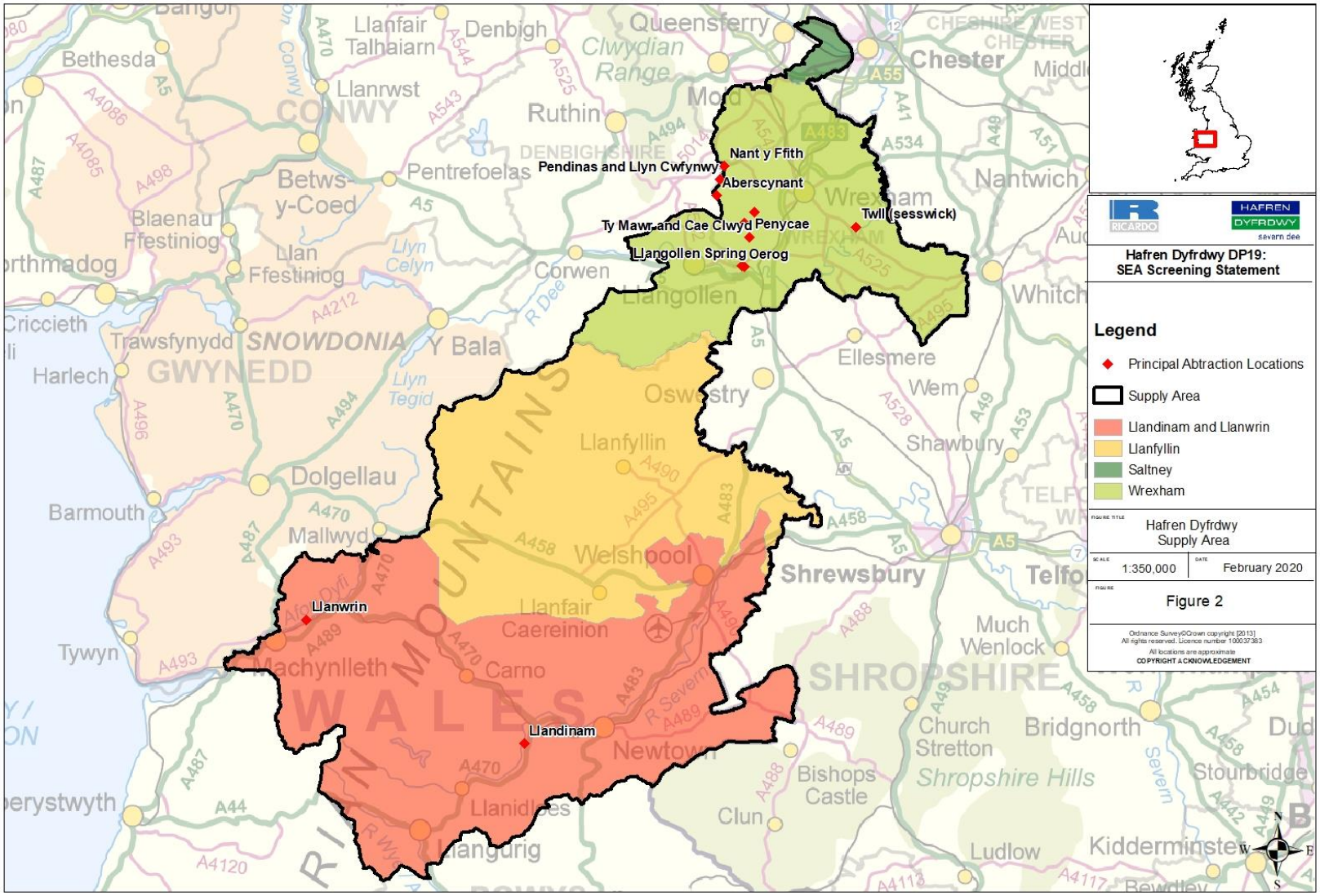
[4] Water Industry Act 1991

- **Temporary water use restrictions** - As the drought becomes more severe (trigger 5), Hafren Dyfrdwy may have to introduce Temporary Use Bans (TUBs) and ultimately apply for Drought Orders in extreme situations. Since the introduction of Section 36 of the Flood and Water Management Act 2010, water companies have wider and more far reaching powers to restrict water use. When required, activities such as those listed below may be prohibited through a TUB:
    - Watering a garden using a hosepipe.
    - Cleaning a private motor-vehicle using a hosepipe.
    - Watering plants on domestic or other non-commercial premises using a hosepipe.
    - Cleaning a private leisure boat using a hosepipe.
    - Filling or maintaining a domestic swimming or paddling pool.
    - Drawing water, using a hosepipe, for domestic recreational use.
    - Filling or maintaining a domestic pond using a hosepipe.
    - Filling or maintaining an ornamental fountain.
    - Cleaning walls, or windows, of domestic premises using a hosepipe.
    - Cleaning paths or patios using a hosepipe.
    - Cleaning other artificial outdoor surfaces using a hosepipe.

  As set out in the legislation and the UKWIR Code of Practice, there are exceptions to the TUB for certain customers and customers may also apply for an exception even if they do not consider themselves to be included within any of the exception categories.
- **Restrictions on non-essential use through a drought order -** Within the drought plan Hafren Dyfrdwy only consider the option of applying for a Drought Order to prohibit or limit the use of water. The main aim of this type of Drought Order is to extend existing restrictions that have been imposed on domestic customers, through the implementation of TUBs, to non-domestic customers. The Drought Direction 2011 sets out those purposes that companies can prohibit or limit under the WRA 1991. These are as follows:
    - Watering outdoor plants on commercial premises.
    - Filling or maintaining a non-domestic swimming or paddling pool.
    - Filling or maintaining a pond.
    - Operating a mechanical vehicle-washer.
    - Cleaning any vehicle, boat, aircraft or railway rolling stock.
    - Cleaning non-domestic premises.
    - Cleaning a window of a non-domestic building.
    - Cleaning industrial plant.
    - Suppressing dust.
    - Operating a cistern in any building that is unoccupied and closed.

It is noted that none of the measures included within a Drought Permit are part of the Hafren Dyfrdwy Drought Plan and as such no allowance has been made for their application.

Figure 2 Hafren Dyfrdwy's Supply Area



3 Policy Context

3.1 Introduction

Annex 1 of the SEA Directive (Directive 2001/42/EC) requires the following specific information to be included within the Environmental Report:

- *'an outline of the…relationship with other plans and programmes'*
- *'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.'*

In accordance with the Directive, a review of relevant plans, policies and programmes is presented in the following section.

3.1 Review of Plans, Policies and Programmes

Relevant plans, policies and programmes that will influence or be influenced by the Drought Plan or were identified from the wide range that has been produced at an international, national, regional and local level and are presented in **Table 3.1**. The review of these plans, policies and programmes has informed the environmental baseline review and the assessment of any likely environmental effects of the Drought Plan.

3.2 Drought Plan Planning Guidance for Wales

The Welsh Government Guiding Principles for Developing Water Undertaker Drought Plans for 2020[5] are guiding principles apply to water undertakers whose area is wholly or mainly in Wales. It provides an overview of the Welsh Government policy, the legal requirements that must be met and the role and responsibilities of Government, regulators, undertakers and their customers. See further details in the box below.

NRW published the Water Company Drought Plan Technical Guideline[6] (DPTG) for water companies wholly or mainly in Wales to follow when preparing a drought plan. It was been produced to help show how water companies intend to manage a drought and help you write a plan that complies with all the relevant statutory requirements and Welsh Government policy. The DPTG specifies that water companies wholly or mainly in Wales are expected to consider how drought management actions:

- affect the sustainable management of natural resources under the Environment Act (Wales) 2016 particularly in relation to their biodiversity and resilience of ecosystems duty and the Section 7 Biodiversity lists and duty; and
- how these contribute towards the well-being goals under the Well-being of Future Generations (Wales) Act 2015 (see boxes below).

The following boxes provide further information on Wales-specific legislation, guidance, and policy relevant to assessing the environmental and social effects of the Drought Plan.

[5] The Welsh Government (2017) *Guiding Principles for Developing Water Undertaker Drought Plans for 2020*. Available from https://gov.wales/docs/desh/publications/171030-drought-plan-guiding-principles-en.pdf
[6] Natural Resource Wales (2017) Water Company Drought Plan Technical Guideline. Available from https://naturalresources.wales/media/682496/wc-dpg-2017-consultation.pdf.

The Welsh Government Guiding Principles for Developing Water Undertaker Drought Plans for 2020

The key guiding principles relevant to environmental and social assessment are:

- demonstrate how the plan has taken into account the Welsh Governments priorities, principles and policy commitments set out in the Well-being of Future Generations (Wales) Act (2015), Environment Act (Wales) Act 2016 and the Water Strategy for Wales.
- follow the guiding principles in conjunction with the NRW Drought Plan Technical Guideline and make sure that their plans cover the requirements specified by the Water Industry Act 1991.
- set out how water supplies will be maintained in the event of a drought - undertakers are expected to plan against more challenging but plausible droughts beyond the capabilities of their current supply system.
- include environmental assessments and environmental monitoring plans for all supply-side drought measures.
- The information for drought permits and orders included in a drought plan is to be 'as close' to application ready as possible, especially for those sites that have been identified as causing significant impact to the environment or are most likely to be required in a drought.
- Be aware of the Water Strategy for Wales which highlights the importance of ensuring a strong customer focus at the heart of the delivery of water and sewerage services in Wales (this requires both a sound understanding of existing and future customer needs, and a strong voice for consumer representation).
- Produce drought plans that demonstrate that all the statutory requirements have been met, but the level of detail within the plan may be relative to the customer base and on how they obtain their water supplies.

Well-being of Future Generations (Wales) Act 2015

This Act places sustainable development principles on a statutory footing and places a well-being duty on public bodies.

Public bodies will set and publish well-being objectives.

There are seven key goals of the Act:

- 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.

To assess the effects of drought plan options, and the plan as a whole, it will be important to demonstrate how the Drought Plan contributes towards improving the social, economic, environmental and cultural well-being of Wales as reflected in these seven well-being goals.

DPs should be developed within the context of ensuring their ability to maintain access to fair and affordable water and sewerage services, both for people and businesses.

Welsh Government National Natural Resources Policy Statement 2016

The policy statement supports the Environment (Wales) Act and set out Ministers' priorities in relation to the management of natural resources. This policy will need to be considered when assessing the Drought Plan.

The National Natural Resources Policy (NNRP) sets out the national priorities in relation to the sustainable management of natural resources as a whole – air, water, land, and sea. The NNRP set outs:

- a definition of the sustainable management of natural resources and the statutory delivery framework.
- predictions of likely future trends in the social, economic, environmental, and cultural well-being of Wales.
- emerging priorities and opportunities for the sustainable management of natural resources.
- measures to build resilience and deliver multiple benefits, including nature-based solutions to provide positive, cost effective responses to key societal challenges and maximise benefits to well-being goals.
- how the priorities and opportunities may be implemented across different stakeholders, and
- the detailed inter-relationships between the Well-being of Future Generations (Wales) Act, the Planning (Wales) Act and the Environment (Wales) Act.

Environment Act (Wales) Act 2016

The Act seeks to promote a low carbon, green economy, ready to adapt to the impacts of climate change, and increased pressures and demands from society. It promotes the sustainable management of natural resources in Wales, including preventing significant damage to ecosystems. It aims to support and complement work to help secure Wales' long-term well-being, so that current and future generations benefit from a prosperous economy, a healthy and resilient environment and vibrant, cohesive communities. It promotes the planning and management of natural resources in Wales in a joined up and sustainable way.
The two aims of the Act that are most relevant to the Drought Plan are:

- Sustainable management of natural resources – enabling Wales' resources to be managed in a more proactive, sustainable and joined-up way, and
- Climate change – providing Welsh Ministers with powers to put in place statutory emission reduction targets, including at least an 80% reduction in emissions by 2050

and carbon budgeting to support their delivery. This sets a clear pathway for decarbonisation. It also provides certainty and clarity for business and investment.

Specific requirements relevant to the Drought Plan:

- Water and sewerage undertakers are required to seek to maintain and enhance biodiversity and in so doing promote the resilience of ecosystems.
- Water companies should adopt the ecosystem approach to managing water, including considering the multiple economic, social, cultural, and environmental services provided from the natural resources and ecosystems in Wales.

Water Strategy for Wales (2015)

The Water Strategy for Wales sets out the strategic direction for water policy over the next 20 years and beyond. It promotes the development of an integrated and sustainable approach to managing the nation's natural water resources which are an integral part of Wales' culture, heritage and national identity.

The strategy highlights the Welsh Government's vision to ensure that Wales continues to have a thriving water environment which is sustainably managed to support healthy communities, flourishing businesses and the environment. The strategic priorities are underpinned by the goals set out in the Well-being of Future Generations (Wales) Act 2015 and focuses on ensuring that the people of Wales receive first class water services that provide value for money, with water used efficiently, safely and respectfully by all.

Delivery of this strategy requires the integrated management of natural resources to maximise economic and social benefits in an equitable way while protecting all ecosystems and the environment.

Table 3.1 Review of Plans and Programmes

International
The Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979)
The Bonn Convention on the Conservation of Migratory Species of Wild Animals (1983)
The Cancun Agreement (2011) & Kyoto Agreement (1997)
COP21 Climate Change Summit, Paris (2015)
The Convention for the protection of the architectural heritage of Europe (Granada Convention)
The European Convention on the protection of archaeological heritage (Valletta Convention)
Council of Europe (2006) European Landscape Convention
Council of Europe (2003) European Soils Charter
Directive 2006/118EC of the European Parliament and of the council of 12 December 2006 on the protection of groundwater against pollution and deterioration
European Commission Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC
The Environment Noise Directive (Directive 2002/49/EC)
European Commission (2008) The 2008 Ambient Air Quality Directive (2008/50/EC)
European Commission (2009) Birds Directive (2009/147/EC)
European Commission, Floods Directive (2007/60/EC)
European Commission (2006) Freshwater Fish Directive (2006/44/EC)
European Commission, Animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals (2006/88/EC)
European Commission (2011) The EU Biodiversity Strategy to 2020
European Commission, Environmental Liability Directive (2004/35/EC)
European Commission (2000) The Water Framework Directive (2000/60/EC)
European Commission, Drinking Water Directive (1998/83/EC) amended 2015
European Commission (1992) Habitats Directive (1992/43/EC)

European Commission (2013) The 7th Environmental Action Programme (EAP) to 2020 Living well, within the limits of our planet' (1386/2013/EU)
European Commission (2012) Blueprint to Safeguard Europe's Water Resources
European Commission (2009) Promotion of the use of energy from renewable sources Directive (2009/28/EC)
European Commission (2006) Thematic Strategy for Soil Protection
European Commission (2005) Thematic Strategy on Air Pollution
EC Regulation 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel
EU Regulation 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species.
European Commission Nitrates Directive (91/676/EEC)
Ramsar Convention The Convention on Wetlands of International Importance (1971)
Revised Bathing Water Quality Directive (76/160/EEC)
European Commission Urban Waste Water Treatment Directive (1991/271/EEC)
United Nations (2000) Millennium Declaration
United Nations (2002) Commitments arising from the World Summit on Sustainable Development, Johannesburg
United Nations Economic Commission for Europe (1998) Aarhus Convention - Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters
United Nations (1992) Convention on Biological Diversity (CBD)
National
Ancient Monuments and Archaeological Areas Act 1979 (updated by Historic Environment (Wales) Act 2016 – see below)
Cadw, CCW and ICOMOS (UK) (International Council on Monuments and Sites) (2001), Register of Landscapes of Historic Importance
Cadw (2013) Historic Environment Strategy for Wales
The Climate Change Act (2008)
The Conservation of Habitats and Species Regulations (as amended by the Conservation of Habitats and Species (Amendment) Regulations 2011 and 2012)
The Countryside and Rights of Way (CRoW) Act, 2000
Countryside Council for Wales (CCW) (2003) Priority Habitats of Wales
Countryside Council for Wales, English Nature, Environment Agency, Royal Society for the Protection of Birds (2004) Strategic Environmental Assessment and Biodiversity: Guidance for Practitioners
Planning (Wales) Act 2015
Department for Culture, Media and Sport (2001) The Historic Environment – A Force for the Future
Department for Energy and Climate Change (2007) Energy White Paper: Meeting the Energy Challenge
Department for Energy and Climate Change (2009) UK Renewable Energy Strategy
Department of energy and climate change, Planning our electric future: a White Paper for secure, affordable and low carbon electricity (2011)
The Energy Act 2013
English Heritage (2010), Heritage at Risk
English Heritage (2008), Climate Change and the Historic Environment
Environment Act, 1995
Environment Agency Wales, Salmon Action Plans
Environment Agency Wales (2009), Water Resources Action Plan
Environment Agency Wales (2009) Water for people and the environment: Water Resources Strategy for Wales.
Environment (Wales) Act 2016
The Environmental Damage (Prevention and Remediation) (England) Regulations 2015
Environment Agency Restoring Sustainable Abstraction Programme
Environmental Protection Act 1990
Environment Agency (Various) Drought Plans
Flood and Water Management Act, 2010
Historic Environment (Wales) Act 2016
HM Treasury (2015) Fixing the Foundations: Creating a More Prosperous Nation
HM Treasury Infrastructure UK (2014) National Infrastructure Plan
HM Government (2011) Water for Life: White Paper
HM Government (2013) Water Bill
Planning (Listed Buildings and Conservation Areas) Act 1990 (updated by Historic Environment)
Salmon and Freshwater Fisheries Act, 1975
The Water Resources Management Plan Regulations 2007
Water Industry Act 1991 was amended by the commencement of Section 36 of the Flood and Water Management Act 2010
The Water Act, 2003

The Water Environment (WFD) (England and Wales) Regulations, 2003
Water Resources Act, 1991 (Amendment) (England and Wales) Regulations 2009 SI3104
Wildlife and Countryside Act, 1981
UKTAG on the WFD e.g. Phase 3 Review of Environmental Standards
UK Climate Projections UKCP09. UKCIP, 2009
UK Climate Projections UKCP18. UKCIP, 2018
Countryside Council for Wales (CCW) (2003) Priority Habitats of Wales
Natural Resources Wales, Drought Plan
Natural Resource Wales (2017) Water Company Drought Plan Technical Guideline
Well-being and Future Generations (Wales) Act 2015
Welsh Government, (2015) A Water Strategy for Wales
Welsh Assembly Government (2014) National Strategy for Flood and Coastal Erosion Risk Management
Welsh Government (2016) National Natural Resources Policy Statement 2016
The Welsh Government (2017) Guiding Principles for Developing Water Undertaker Drought Plans for 2020
Welsh Assembly Government (consultation document 2012), Sustaining a Living Wales: a green paper on a new approach to
Welsh Assembly Government (2012), State of the Environment Report – Wales
Welsh Assembly Government GLASTIR - Agri-environment scheme funded under the Rural Development Plan
Welsh Assembly Government (2008) Wales Spatial Plan
Welsh Assembly Government (2009) One Wales: One Planet – a new sustainable development scheme for Wales
Welsh Assembly Government (2010) Climate Change Strategy for Wales
Welsh Assembly Government (2011) Strategic Policy Position Statement on Water
Welsh Assembly Government (2009) Technical Advice Note 5. Nature Conservation and Planning
Welsh Assembly Government (2010), Technical Advice Note 6: Planning for Sustainable Rural Communities
Welsh Assembly Government (1997), Technical Advice Note 13: Tourism
Welsh Assembly Government (2004), Technical Advice Note 15: Development and Flood Risk
Welsh Assembly Government (2009), Technical Advice Note 16: Sport, Recreation and Open Space
Welsh Assembly Government (2006) Environment Strategy for Wales
Welsh Assembly Government (2013) Wales Marine and Fisheries Strategic Action Plan
Welsh Assembly Government (2010), Low Carbon Revolution – The Welsh Assembly Government Energy Policy Statement
Welsh Government (2012) Welsh Government Policy Statement: Preparing for a Changing Climate
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Regional
Severn Trent Water (2018) Draft Drought Plan 2019
Severn Trent Water (2019) Draft Water Resources Management Plan 2019
United Utilities (2018) Draft Water Resources Management Plan 2019
United Utilities (2018) Draft Drought Plan 2018.
Dyr Cymru Welsh Water (2018) Revised Draft Water Resources Management Plan 2019
Dyr Cymru Welsh Water (2015) Final Drought Plan 2015
Natural Resources Wales (2015) Dee River Basin Management Plan 2015 – 2021
Environment Agency (2010) River Dee Catchment Flood Management Plan
Environment Agency Wales (1997) Dee Catchment Salmon Action Plan
Natural Resources Wales (2015) Know Your River – Dee Salmon & Sea Trout Catchment Summary
Environment Agency and Natural Resources Wales (2016) Severn River Basin District: Flood Risk Management Plan 2015-
Local
Public Rights of Way Improvement Plans (ROWIP)
Biodiversity Action Plans.
Clwydian Range AONB (2014) AONB Management Plan Strategy 2014 – 2019
Wrexham Borough Council (2016) Wrexham Local Development Plan 2 (LDP2) 2013 to 2028- Preferred Strategy 2016
Wrexham Borough Council (2014) Wrexham Parks Strategy
Wrexham Borough Council (2002) Wrexham Countryside Strategy
Local Planning Authorities (various) Water Cycle Studies that have been undertaken for housing growth points

4 Environmental Baseline Review

4.1 Biodiversity

4.1.1 Baseline

Biodiversity comprises the variety of plants (flora) and animals (fauna) in an area, and their associated habitats. The importance of preserving biodiversity is recognised from an international to a local level. Biodiversity has importance in its own right and has value in terms of quality of life and amenity.

Hafren Dyfrdwy abstracts water from the River Dee from the Bangor-on-Dee intake site. The River Dee is designated as a Special Area of Conservation (SAC)[7] (as part of The River Dee and Lake Bala SAC) and is designated primarily for the protection of:

- Atlantic salmon (*Salmo salar*).
- Floating water plantain (*Luronium natans*).
- Watercourses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

River (*Lampetra fluviatilis*), brook (*Lampetra planeri*) and sea lamprey (*Petromyzon marinus*), otter (*Lutra lutra*) and bullhead (*Cottus gobio*) are also qualifying features of the site.

In addition to the River Dee and Bala Lake SAC, there are ten further SACs and three SPAs within the supply area, including:

- Fenn's, Whixall, Bettisfield Wem and Cadney mosses SAC, of which an important aspect is the large lowland raised Bogs and over 1,700 invertebrate species have been recorded here, including 29 nationally rare Red Data Book species[8].
- The Tanat and Vyrnwy Bat Sites SAC, which contains Annex II species including the Lesser Horseshoe bat[9].
- The Granllyn SAC, which contains Annex II species including Great Crested Newt and this site is home to the largest known population of this species in central Wales[10].
- The Coedydd Llawr-y-glyn SAC, which contains Annex I habitats, including Old Sessile oak woodlands[11].
- The Berwyn and South Clwyd Mountains SAC & SPA which lies adjacent to the boundary of the Supply Area. The important aspect of this SAC are blanket bogs, heaths and fenlands. Llyn Cyfynwy reservoir, operated by Hafren Dyfrdwy, is located on the northern edge of this SAC.
- The Johnstown Newt Sites SAC at Rhosllannerchrugog, which contain Annex II species including Great Crested Newts. It's habitat varies from marshy grassland, grazed farmland and swamp through to scrub and broad-leaved woodland[12].

[7] Special Areas of Conservation (SACs) are strictly protected sites designated under the EC Habitats Directive. Article 3 of the Habitats Directive requires the establishment of a European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). www.jncc.org.uk
[8] The JNCC. Special Areas of Conservation (SACs): Fenn's, Whixall, Bettisfield, Wem and Cadney Moss. Available at: http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0012912. Accessed 30 January 2019.
[9] The JNCC. Special Areas of Conservation (SACs): Tanat and Vyrnwy Bat Sites. Available at: http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0014783. Accessed 30 January 2019.
[10] The JNCC. Special Areas of Conservation (SACs): Granllyn SAC. Available at: http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030158. Accessed 30 January 2019.
[11] The JNCC. Special Areas of Conservation (SACs): Coedydd Llawr-y-glyn SAC. Available at: http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030119. Accessed 30 January 2019.
[12] The JNCC. Special Areas of Conservation (SACs): Johnstown Newt Sites. Available at: http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030173. Accessed 25 March 2019.

- The Elenydd SAC and SPA which lies adjacent to the southern-most boundary of the Supply Area is the largest blanket mire within the central Wales uplands. This SAC contains Annex I habitats, including; Calaminarian grasslands, Blanket bogs, oligotrophic to mesothrophic standing waters with vegetation of the Littorelletea uniflorae and European Dry Heaths. Annex II species include Floating water plantain[13].
- The Dyfi Estuary SPA, which is located on the west coast of Wales on the boundary between Ceredigion, Gwynedd and Powys. The SPA comprises the estuary, with adjoining saltmarsh, marshy grassland and improved grassland. The site is of importance primarily as a wintering area for Greenland White-fronted Goose[14].
- The Montgomery Canal SAC, which contains Annex II species including Floating water plantain. This site is the largest and the most extensive population of floating water-plantain in Britain[15].
- The River Wye SAC, which contains two Annex I species and numerous Annex II species. The primary reason for selection as an Annex I and Annex II site is due an exceptional range of aquatic flora in the largely unmodified catchment[16].
- Lleyn Peninsula and the Sarnau SAC, which contains a range of Annex I habitats, including sandbanks, estuaries, coastal lagoons, large shallow inlet bays and reefs. Additionally there are three Annex II species present, including the Bottlenose dolphin, otter and Grey seal[17].

Midland Meres and Mosses Phase 2 Ramsar[18] site consists of numerous wetland sites considered to be "*internationally important wetlands*" for protected bird species within the supply area. These are also cited as supporting a number of rare nationally important plants and invertebrates.

There are 113 Sites of Special Scientific Interest (SSSI)[19] within the Supply Area including the River Dee (England) SSSI and the Afon Dyfrdwy (River Dee - Wales) SSSI (hereafter referred to as the River Dee SSSI) and 1918 Ancient Woodland sites. The citation for the River Dee SSSI considers abstraction to be an activity which threatens the integrity of the SSSI through alterations in water levels. **Figure 3** shows the European and national designated sites which are within the Supply Area while **Figure 4** shows the National Nature Reserves (NNR) and Local Nature Reserves (LNR) within the Supply area, as well as the distribution of ancient woodlands.

The River Dee and surrounding areas support a number of priority habitats (e.g. lowland bog, wet woodland, reedbed and unimproved grassland) and species (e.g. great crested newt, allis and twaite shad, water vole, otter, white clawed crayfish and lesser horseshoe bats) that have been identified as being of conservation importance under Natural Environmental and Rural Communities (NERC) Act Section 41 (Section 42 in Wales).

4.1.2 Future Baseline

It is not expected that many additional sites will be designated under international or national legislation, with the focus therefore on achieving the conservation objectives set for each of these sites. A range of measures are included in the management plans for each site to contribute to these objectives and, assuming sufficient resources are in place, it is likely that the condition of these sites will improve over the next two or three decades to reach the objectives. These timescales recognise the time required for

[13] The JNCC. Special Areas of Conservation (SACs): Johnstown Newt Sites. Available at: http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0012928. Accessed 25 March 2019.
[14] The JNCC Special Protection Areas (SPAs): Dyfi Estuary. Available at: http://jncc.defra.gov.uk/default.aspx?page=2082
[15] The JNCC. Special Areas of Conservation (SACs): Montgomery Canal. Available: http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030213. Accessed 26 March 2019.
[16] The JNCC. Special Areas of Conservation (SACs): River Wye. Available at: http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0012642. Accessed 26 March 2019.
[17] The JNCC. Special Areas of Conservation (SACs): Lleyn Peninsula and the Sarnau. Available at: http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0013117. Accessed 26 March 2019.
[18] Ramsar sites are wetlands of international importance designated under the Ramsar Convention
[19] Natural England now has responsibility for identifying and protecting the SSSIs in England under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000).

environmental changes to arise following positive interventions. A similar trend is likely for achievement of objectives associated with the NERC Act habitats.

The number of locally designated sites may increase slightly in response to growing community activities and the development of local environmental initiatives. An improving trend in condition of these sites is also anticipated with greater resources (particularly voluntary resources) devoted to their protection and enhancement. It is acknowledged that there is a need to allow wildlife to adapt to the impacts of climate change.

More broadly, the recent Welsh Government policy encourages partnership working by a wide range of organisations (including water companies where applicable) to take a catchment and/or landscape-scale perspective to the management of biodiversity, flora and fauna. Catchment-based approaches are likely to be increasingly taken with respect to the delivery of biodiversity and ecological objectives for water-dependent sites and species, with partnership working a key component of the delivery of improvement activities.

The Environment Act (2016) for Wales[20] also promotes the sustainable management of natural resources – including preventing significant damage to ecosystems which need to be healthy to withstand increased pressures and demands.

The Well-being for Future Generations Act (2015) for Wales[21] places significant emphasis on the importance of enhancing people's personal connection with wildlife and nature and better understanding of the value of nature's services.

4.1.3 Key Issues

The key sustainability issues arising from the baseline assessment for biodiversity are:

- The need to protect or enhance the region's biodiversity, particularly protected sites designated for nature conservation.
- The need to avoid activities likely to cause irreversible damage to natural heritage.
- The need to take opportunities to improve connectivity between fragmented habitats to create functioning habitat corridors.

[20] Environment (Wales) Act 2016
[21] Well-being for Future Generations (Wales) Act 2015

Figure 3 European and National Designated Sites in the Assessment Area

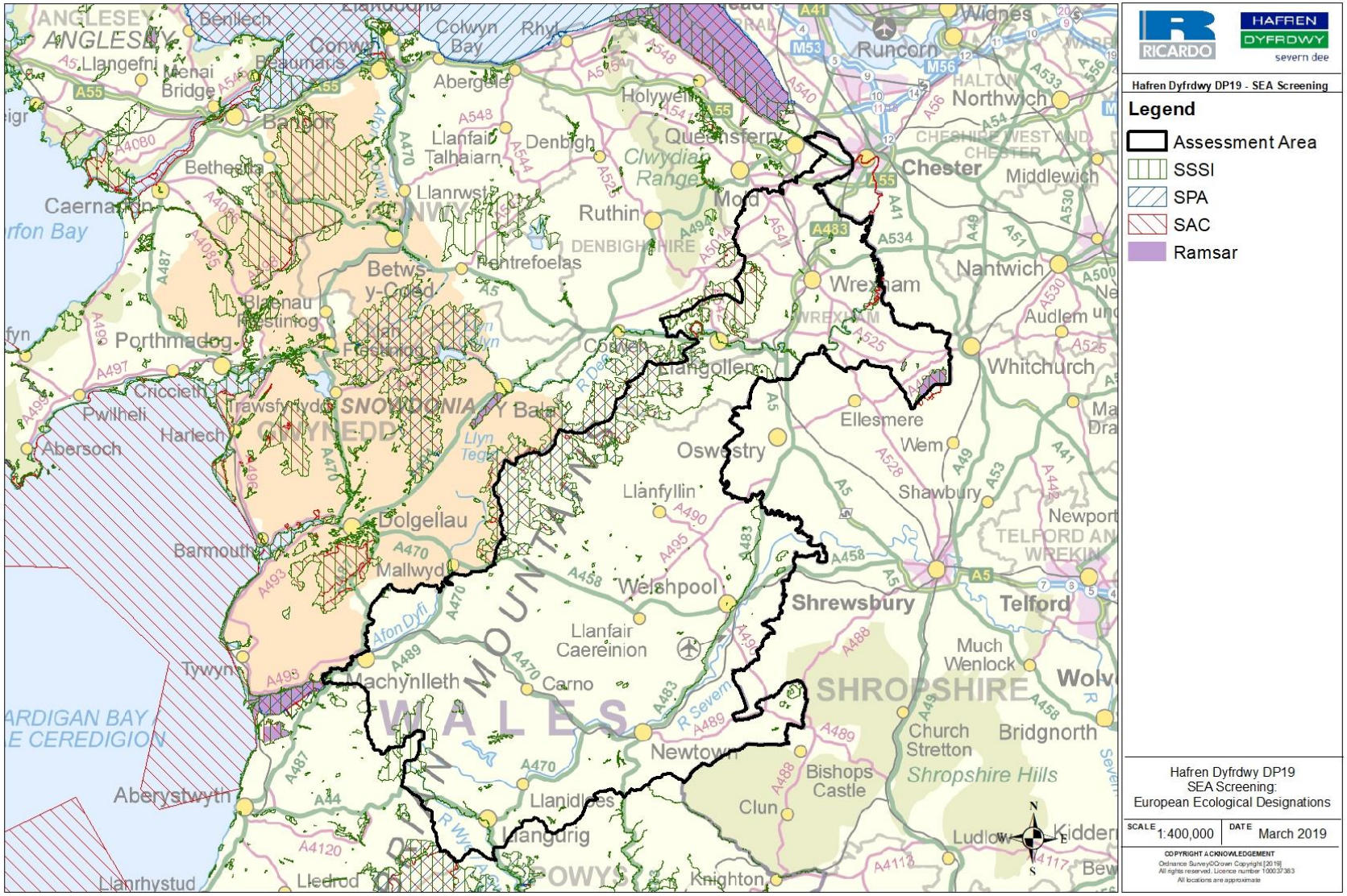
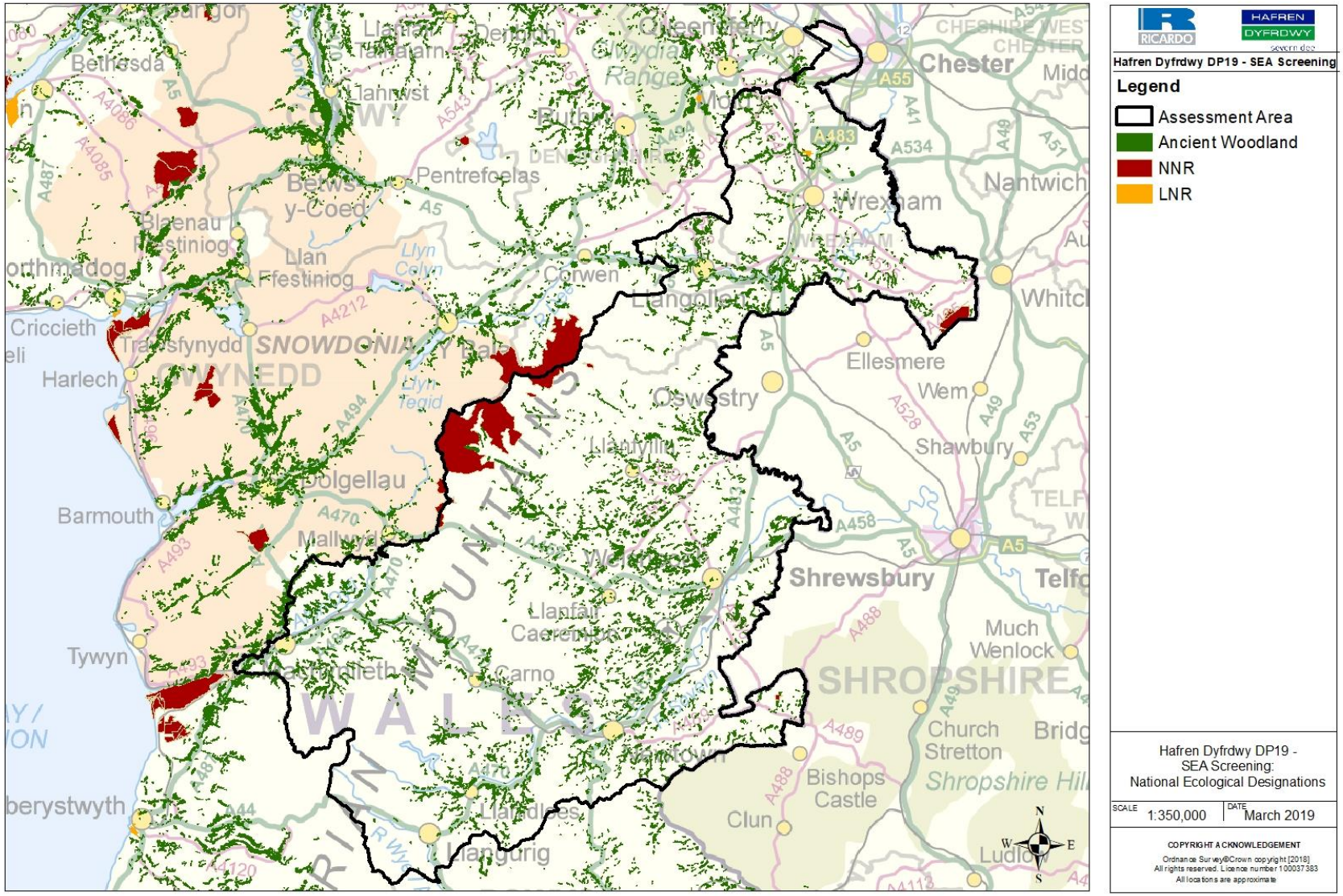


Figure 4 Ancient Woodlands, National Nature Reserves and Local Natural Reserves in the Assessment Area



- The need to recognise the importance of allowing wildlife to adapt to climate change.
- The need to control the spread of Invasive Non-Native Species (INNS).
- The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of ecosystem services.

4.2 Population and Human Health

4.2.1 Baseline

Population

Hafren Dyfrdwy supply water to over a quarter of a million people in the area of Mid and North East Wales[22]. Statistics figures from 2016 estimate that the population will rise by 4.6% over the next 25 years[23], whilst statistical figures from 2014 estimate that the number of household properties is expected to increase by an average of 0.4% each year to 2039[24]. The Local Authorities that are wholly or partially in the Hafren Dyfrdwy's supply area are all expected to incur population increases by 2039, based on the 2014 baseline figures. To provide context, the population of Wales as a whole is expected to increase by 6% by 2039, meanwhile the population of England is estimated to rise by 16%. **Table 2** shows the population statistics and projections for the regions which fall within the supply area.

Table 2 Population statistics and projections

	Period		
Region	2014	2039	Population change (%)
Denbighshire	94,800	97,300	3%
Wrexham	136,700	150,000	10%
Flintshire	153,800	155,900	1%
Powys[25]	132,770	122,400	-8%
Wales	3.1 million	3.3 million	6%
England	54.3 million	63.3 million	16%

The long-term issues relating to population growth and associated requirement for housing and water (and wastewater) infrastructure provision are not a key consideration in relation to the short-term horizon (5 years) covered by the Drought Plan; these issues are however very important in respect of the Hafren Dyfrdwy's Water Resources Management Plan (WRMP).

Human Health and Deprivation

The Drought Plan has the potential to influence quality of life, including human health, well-being, amenity and community, through alterations to the operation of existing infrastructure, the construction and operation of new infrastructure temporary water use restrictions and drought orders. For example, additional leakage reduction activities in drought may lead to greater traffic congestion due to street works to repair leaks, with temporary effects relating to odour and noise nuisance.

Drought management and planning is of critical importance in maintaining reliable and safe water supplies for the health and wellbeing of the population supplied by Hafren Dyfrdwy. In times of drought, water levels in reservoirs used for recreation may be too low for the recreational activities to continue (e.g. sailing).

[22] Hafren Dyfrdwy Water Resource Management Plan 2019
[23] Office for National Statistics – National Population Projections: 2016-based Statistical Bulletin. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2016basedstatisticalbulletin.
[24] City and County of Swansea (2017): Welsh Government Household Projections Briefing Note May 2017. Available at: https://www.swansea.gov.uk/media/3546/Welsh-Government-Household-Projections-2014-based-Mar-17/pdf/WG_Household_Projections_Briefing_Note_May17.pdf.
[25] Local Authority Population Projections for Wales (2014-based): Principal projection September 2016. Available at: https://gov.wales/sites/default/files/statistics-and-research/2018-12/160929-local-authority-population-projections-2014-based-en.pdf

Wrexham is a large urban centre within the supply area. In 2011, 47.2% of the population in Wrexham reported to be in 'very good health', with a further 32.5% reporting to be in 'good health. These figures generally align with those for Wales[26].

It has been shown that, in some cases, people in disadvantaged areas experience greater exposure to negative impacts on human health including air pollution, flooding and proximity to large industrial and waste management sites[27]. The Index of Multiple Deprivation combines a number of indicators, chosen to cover a range of economic, social and housing issues[28], into a single deprivation score for each Lower Super Output Area[29] in the UK. This allows each area to be ranked relative to one another according to their level of deprivation. The indices are used widely to analyse patterns of deprivation, identify areas that would benefit from special initiatives or programmes and as a tool to determine eligibility for specific funding streams. The English Index of Multiple Deprivation (2015)[30] and the Welsh Index of Multiple Deprivation (WIMD, 2014)[31] have been developed slightly differently and cannot be compared directly. WIMD does not measure the level of deprivation in a small area, but rather whether an area is more or less deprived relative to all other small areas in Wales. **Figure 5** shows the English Index of Multiple Deprivation and the Welsh Index of Multiple Deprivation across the assessment area. As is the case with the rest of the UK, most large urban centres in the assessment area contain areas with high levels of deprivation. In the Hafren Dyfrdwy's supply area, the most deprived areas lie around Wrexham, Liangollen, Lianfyllin, Welshpool and Newtown.

Affordability of Water

Nationally, approximately 24% of households spend more than 3% of their income (after housing costs) on water and sewerage bills, and 11% spend more than 5%[32]. Ofwat and government policy has focused on addressing this issue through continued incentives for water companies to drive out financial efficiencies in its operations and investment programmes, as well as consider the use of 'social tariffs' for those struggling to pay their water bills. Hafren Dyfrdwy customers currently have an average household bill for water and sewerage of around £312 per year (the lowest combined bill in the UK), which compares with an average bill of £415 for England and Wales[33]. Water metering can help customers reduce their bills through improved water use efficiency. However, there are concerns that metering can disadvantage vulnerable and low-income groups. Hafren Dyfrdwy's current strategy is to continue offering unmetered customers the option to swap to a water meter free of charge.

Recreation and Tourism

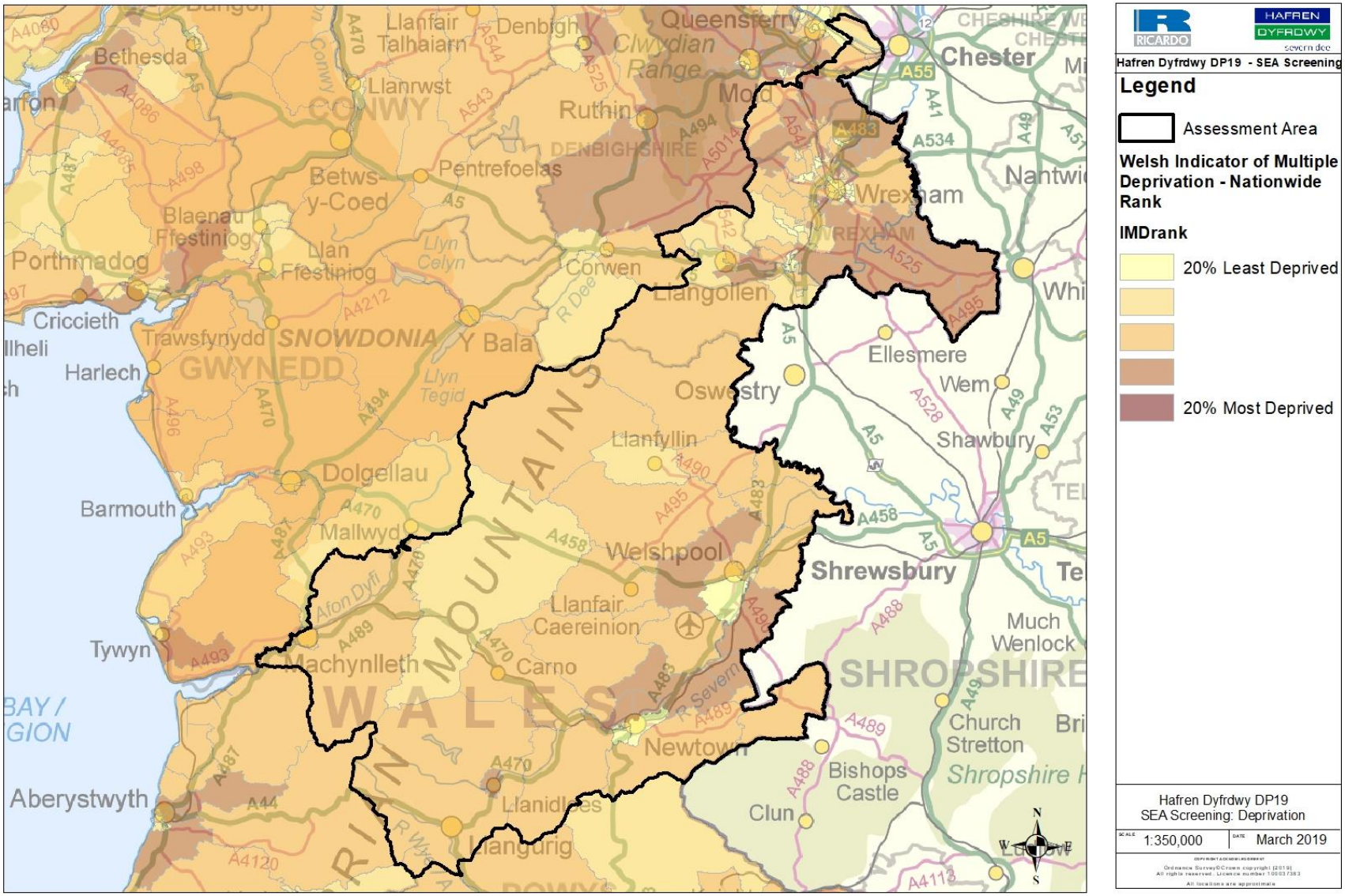
Drought Plan actions have the potential to affect areas with recreation value. Effects could arise as a result of scheme operation (for example on lake or river water levels).

There are a variety of opportunities for recreation and tourism within the Hafren Dyfrdwy's supply area. Many of the recreational and cultural offerings are represented in other topic areas in the baseline. For example, the supply area includes a number of water resources of recreation importance including canals (e.g. Montgomery Canal, Llangollen Canal) and reservoirs (the Clywedog Reservoir and Lake Vyrnwy Reservoir). The River Dee is an important recreational feature providing facilities for angling, canoeing, kayaking, sailing and bathing. There are networks of footpaths along the River Dee which are in frequent use by walkers and cyclists.

Figures 4 show some of the areas that may be used for recreation within the assessment area. This includes AONBs (see Landscape and Visual Amenity topic), NNRs and LNRs (see Biodiversity, Flora and Fauna topic).

[26] Office for National Statistics - General Health in England and Wales: 2011 and comparison with 2001. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandwellbeing/articles/generalhealthinenglandandwales/2013-01-30
[27] Defra (2006) Air Quality and Social Deprivation in the UK: an environmental inequalities analysis
[28] Income Deprivation, Employment Deprivation, Health Deprivation and Disability, Education Skills and Training Deprivation, Barriers to Housing and Services, Living Environment Deprivation, and Crime.
[29] Super Output Areas (SOAs) are a set of geographical areas developed following the 2001 census. The aim was to produce a set of areas of consistent size, whose boundaries would not change, suitable for the publication of data such as the Indices of Deprivation. They are an aggregation of adjacent Output Areas with similar social characteristics. Lower Layer Super Output Areas (LSOAs) typically contain 4 to 6 OAs with a population of around 1500
[30] http://www.communities.gov.uk/communities/research/indicesdeprivation/deprivation10/
[31] http://gov.wales/docs/statistics/2015/150812-wimd-2014-summary-revised-en.pdf
[32] Ofwat (2015) Affordability and debt 2014-15.
http://www.ofwat.gov.uk/wpcontent/uploads/2015/12/prs_web20151201affordability.pdf
[33] https://www.discoverwater.co.uk/annual-bill

Figure 5 Indices of Multiple Deprivation in the Assessment Area



Other, non-water based, recreational and cultural resources in the assessment area include many nature reserves presented (see Section 4.1). Section 4.7 identifies the importance of the assessment area with respect to heritage assets, including 49 Registered Parks and Gardens, of which 44 contain listed buildings. Section 4.8 presents the landscape baseline, which includes a number of Areas of Outstanding Natural Beauty (AONB) and National Parks within the assessment area.

Public areas of open space, National Parks (see Section 4.8), country parks[34], Public Rights of Way, walking routes and cycle routes are also important with respect to recreation and tourism. Planning Policy Wales states planning policies should protect and enhance public rights of way and access. All Local Authorities are required to prepare and publish Rights of Way Improvement Plans (ROWIPs). These plans explain how improvements made by local authorities to the public rights of way network will provide a better experience for a range of users, including pedestrians, cyclists, horse riders, horse and carriage drivers, people with mobility problems, and people using motorised vehicles (e.g. motorbikes).

Planning Policy Wales defines green infrastructure as 'the network of natural and semi-natural features, green spaces, rivers and lakes that intersperse and connect places'. Local planning authorities are required to plan positively for strategic networks of green infrastructure and take account of the benefits of green infrastructure in reducing the risks posed by climate change. Green infrastructure will often play a large part in local recreational resources.

Tourism is the fifth largest industry in the UK and supports 3.1 million jobs (9.6% of total UK jobs), contributing nearly £126.9 billion to the economy[35]. Around 10.4 million domestic tourism trips were taken in Wales during 2015, staying for 36.2 million bed nights and spending £2.0 billion[36].

4.2.2 Future Baseline

The population in the assessment area is expected to grow in the range of 1-10% by 2039, apart from Powys where there is a projected decline in population (see **Table 2**), and there is likely to be an increasing proportion of people at or above state pension age. Aside from Powys, household projections show potential increases of between 4% and 15% across local authorities within the assessment area, with an increasing proportion of one-person households and average household size decreasing[37]. The Powys local authority statistics indicate that its population is expected to decline by approximately 8% by 2039 and household projections show a potential decrease of 2.3%, as a result of natural change[38]. However, the UK's imminent exit from the European Union (EU) may lead to greater uncertainty in the short term regarding future population and housing growth.

The Water White Paper[39] describes modelling undertaken under a range of scenarios which suggests that by 2030, water bills may increase by an average of 14%. This is below the expected rate of inflation. Reforms to the water industry stemming from the Water White Paper and now being introduced are designed to increase competition and innovation in the water industry market, and drive cost-effective responses to water resources challenges, thereby limiting the impact on customer bills. Guidance from the Government was issued in 2012 on the introduction of social tariffs which enable water companies to offer more support to customers at risk of affordability problems[40]. It also ensures that water companies have the freedom to offer enhanced terms to WaterSure customers (a capped charge intended to help customers who pay for their water charges via a water meter who experience difficulties as a result of high water usage or low income) through their social tariffs from April 2013. Hafren Dyfrdwy have also introduced the Here2Help tariff which offers a subsidised tariff for customers on low incomes (less than £15,500).

In response to recent studies, access to the recreational resources, green spaces and the historic environment will have greater importance in future planning[41]. For example, the National Ecosystem Assessment and the Marmot Review, *Fair Society, Healthy Lives*, demonstrate the positive impact that

[34] Area designated for people to visit and enjoy recreation in a countryside environment
[35] Deloitte (2013) Tourism: jobs and growth: The economic contribution of the tourism economy in the UK
[36] The GB Tourist Statistics 2015
https://www.visitbritain.org/sites/default/files/vb-corporate/Documents-Library/documents/England-documents/gb_tourist_report_2015.pdf
[37] ONS (2011) Housing Statistical Release - Household Projections 2008 to 2033, England
[38] Local Authority Population Projections for Wales (2014-based): Principal projection September 2016. Available at:
https://gov.wales/sites/default/files/statistics-and-research/2018-12/160929-local-authority-population-projections-2014-based-en.pdf
[39] https://publications.parliament.uk/pa/cm201213/cmselect/cmenvfru/374/374.pdf
[40] Defra (2011) Water for Life - Water White Paper
[41] Defra (2011) *The Natural Choice: securing the value of nature, The Natural Environment White Paper*

nature has on mental and physical health and, as a result, the Government intends to establish a Green Infrastructure[42] Partnership with civil society to support the development of green infrastructure in England. The 'Sustaining a Living Wales' consultation document has the aim to ensure that Wales has increasingly resilient and diverse ecosystems that deliver economic, environmental and social benefits. Improvements to the quality of the water environment and certain potential climate change impacts will present opportunities for an expanding tourist industry in the region[43].

4.2.3 Key Issues

The key sustainability issues arising from the baseline assessment for population and human health are:

- The need to ensure water supplies remain affordable especially for deprived or vulnerable communities, reflecting the importance of water and sewerage services for health and wellbeing.
- The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas.
- The need to ensure public awareness of drought conditions and importance of maintaining security of supply without the need for emergency drought measures.
- The need to ensure continuing safe, reliable and resilient provision of water and sewerage services to maintain health and wellbeing of the population.
- The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities for local residents and tourists, including opportunities for access to, protecting and enhancing recreation resources, green infrastructure and the natural and historic environment.
- The need to accommodate an increasing population.
- Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and well-being and the economy.

4.3 Material Assets

4.3.1 Baseline

Water Use

Hafren Dyfrdwy supplies approximately 58 million litres of water per day to over 225,000 customers[44]. Hafren Dyfrdwy has ongoing programmes to reduce leakage from its network and to encourage more efficient use of water by customers.

Hafren Dyfrdwy operates three Water Treatment Works (WTW) (Llwyn Onn, Pendinas and Oerog) and maintain and operate seven upland reservoirs, three supplying the Pendinas WTW and four supplying Llwyn Onn WTW. The largest WTW is Llwyn Onn WTW in Wrexham which is supplied by water abstraction at Bangor on Dee from the River Dee and upland reservoirs. Treated water is then supplied through a network of approximately 2600km of water mains, 100 pumping stations and 85 clean water storage reservoirs[45].

Additionally, there are several bulk water supply agreements in place between Hafren Dyfrdwy and Severn Trent Water, notably the Llanfyllin bulk water import from Shelton and Mardy (6.75Ml/d), the Wrexham bulk import from Mardy (<0.1Ml/d) and the Llandinam import from Shelton and Bishops Castle (<0.5 Ml/d).

Resource use and waste

[42] Green infrastructure is a term used to refer to the living network of green spaces, water and other environmental features in both urban and rural areas.
[43] Defra (2016) The UK Climate Change Risk Assessment 2016 Evidence Report.
[44] Hafren Dyfrdwy Final Water Resources Management Plan 2019
[45] Hafren Dyfrdwy Final Water Resources Management Plan 2019

There is an ongoing need for society to reduce the amount of waste it generates, by using materials more efficiently, and improving the management of waste that is produced.

Waste going to landfill has decreased significantly over the period 2012/13 to 2017/18 (42% to 11% of total waste sent for disposal/treatment[46]); household recycling rates have climbed to 57.3% (2016)[47]; waste generated by businesses (commercial) declined from 1,677,000t (+/- 10.4%) in 2007 to 1,665,000t (+/-7.4%) in 2012 and business recycling rates increased drastically from 37% (2007) to 68% (2012)[48]. In line with the widely adopted 'waste hierarchy', best practice for waste management is to reduce, re-use, recycle and recover, and only then should disposal (or storage) in landfill be considered.

Data on waste arisings is collected in a range of categories. The activities of the water industry contribute to construction, demolition and excavation waste (CDEW), through construction of new infrastructure. The water industry also contributes to several waste streams through the operation of facilities. Waste streams include commercial and industrial waste (C&I) (statistics include waste arisings from the power and utilities sector, which includes water supply and sewage removal), and also hazardous wastes. **Table 3** shows waste according to waste type by region.

Table 3 Waste Arisings by Region

Waste	North Wales (2012)	Wales (2012)	England (2016)[49]
Commercial and Industrial waste arisings produced in region (million tonnes)[50]	0.9	3.7	19.8
Construction & Demolition Waste (million tonnes)[51]	0.74	3.4	107.6
Total waste produced by region[52]	Unavailable	7.9	167.6

4.3.2 Future Baseline

Defra's national aspiration for England is to reduce water usage to an average of 130 litres per person per day by 2030. Defra, Ofwat and the Environment Agency expect that leakage will not rise in any water company area in England and leakage targets must be set that take account of customer priorities for reliable water supplies. The Welsh Government's vision for water resources is for there to be enough water for people and the environment now and in the future[53]. The Welsh Government will publish new guidelines for WRMPs by 2025 and has pushed for a stronger stance on reducing leakage. In line with national government expectations, Ofwat has set all water companies a minimum target of 15% reduction in leakage by 2025[54].

There is the potential for increase in operational waste from the water sector as regional population increases and standards of treatment are increased through regulatory requirements and/or customer expectations.

With the Welsh Government Towards Zero Waste Strategy and the Waste Strategy for England, diminishing landfill capacity and a fast-growing waste recycling and recovery industry, the proportion of waste sent to recovery rather than landfill is set to continue to increase in the future. One of the Waste Framework Directive targets is for a minimum of 70% by weight of construction and demolition waste to go to recovery by 2020.

The Government's National Infrastructure Plan (NIP) (2010) for England included visions to manage natural capital sustainably; treat water and waste in ways that sustain the environment and enable the

[46] The Welsh Government (2018), Statistical First Release: Local Authority Municipal Waste Management 2017-18.
[47] Defra (2018) UK statistics on waste.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/746642/UK_Statistics_on_Waste_statistical_notice_October_2018_FINAL.pdf
[48] Natural Resource Wales (2012), Survey of Industrial and Commercial waste generated in Wales 2012.
[49] Defra (2016) UK Statistics on Waste
[50] Natural Resources Wales (2012) Survey of Industrial & Commercial Waste Generated in Wales
[51] Natural Resources Wales (2012) Survey of Construction & Demolition Waste Generated in Wales 2012
[52] Natural Resources Wales (2012) Wales Waste Information 2012
[53] Environment Agency Wales (2009) Water for people and the environment: Water Resources Strategy for Wales.
[54] The Welsh Government (2019). Prosperity for all: A Climate Conscious Wales. A Climate Change Adaptation Plan for Wales.

economy to prosper; ensure a supply of water that meets the needs of households, businesses and the environment now and in the future and deals with waste in accordance with the waste hierarchy. The plan was updated in 2014, setting out progress to date whilst including detailed delivery plans to 2020 in key economic sectors[55].

The Environment (Wales) Act (2016) is designed to support and complement work to help secure Wales' long-term well-being and one of the key components of this Act is Part 4: collection and disposal of waste[56]. This envisions the future continuous improvement of waste management practices through higher levels of business waste recycling, enhanced food waste treatment and increased energy recovery. This aspiration is for waste management is backed up by the sustainable development goals set out in the Well-being of Future Generations Act 2015. Natural Resources Wales is implementing these waste management principles through the Sustainable Management of Natural Resources, as mandated through the Environment (Wales) Act 2016.

4.3.3 Key Issues

The key sustainability issues arising from the baseline assessment for Material Assets and Resource Use are:

- The need to minimise the consumption of resources, including water and energy.
- The need to reduce the total amount of waste produced in the region, from all sources. The need to recognise waste as a potential resource and reuse waste productively where possible to support development of the circular economy.
- The need to reduce the proportion of waste sent to landfill.
- The need to continue to actively control leakage from the water supply system and promote the efficient use of water to help reduce future demand for water.

4.4 Water

4.4.1 Baseline

The Water Framework Directive (WFD) brings together the planning processes of a range of other European Directives. These Directives establish protected areas to manage water, nutrients, chemicals, economically significant species, and wildlife, and have been brought in line with the planning timescales of the WFD.

In the context of the WFD, the water environment includes rivers, lakes, estuaries, groundwater and coastal waters out to one nautical mile. The aquatic environment has been characterised as part of the UK Government's reporting obligations to the EU under the WFD and this provides the most appropriate baseline reference. **Table 4** shows the current classification (2015) of surface water bodies in the assessment area.

Surface Waters: Rivers and Canals

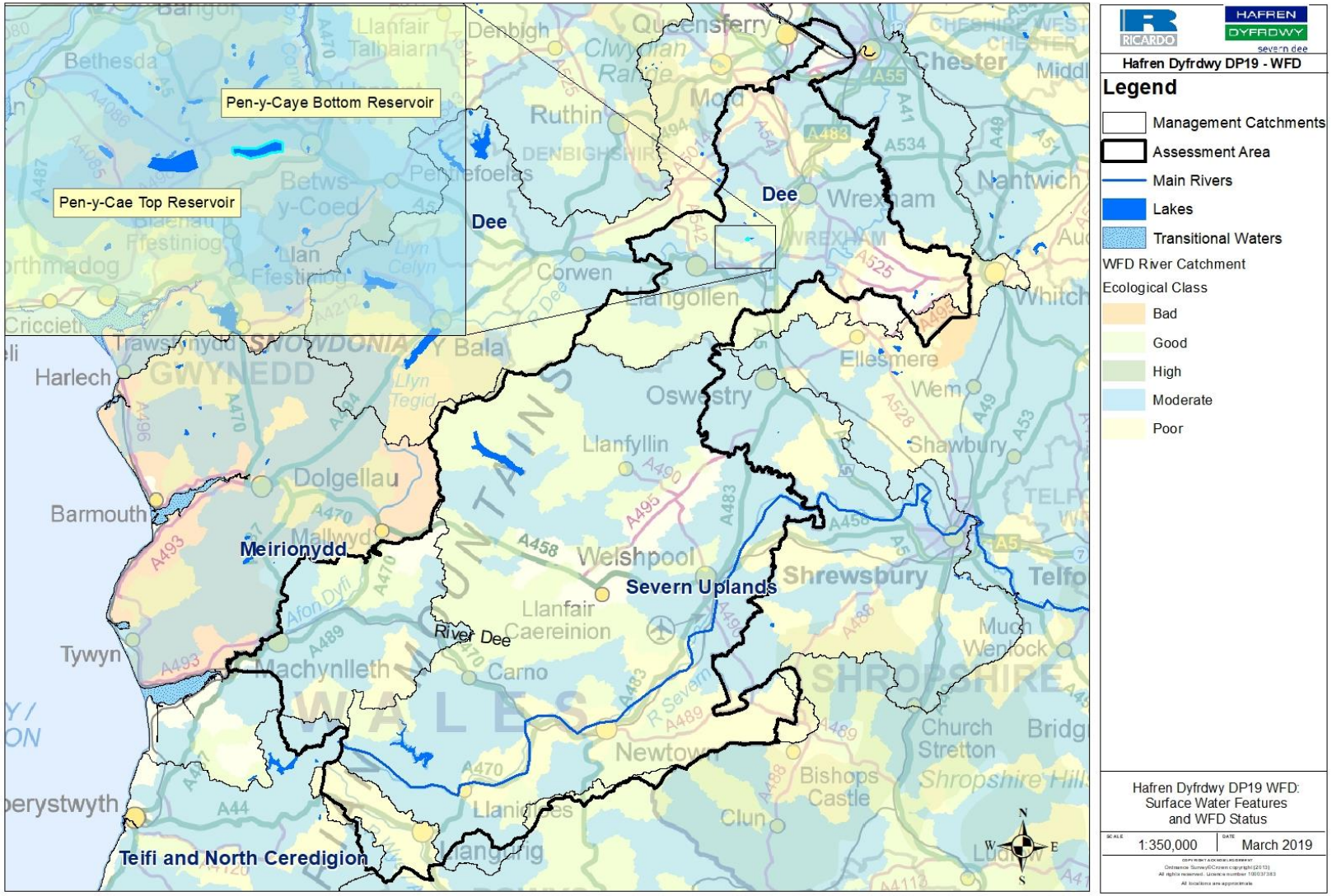
The assessment area is largely situated within the Severn and Dee River Basin District (RBD), with smaller portions of the area falling within the Western Wales RBDs, respectively. The Dee RBD includes the River Dee and its tributaries, such as River Clywedog. The part of the assessment area that falls within the Western Wales RBD includes the Afon Dyfi and its tributaries, including the Afon Twymyn and Afon Dulas**.** The part of the assessment area which falls within the Severn Uplands RBD includes; the Afon Gam, River Severn, River Morda, Bele Bk, Afon Cain, River Vrynwy, Afon Banwy, Afon Tanat, River Camlad, Afon Clywedog, Afon Vyrnwy, Bechan Bk, Afon Cerist, Afon Carno and the Afon Rhiw WFD waterbodies. **Figure 6** shows the distribution of surface waters in the assessment area.

[55] HM Treasury (2014) National Infrastructure Plan 2014: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/381884/2902895_NationalInfrastructurePlan2014_acc.pdf
[56] Wales Council for Voluntary Action (2019) The Environment (Wales) Act – All you need to know. Available at: https://www.wcva.org.uk/what-we-do/the-environment-(wales)-act

Table 4 Key Statistics for WFD Catchments within the Assessment Area

RBD	Relevant RBMP Management catchment	% at good or high ecological status or potential		% assessed at good or high biological status		% at good chemical status		% at good status overall	
		RBMP 2015	Target 2021	RBMP 2015	Target 2021	RBMP 2015	Target 2021	RBMP 2015	Target 2021
Dee	Dee	0	10	10	30	90	NA	0	NA
Severn	Severn Uplands	24	82	43	61	81	95	24	82
Severn	Teme	30	65	28	59	98	98	28	63
Severn	Wye	24	38	30	N/A	98	N/A	24	38
Western Wales	Meirionnydd	33	N/A	67	N/A	78	N/A	33	39
Western Wales	Teifi and North Ceredigion	8	N/A	75	N/A	67	N/A	8	22

Figure 6 Water Framework Directive (WFD) Surface Water Features in the Hafren Dyfrdwy's Assessment Area



The River Dee is one of the largest lowland rivers used for public water supplies in England and Wales, providing drinking water to over 2 million people in North East Wales, Cheshire and Merseyside. The flow of the River Dee is heavily regulated to allow for continual supply of water for residential, agricultural and industrial purposes, whilst maintaining enough in-channel flow to sustain healthy flora and fauna communities and the passage of migratory fish. Hafren Dyfrdwy is licenced to abstract from the River Dee at Twll (Sesswick).

Surface Waters: Lakes and Reservoirs

In total, there are 10 lakes in the assessment area, including. Lower Pen-y-Cae Reservoir, Upper Pen-y-Cae Reservoir, Pendinas Reservoir, Lyn Cyfynwy Reservoir, Nant y Ffrith Reservoir, Pant Glas, Ty Mawr Reservoir, Cae Llwyd Reservoir. Lake Clywedog Reservoir and Lake Vyrnwy Reservoir and Hanmere Mere. Hafren Dyfrdwy operates a total of 85 service reservoirs in order to ensure continuous supply of drinking water to its customers. Additionally, there is ongoing surface-water abstraction at Oerog Spring. Abstraction from the River Dee is supported by river regulation releases from Llyn Brenig Reservoir, Llyn Celyn Reservoir and Llyn Tegid which are all geographically located outside of the assessment area but the operation of which influence the measures included in the Drought Plan.

Groundwater

The main groundwater bodies situated within the supply area are the Severn Uplands – Secondary Combined aquifer, beneath the Lower reaches of the River Severn and the Afon Rhiw River and the Meirionnydd aquifer beneath the Afon Twymyn and Afon Dyfi rivers. In the northern part of the assessment area the main groundwater bodies are beneath the Middle reaches of the River Dee and include the following; the Dee Silurian/Ordovician, Dee Carboniferous Coal Measures, Dee Permo-Triassic Sandstone Dee - Carboniferous Limestone and Dee Triassic Mercia Mudstone aquifers. **Figure 7** indicates that a majority of the supply area has a 'Good' groundwater quantity status. A majority of Hafren Dyfrdwy's water is sourced from rivers and reservoirs. There are three operational boreholes where abstraction currently occurs, at Llangollen Spring, Llanwrin and Llandinam. Both the quantity and quality of groundwater is extremely important in maintaining these resources.

Groundwater is vulnerable to pollution from surface activities since aquifers underlie roughly half of the land surface in the assessment area. The chemical status of the Dee Permo-Triassic Sandstone groundwater body is currently good, however drinking water quality has failed to achieve this standard in the past (i.e. assessment in Cycle 1-2009). The Dee Permo-Triassic Sandstone groundwater body however is currently at poor drinking water quality status.

Source Protection Zones (SPZ) provide additional protection to safeguard drinking water quality. This is achieved through constraining the proximity of an activity that may impact upon drinking water abstraction. They are defined around large and public potable groundwater abstraction sites, and the groundwater travel time to an abstraction. The strategic importance of the Dee and the risk posed to it from pollution associated with the adjacent manufacturing industries in the lower Dee and estuary have led to the designation of the lower Dee (in 1999) as the UK's first and only Water Protection Zone (to date)[57]. This allows for greater controls on polluting activities, placing greater emphasis on industry and others to put in place pollution-control measures (The Water Protection Zone (River Dee Catchment) Designation Order 1999).

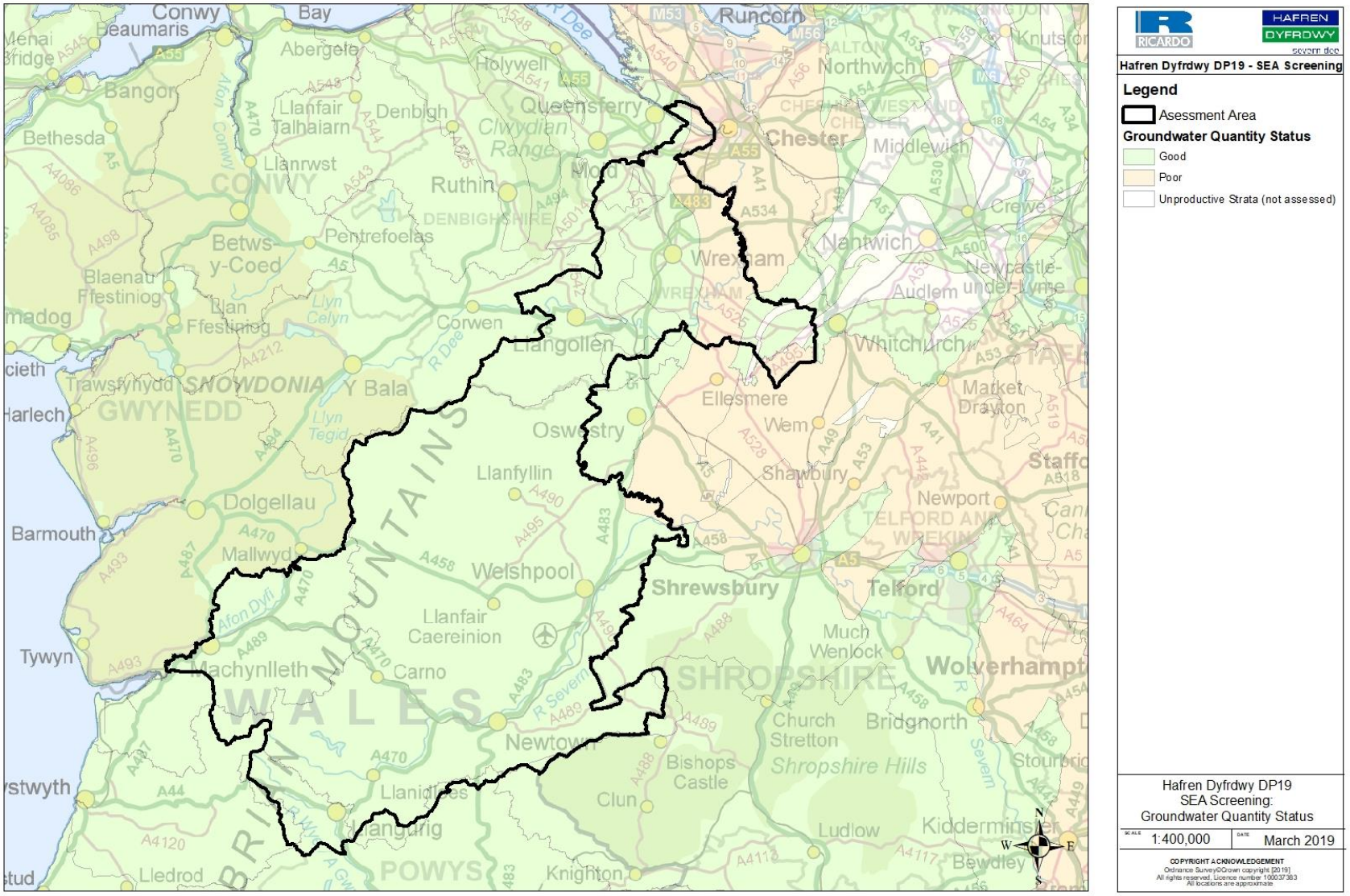
Catchment Abstraction Management Strategies and Abstraction Licensing Strategies

Hafren Dyfrdwy's assessment has taken account of the Shropshire Middle Severn and Severn Corridor Abstraction Licensing Strategies (ALS), the Dee Valley ALS (in the north-east and south-east), the Weaver and Dane (in the north), the Meirionnydd (in the south-east), the Teifi and North Ceredigion (in the south), and the Wye (in the southwest). The ALS work seeks to identify where additional abstractions can be made from rivers, where no additional abstractions can be made and where over-abstraction is possible through existing licensed abstractions. This has been achieved by identifying the 'resource availability status' for specific Water Resource Management Units (WRMUs) and Groundwater Management Units (GWMUs) within individual catchments. The resource availability status for surface waters is quantified at various assessment points (APs) along watercourses, where hands-off flow (HOF) conditions may apply to protect ecological flows. There are five categories of water availability:

[57] The Water Protection Zone (River Dee Catchment) Designation Order 1999. Available at https://www.legislation.gov.uk/uksi/1999/915/contents/made. Accessed 28/11/2017

- High hydrological regime: There is more water than required to meet the needs of the environment. However, due to the need to maintain the near pristine nature of the water body, further abstraction is severely restricted.
- Water Available: 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: Fully Licensed flows fall below the Environmental Flow Indicators (EFIs). 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. It may also be appropriate to investigate the possibilities for reducing fully licensed risks. Water may be available if you can 'buy' (known as licence trading) the entitlement to abstract water from an existing licence holder.
- No Water Available: Recent Actual flows are below the EFI. This scenario highlights water bodies where 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. Water may be available if you can buy (known as licence trading) the amount equivalent to recently abstracted from an existing licence holder.
- Heavy Modified Water Bodies (HMWBs) (and /or discharge rich water bodies): These water bodies have a modified flow that is influenced by reservoir compensation releases or they have flows that are augmented. These are often known as 'regulated rivers'. They may be managed through an operating agreement, often held by a water company. The availability of water is dependent on these operating agreements.

Figure 7 Water Framework Directive (WFD) Groundwater Quantity Status in the Hafren Dyfrdwy's Assessment Area



The Dee Catchment ALS sets out a future strategy for the renewal of existing time-limited abstraction licences and consideration of new applications for licensed abstractions. None of the Hafren Dyfrdwy's abstraction licenses source water from WRMUs considered to be over licensed, whilst the provisions of the Dee Catchment ALS should allow Hafren Dyfrdwy to abstract up to its present abstraction limits within WRMUs 1 and 2 without undue pressure on water resources in these areas

Table 5 shows the representation of resource availability based on the worst downstream water body at low flows (the flow percentile called Q_{95}) for the Hafren Dyfrdwy's supply area.

Water Quality

Since 2007, water quality has been classified according to several quality elements in line with the requirements of the WFD. For surface waters, there are two separate status classifications for water bodies: ecological and chemical. For a water body to be in overall 'good' status/potential both ecological and chemical status must be at least 'good'. Biological status classification considers the condition of biological quality elements, e.g. aquatic invertebrates, plants and fish, the morphology of the habitat available, concentrations of supporting physio-chemical elements e.g. oxygen or ammonia and concentrations of specific pollutants.

Under the WFD there are two separate classifications for groundwater bodies: chemical status and quantitative status. A groundwater body will be classified as having poor quantitative status in the following circumstances: where low groundwater levels are responsible for an adverse impact on rivers and wetlands normally reliant on groundwater; where abstraction of groundwater has led to saline intrusion; where it is possible that the amount of groundwater abstracted will not be replaced each year by rainfall. For a groundwater body to be at good status overall, both chemical status and quantitative status must be good. In addition to assessing status, there is also a requirement to identify and report where the quality of groundwater is deteriorating as a result of pollution and which may lead to a future deterioration in status. The main reasons for poor status were identified as high or rising nitrate concentrations, with some failures for pesticides and other chemicals. The main reason for poor quantitative status is that abstraction levels, mainly for public water supply, exceed the rate at which aquifers recharge[58].

The main reasons for failure, and the contribution of each, are presented in **Table 6**, which identifies 4% of waterbodies failing as a result of insufficient flow/abstraction.

The generally 'Good' water quality in the supply area is reflected by the high number of designated habitats and important salmon fisheries within the district. Additionally, Hafren Dyfrdwy samples private water supplies, reservoirs and treatment works throughout the supply area to assess water quality and to act if any standards are exceeded. Nevertheless, water quality along some sections of the River Dee is adversely affected by pollution from Waste Water Treatment Works (WwTWs), industrial discharges, agricultural activities, urban runoff and acidification (i.e. from mine audits and forestry operations). This is reflected by the strong presence of 'Moderate' water quality areas in the supply area.

Flood Risk

Flooding can result from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources. The Flooding in Wales report[59] highlight the baseline with regard to flood risk in the assessment area. **Table 7** illustrates the number of properties at risk of flooding in regions covering the assessment area. There have been several recent flood incidents in the Lower River Dee in this century.

The extreme floods of 2007 prompted the Pitt Review (2008) and the subsequent Flood and Water Management Act 2010. The Government recognised the importance of investing in flood risk and coastal management and will invest £3 billion between 2016 and 2021 into a programme that will result in flood risk and coastal erosion reduction. Climate change may have a significant effect upon future flood risk in the region (see Section 4.6).

[58] Environment Agency (2015), Severn River Basin District River Basin Management Plan
[59] Environment Agency (2009) Flooding in Wales: A National Assessment of Flood Risk

Table 5 Environment Agency Assessment of Resource Availability Status

Catchment	Relevant Management Unit	Resource availability status	Commentary
Dee	Aldford Brook Alwen Alyn Ceiriog Clywedog Dee (source to Chester weir) Pulford Brook Worthenbury Brook	No Water Available	Time limits will be applied to all new and varied licences (other than those requesting reductions in water volumes, or minor changes with no environmental impact). In this catchment, new licences have generally issued with a time limit to 31 March 2027. Existing time-limited licences will be renewed as long as three tests are passed: the water is still required, it is used efficiently, and the abstraction is environmentally sustainable. Water is not available for abstraction from the River Dee (or its tributaries) upstream of Chester Weir, when the river is being regulated. Some additional water may be available during wetter periods, but abstractors would be required to stop taking water as soon as the river flow dropped again. Special conditions may be placed on any new licences granted to safeguard the wildlife and conservation interest of the River Dee.
	Aldford & Peckforton GWMU Dee Estuary & Wirral GWMU	No Water Available	Non-consumptive licences may be considered.
	Middle Dee GWMU Chester Block GWMU	Restricted Water Available	Where more groundwater is available, it will only be licensed if it can be demonstrated conclusively that it will not reduce the flow in any river upstream of Chester Weir, or if 100% of the water abstracted is returned upstream of the weir. This applies equally to water contained in the bedrock (such as sandstone), and in the shallow deposits known as "drift". In the area to the west of Llangollen, a licence is not required to abstract groundwater (even if it is more than 20 cubic metres per day) unless the abstraction is likely to reduce the flow in a nearby river (exception likely to be removed in the future).
Meirionnydd	Dyfi	Water Available	Time limits will be applied to all new and varied licences (other than those requesting reductions in water volumes, or minor changes with no environmental impact). In this catchment, new licences have generally issued with a time limit to 31 March 2030. Existing time-limited licences will be renewed as long as three tests are passed: the water is still required, it is used efficiently, and the abstraction is environmentally sustainable. In the case where an abstraction from groundwater (water stored in rocks) in the Meirionnydd catchment is likely to reduce the flow in a nearby river, a licence is required. In this case, water availability is the same as for the corresponding river catchment. However, if there is no likely effect on river flows, a licence is not required, even for more than 20 cubic metres per day.

Severn Uplands (CAMS (Oswestry and Welshpool))	WRMU 1. Dulas; WRMU 2. Trannon WRMU 3. Carno; WRMU 4. Rhiw WRMU 5. Camlad; WRMU 6. Banwy WRMU 7. Cain; WRMU 9. Morda WRMU 8. Tanat WRMU 10. Weir Brook	Restricted Water Available	New licences and renewals will be evaluated in accordance with national guidance and specific criteria.
Wye	Wye Trothy Monnow Garren Gamber Lugg Arrow Llynfi	Restricted Water Available	During a period of low flows (Q_{95}), the availability of water for licensing is restricted to ensure that there is enough water available for the environment. Consequently, no further consumptive licences will be granted and non-consumptive licences can be issued but local flow restrictions will be applied. However, water may be available if you can 'buy' (license trading) the entitlement to abstract water from an existing license holder.

Table 6 Main reasons for waterbodies failing to achieve good ecological status or potential

Reason for failure	Contribution (%)
Physical modification	24%
Diffuse source agriculture	18%
Flow / abstraction	4%
Diffuse source non-agriculture	11%
Point source water industry sewage discharge intermittent	5%
Point source water industry sewage discharge continuous	15%
Point source non-water industry	6%
Suspect data	4%
Unknown reason	5%
Uncertain failure	6%
Other	3%

Table 7 Properties in England and Wales at risk of river and sea flooding, by risk category

Region	Number of properties at risk of flooding	Number of properties at significant risk of flooding
North West Wales	220,000	28,900
Wales	220,000	64,000
England	2,400,000	500,000

4.4.2 Future Baseline

Originally, the WFD set a target of aiming to achieve at least 'good status' in all water bodies by 2015. However, provided that certain conditions are satisfied, it was acknowledged that in some cases the achievement of good status may be delayed until 2021 or 2027. The primary objective in the short-term is to ensure no deterioration in status between status classes: the 2015 water body classification is the baseline from which deterioration between classes is to be assessed; no deterioration between status classes is permitted unless certain and specific conditions apply.

The Planning Policy Wales (PPW)[60] states that inappropriate development in areas at risk of flooding (in Flood Zone 1[61], Flood Zone 2[62], Flood Zone 3a[63] or Flood Zone 3b - the functional floodplain) should be avoided by directing development away from areas at highest risk. The PPW requires that where development is necessary, it should reduce, and must not increase, flood risk arising from river and/or coastal flooding on and off the development site itself. The priority should be to protect the undeveloped or unobstructed floodplain from development and to prevent the cumulative effects of incremental development. Planning Policy Wales requires the application of a sequential, risk-based approach (operated through Strategic Flood Risk Assessment) to the location of development to avoid where possible flood risk to people and property and to manage any residual risk, taking account of the impacts of climate change. Following application of the Sequential Test, if it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. This includes development for water-compatible uses

[60] The Welsh Government (2018) Planning Policy Wales: Edition 10
[61] Low probability of river or sea flooding (<0.1%) which has critical drainage problems
[62] Medium probability of river (1%-0.1%) or sea flooding (0.5%-0.1%)
[63] High probability of river (>1%) or sea flooding (>0.5%)

(e.g. water transmission infrastructure and pumping stations) and essential infrastructure (e.g. water treatment works that need to remain operational in times of flood).

In the future, there will be an even higher demand for water due to increases in population and development.

The UK Climate Change Risk Assessment (CCRA) 2017 Evidence Report: Summary for Wales[64] draws together and interprets the evidence gathered by CCRA regarding current and future threats and opportunities for Wales posed by the impacts of climate change up until 2100. The key risks to Wales in relation to water are taken from a summary report of the UK CCRA (2017)[65] which was presented to the UK Parliament in January 2017, included below:

- Increasing pressure on the UK's water resources due to changes in hydrological conditions, increases in water demand for irrigation crops, population growth and regulatory requirements to maintain good ecological status. Major supply-demand deficits were identified for five river basin regions including the Severn.
- Risks to public water supplies, infrastructure, business and buildings from high river flows, erosion, drought and extreme weather.
- Risks to people's health and well-being and associated service delivery from high temperatures, flooding and extreme weather.
- Lower summer rivers flows across the UK due to warming and drying conditions.
- An increase in precipitation in winter months due to a combination of greater depths and more frequent heavy rainfall events - suggesting larger volumes of runoff with potential negative impacts on flood risk and sewer overflows in urban environments.
- Flash-flooding associated releases from combined sewer overflows (CSO) could in turn increase associated illnesses at the coast due to the varying occurrence of microbial pathogens in the marine environment. Risks from some land management practices exacerbating flood risk.

4.4.3 Key Issues

The key issues arising from the baseline assessment for water are:

- The need to further improve the quality of the regions' river and estuarine waters taking into account WFD objectives.
- The need to maintain the quantity and quality of groundwater resources taking into account WFD objectives.
- The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface water and groundwater.
- The need to ensure sustainable abstraction to protect the water environment and meet society's needs for a resilient water supply.
- The need to reduce and manage flood risk.
- The need to ensure that people understand the value of water.

[64] Defra (2017) The UK Climate Change Risk Assessment 2017 Evidence Report: Summary for Wales
[65] HM Government (2017). UK Climate Change Risk Assessment 2017. © Crown Copyright 2017.

4.5 Soil, Geology and Land Use

4.5.1 Baseline

Geology

The assessment area is geologically diverse underlain by predominantly sedimentary bedrock of varying age. The overlying drift geology which dominates the supply area is glacial diamicton with some scattered areas of alluvium, glacial sand and gravel and river terrace deposits. The Hafren Dyfrdwy's supply area includes two principal aquifers: Carboniferous Limestone and Permio-Triassic together with several minor aquifers: Ordovician-Silurian Mudstone, Siltstone and Sandstone.

England has been divided into areas with similar landscape character, which are called National Character Areas (NCAs), previously known as Joint Character Areas (JCAs). Similarly, Wales has been divided into National Landscape Character Areas (NLCAs) which are defined at a broad landscape scale. Character descriptions for each of the NCAs were produced and published in regional volumes to highlight the influences determining the character of the landscape, including surface geology. Landscape Character Maps for Wales include 48 regional scale landscape character areas. Each area has a distinctive sense of place that enables it to be recognised as a single area. This is described for each area, according to its geological, habitats, historic, cultural and perceptual characteristics. Relevant NCA and Welsh regional landscape character area boundaries are discussed in Section 4.7 (**Figure 10)**.

Soil

The Soil Map of England and Wales[66] identifies dominant soil subgroups. The dominant soil types in the Supply Area are described by National Soil Resources Institute as:

- slowly permeable seasonally wet, slightly acid but base-rich, loamy and clayey soils; found in seasonally wet pastures and woodlands.
- freely draining acid loamy soils over rock; found in steep acid upland pastures dry heath and moor; bracken gorse and oak woodlands.
- blanket bog peat soils; found in peatland areas.

Land Use

Land use ranges from open areas, moorland, areas of forestry, sparsely populated rural areas to thriving towns with growing populations. NLCAs that form a significant proportion of the assessment area includes the Cambrian Mountains NCLA which contains an abundance of peat bogs, open moorland and areas of forestry, lakes and reservoirs. The Montgomeryshire Hills and Vales NCLA is described as a transitional area between adjacent upland and lowland with neatly managed mixed fields in the richer valley bottoms and grazing on higher slopes and moorlands. Berwyn NCLA is described as area is a sparsely settled upland massif, mostly covered by extensive tracts of open moorland, often heather-clad.

There are significant areas of urban and suburban development, heavy industry, open cast mines and areas of mineral abstraction. The land surrounding the River Dee supports mixed intensive dairy farming and arable production. Reforms in the Common Agricultural Policy are leading to shifts towards more extensive farming systems and some areas of England and Tir Cynnal and Tir Gofal in Wales have now entered Environmental Stewardship Schemes, these schemes encourage agricultural practices which protect and enhance the landscape and associated wildlife.

In terms of agricultural land quality, planning policy seeks to protect best and most versatile agricultural land (defined as land in Grades 1, 2 and 3a of the Agricultural Land Classification). The Agricultural Land Classification (ALC) System developed by Defra provides a method for assessing the quality of farmland, principally for the use in planning. The system divides the quality of land into five categories as well as non-agricultural and urban.

[66] Produced by the Soil Survey of England and Wales

The majority of land in the assessment area is farmed and agricultural practices have a major influence on soil quality. Good soil structure is beneficial to water retention and crop yield. It can be seen from **Figure 8** that a large proportion of the supply area is characterised by poor quality agricultural land (Grade 4 and 5) which generally improves from west to east. Soil quality and structure is affected by changes in land use, groundwater levels and farming practices. Soil quality can influence run-off rates and therefore flooding and water quality.

Contaminated land is defined as land where substances could cause significant harm to people or protected species; or significant pollution of surface waters or groundwaters. Some types of contaminated land can be designated as special sites for a variety of reasons, including land that seriously affects drinking water, surface waters (e.g. lakes and rivers) and important groundwater sites. Data on contaminated land are compiled for the Government by the British Geological Survey[67]. Minerals Safeguarding Areas (MSAs) are designated by Mineral Planning Authorities for areas that include known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development.

4.5.2 Future Baseline

One of the core planning principles of the Planning Policy Wales (2018)[68] is to encourage the effective use of land by ensuring that previously developed (brownfield land) be used where-ever possible, in preference to greenfield sites where it is suitable for development provided that it is not of high environmental value. Green Belt serves five purposes: to check the unrestricted sprawl of large built-up areas; to prevent neighbouring towns merging into one another; to assist in safeguarding the countryside from encroachment; to preserve the setting and special character of historic towns; and to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

The Water White Paper described the Government's intentions to take forward a catchment-based approach to water quality and diffuse pollution and work towards Common Agricultural Policy reforms that will promote the farming industry's role as custodian of the natural environment[69]. The Water White Paper and subsequent Defra strategic policy supports catchment-based approaches to prevent and manage future risks to drinking water quality from agricultural activities, working in partnership with farming communities. These policy objectives are reflected in regulatory guidance (including the Final Water Resources Planning Guideline) from Government and the regulators. The catchment-based approach has now been implemented across England and Wales, with catchment partnerships now in place across most of the assessment area to take forward the approach over the coming years.

Soil quality and structure is affected by changes in land use, groundwater levels and farming practices. Soil quality can influence run-off rates and therefore flooding and water quality. Hafren Dyfrdwy has been working with landowners to reduce catchment risks, which may offer viable alternatives to future treatment investment.

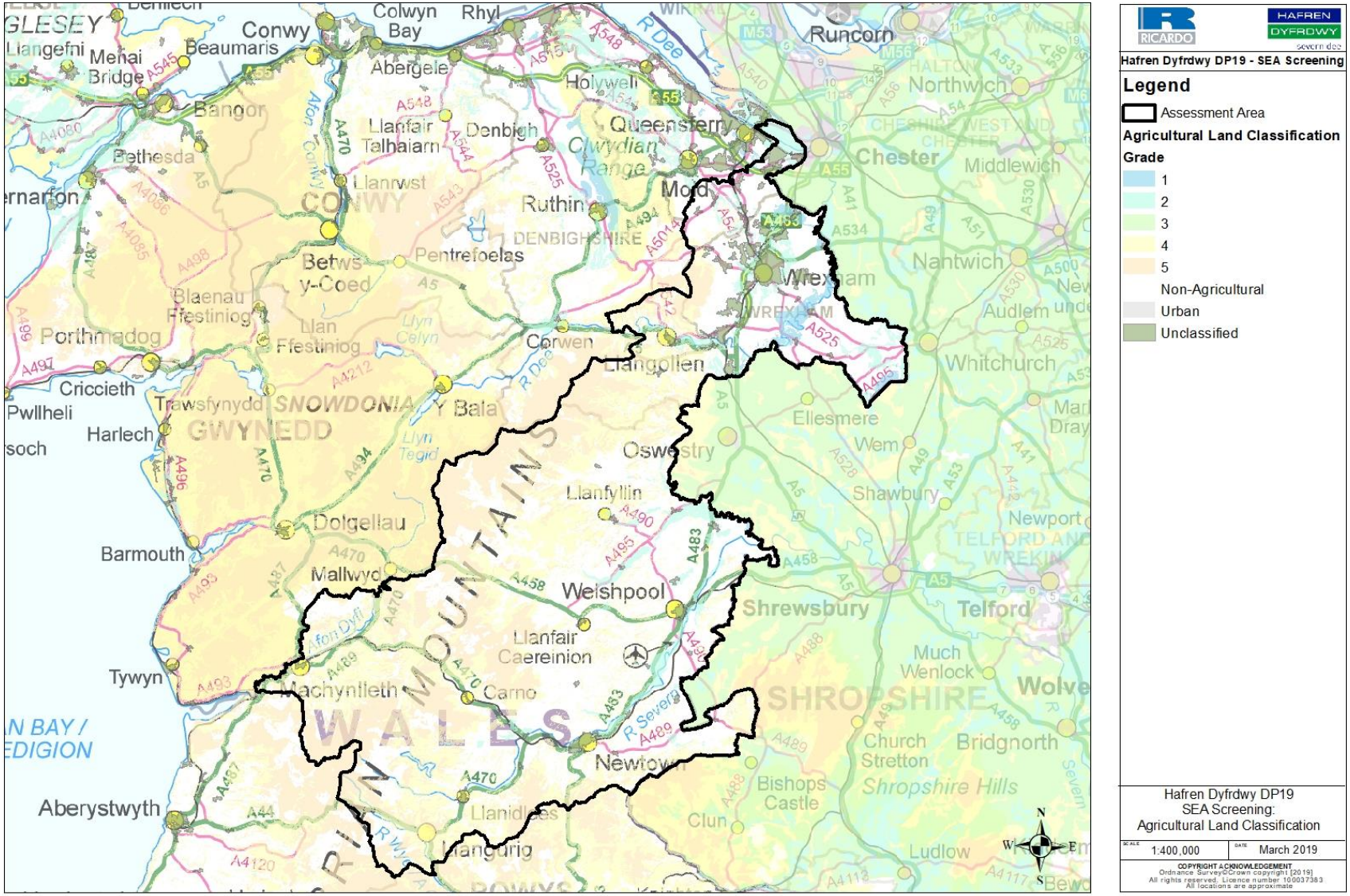
4.5.3 Key Issues

The key sustainability issues arising from the baseline assessment for soil, geology and land use are:

- The need to protect geological features of importance (including geological SSSIs) and maintain and enhance soil function and health.
- The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources).
- The need to make use of previously developed land (brownfield land) and to reduce the prevalence of derelict land in the region.

[67] https://data.gov.uk/dataset/contaminated-land
[68] The Welsh Government (2018). Planning Policy Wales: Edition 10 December 2018.
[69] Defra (2011) Water for Life - Water White Paper

Figure 8 Agricultural Land Classification in Dee Valley Water Supply Area



4.6 Air and Climate

4.6.1 Baseline

Air Quality

Air quality is generally good within the study area and there are no Area Quality Management Areas (AQMAs) in Wrexham Borough or Flintshire County councils, but there is one AQMA in the Powys County Council area (Newtown). There are pockets of poorer air quality associated with Wrexham, industrial sites and major transport routes.

In April 2015, the Supreme Court ruled that the UK Government must redraft the national nitrogen dioxide (NO_2) air quality action plan, as well as 16 regional action plans, with the aim of ensuring that these areas reach compliance with legal NO_2 limits as soon as possible.

Greenhouse Gases and Climate Change

Climate change may result in higher flood risk. Increased flood risk has potential implications for water supply assets located in floodplain area and consequently the security of public water supply.

Climate change could also lead to variations in water supply and demand, e.g. temperature increase and changes to rainfall patterns are predicted which may lead to an increase in the frequency and duration of drought events, associated with evaporative losses and seasonally reduce rainfall run-off to watercourses. **Table 8** illustrates the potential impacts of climate change on water resources and demand management schemes.

Climate change is likely to result in greater chance of hotter, drier summers and warmer, wetter winters[70]. To help combat the effects of climate change and reduce CO_2 emissions, the Welsh Assembly Government has developed a policy to support the development of renewable energy resources however, no areas are being investigated within the Supply Area.

Table 8 Potential Impact of Climate Change on Water Resource and Demand Management Schemes

Sector	Impact
Water Resources (i) water supply	Reduction in water source yield, either in total or at certain times of the year. Increased evaporation losses from surface water stores. Increased sediment and pollution runoff into watercourses caused by changes in farm management practices adopted to adapt to climate change. Increased risk of algal blooms and pollution in reservoirs.
(ii) water demand	Increase in demands in summer months leading to increase in average and peak requirements. Increased pressure on treatment and distribution system.
Flood management	Increased riverine flood risk and storm occurrence due to increased rainfall, leading to reduction in safety standards. Improvements and higher specifications required for flood defences, urban drainage and rainwater disposal.
Water quality management	Lowered water quality in lowland rivers, with implications for in-stream ecosystems and water abstractions. Altered potential for polluting incidents. Increased potential for combined sewer overflows.

[70] UKCP18: https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/ukcp18/ukcp18-infographic-headline-findings-land.pdf

Sector	Impact
Navigation	Lower summer flows leading to reduced navigation opportunities in rivers and canals.
Aquatic ecosystems	Altered habitat potential, with species at their environmental margins most affected.
Water-based recreation	Impacts through changes in river flows and water quality.

Climate

On April 29 2019, the Welsh Government declared a climate emergency, in-line with its commitment to achieving a carbon neutral public sector by 2030, and to support other areas of the economy to shift away from reliance on fossil fuels[71]. This declaration was amplified by the publishing of its Prosperity for All: A Low Carbon Wales, which sets out 100 policies and proposals to meet its 2020 carbon emission reduction targets.

Climate monitoring and risk assessments have improved significantly over the last two decades but there are still limits to the understanding of future climate risks. A certain amount of global warming will occur due to inertia in the global climate system, irrespective of future greenhouse gas emissions. Mitigation through reduction in greenhouse gas emissions will contribute to risk reduction over the long term (100 years). Adaptation is needed to reduce the costs and damages of inevitable related impacts and to take advantage of opportunities that result from a changing climate.

The latest UK Climate Projections (UKCP18) estimate that summers in England and Wales will be hotter and drier and the winters warmer and wetter. **Table 9** presents the key findings of UKCP18 projections.

Table 9 Key findings of UKCP18 projections using high emissions scenario[72]

	Summer rainfall change		**Winter precipitation change**		**Summer temperature change**		**Winter temperature change**	
Location	Low emissions scenario	High emissions scenario	Low emissions scenario	High emissions scenario	Low emissions scenario	High emissions scenario	Low emissions scenario	High emissions scenario
Central Wales	39% drier to 3% wetter	56% drier to 2% wetter	2% drier to 19% wetter	No change to 29% wetter	No change to 3.3^{0}C warmer	0.9^{0}C warmer to 5.9^{0}C warmer	0.1^{0}C warmer to 2.4^{0}C warmer	0.7^{0}C warmer to 4.1^{0}C warmer
Central England	41% drier to 9% wetter	57% drier to 3% wetter	3% drier to 22% wetter	2% drier to 33% wetter	No change to 3.3^{0}C warmer	1.1^{0}C warmer to 5.8^{0}C warmer	-0.1^{0}C cooler to 2.4^{0}C warmer	0.7^{0}C warmer to 4.2^{0}C warmer
Central Scotland	30% drier to 6% wetter	40% drier to 8% wetter	4% drier to 9% wetter	3% drier to 12% wetter	-0.1^{0}C cooler to 3.3^{0}C warmer	0.6^{0}C warmer to 4.8^{0}C warmer	-0.3^{0}C cooler to 2.7^{0}C warmer	0.6^{0}C warmer to 4.5^{0}C warmer
Central Northern Ireland	28% drier to 6% wetter	38% drier to 3% wetter	3% drier to 17% wetter	2% drier to 25% wetter	No change to 2.8^{0}C warmer	0.8^{0}C warmer to 4.9^{0}C warmer	0.1^{0}C warmer to 2.2^{0}C warmer	0.6^{0}C warmer to 3.9^{0}C warmer

* All results are for the 10th-90th percentile range for the 2060-2079 period relative to 1981-2000

[71] Welsh Government (2019). Welsh Government makes climate emergency declaration: https://gov.wales/welsh-government-makes-climate-emergency-declaration
[72] Defra (2018) UKCP18 Climate Change Over Land: https://www.metoffice.gov.uk/binaries/content/assets/mohippo/pdf/ukcp18/ukcp18-infographic-headline-findings-land.pdf

Adaptation to Climate Change

The UK Climate Change Risk Assessment (CCRA) Evidence Report[73] draws together and interprets the evidence gathered by CCRA regarding current and future threats and opportunities for the UK posed by the impacts of climate change up until 2100. Overall, the findings of the CCRA indicate that the greatest need for early adaptation action (i.e. within the next 5 years) is in the following areas:

- Flood and coastal erosion risk management.
- Specific aspects of natural ecosystems, including managing productivity and biodiversity (the management of forest pests and diseases, low summer river flows and the movement of plants and animal species are all highlighted as high priorities for action).
- Managing water resources, particularly in areas with increasing water scarcity.
- Overheating of buildings and infrastructure in the urban environment.
- Health risks associated with heatwaves and other risks that may affect the NHS.
- Opportunities for the UK economy, particularly to develop climate adaptation products and services.

The Welsh Government's Climate Change Adaptation Plan for Wales[74] illustrates its statutory climate change adaptation strategy for 2020-2025. This plan is comprised of 100 policies and proposals which will enable the Welsh Government to comply with its carbon budget for this period. It draws on the key research priorities for Wales identified in the UK CCRA. The CCRA summary for Wales identifies key risk areas where greater action is needed:

- Risks to infrastructure from all sources of flooding.
- Risks to public water supplies from drought and low flows.
- Land management practices exacerbating flood risk.
- Risks to ecosystems and agriculture businesses from changes in climatic conditions.

4.6.2 Future Baseline

Government and international targets, revised recently by the Paris Agreement (2016), indicate significant cuts in greenhouse gas emissions will take place by 2027. The UK is currently projected to meet its first three legislated carbon budget targets (until 2022)[75]. Objectives are being achieved for many air pollutants (lead, benzene, 1,3-butadiene and carbon monoxide (CO)). However, measurements show that long-term reducing trends for NO_2 and PM_{10} are flattening or even reversing at a number of locations, despite current policy measures.

The Climate Change Risk Assessment 2017 (CCRA2) describes the impacts of climate change in the UK for different degrees of global temperature increase using information from a range of different studies. It states that:

- Even if global temperature increases are limited to 2°C or less, there are projected to be high magnitude impacts for the UK. Temperatures over land, and at northern latitudes such as in the UK, would be expected to increase by more than the 2°C global average. In this scenario, compared to today, there could be a 30% decrease in river flows during 'dry' periods, a 5-20% increase in river flows during 'wet' periods, and between 700 and 1,000 more heat-related deaths per year in southeast England.
- At global average temperature rises approaching 4°C, impacts become increasingly severe and may not be avoidable through adaptation. For example, damages caused by river, coastal and surface water flooding all increase markedly with 4°C of warming. Residual flood risks remain high under all adaptation scenarios considered, suggesting limits in the amount of risk that can be avoided through investment in flood defences and other responses. Potentially irreversible

[73] Defra (2016) The UK Climate Change Risk Assessment 2017 Evidence Report
[74] The Welsh Government (2019). Prosperity for all: A Climate Conscious Wales. A Climate Change Adaptation Plan for Wales.
[75] DECC (2015) Updated energy and emissions projections 2015
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/501292/eepReport2015_160205.pdf

impacts to the natural environment are projected with 4°C of warming, including risks to blanket bog, species in protected areas, and internationally important UK bird populations.

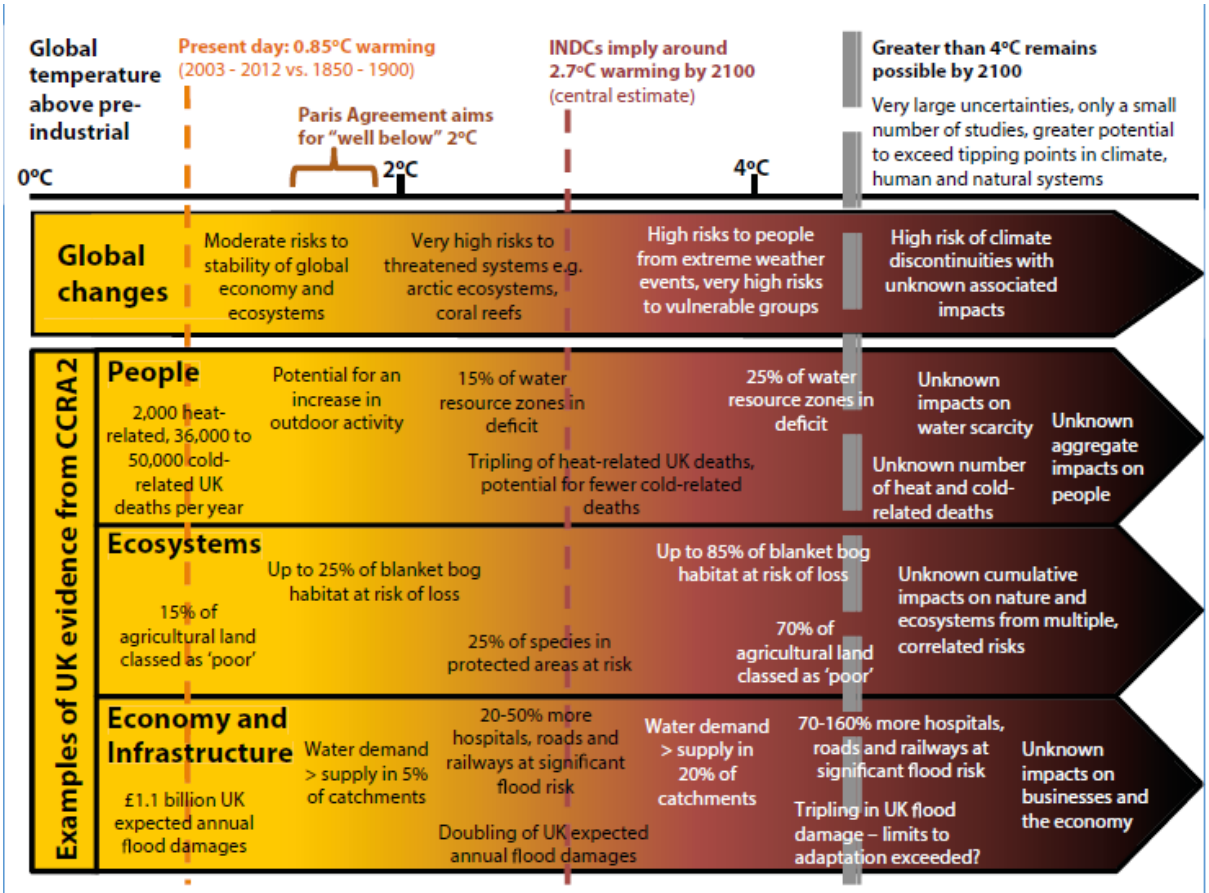
Figure 9 presents further information on the magnitude of UK climate change impacts for various degrees of global warming taken from the CCRA2 report.

4.6.3 Key Issues

The key sustainability issues arising from the baseline assessment for air and climate is:

- The need to reduce air pollutant emissions (industrial processes/transport) and limit air emissions to comply with air quality standards.
- The need to reduce greenhouse gas emissions (industrial processes and transport).
- The need to mitigate against climate change through the reduction in greenhouse gas emissions in order to contribute to risk reduction over the long term.
- The need to adapt to the impacts of climate change for example through, sustainable water resource management, water use efficiencies, specific aspects of natural ecosystems (e.g. connectivity), as well as accommodating potential opportunities afforded by climate change.

Figure 9 Magnitude of UK climate change impacts for various degrees of global warming (CCRA2, 2017)



Source: Warren et al. (2016) for the ASC.
Notes: This chart shows a selection of impacts drawn from the CCRA2 chapters for different degrees of global temperature increase above a pre-industrial baseline. The methodology, references and precise temperature estimates for each of the impacts shown can be found in Warren et al. (2016) for the ASC, including for a wider range of impacts than shown above. Colours in bars denote changes in global temperature only, and do not indicate the magnitude or severity of the impacts shown (and therefore this should not be compared to the 'burning embers' diagram in IPCC (2014, Assessment Box SPM.1, Figure 1)). The temperature scale refers to the possible changes in global temperature by the end of the century but not the rate of change. Many impacts will be sensitive to the speed, as well as the magnitude, of global temperature change.
Water resource zones (WRZs) are those used for the public water supply.
Intended Nationally Determined Contributions (INDCs) towards reducing global greenhouse gas emissions are as proposed by countries in advance of the Paris Conference of the Parties (Gütschow et al., 2015).

4.7 Archaeology and Cultural Heritage

4.7.1 Baseline

Drought management actions could affect historic landscape character, heritage asset setting and historic structures associated with the water environment. Archaeological remains are sensitive to changes in water quality, water levels (for example, waterlogged deposits), pollution and land use practices.

The Planning Policy Wales defines the historic environment as:

All the surviving physical elements of previous human activity and illustrates how past generations have shaped the world around us.

Nationally important archaeological sites are statutorily protected as designated heritage assets. **Table 11** lists the designated heritage asset count nationally, regionally and for the assessment area. Wrexham was known for its leather industry in the 18th Century and it grew rapidly during the industrial

revolution being one of the period's pioneering cities. Industry in the area declined during the depression periods in the late 20th Century with the area losing its coal mines, brickworks and then its steel works in the 1980s.

Table 11 Designated Heritage Assets within the Hafren Dyfrdwy's Supply Area

Asset	England	Wales	Hafren Dyfrdwy's Supply Area*
World Heritage Sites	57	12	1
Scheduled Monuments	19,855	4, 198	450
Listed Buildings	376,830	60,034	3,888
Registered Historic Parks and Gardens	1,774	385	0
Registered Historic Battlefields	46	-	0
Protected Historic Wrecks	49	11	0

Source: English Heritage: Heritage counts 2016 and CADW: Heritage Counts Wales 2016. (*designated assets identified from GIS datasets available from English Heritage at http://services.english-heritage.org.uk/NMRDataDownload/)

The NCAs and the draft Welsh regional landscape character areas[76] described in Section 4.5 include consideration of historic and cultural influences on the landscape. The key historic and cultural characteristics of each NCA or Welsh regional landscape character area are included in **Table 12** below. Relevant NCA and Welsh regional landscape character area boundaries are shown in **Figure 10.**

Table 12 Landscape Character Areas: Historic and cultural characteristics

Area	Characteristics
Bryniau Clwyd/Clwydian Range	A pattern of very early human activity and habitation is evidence in preserved deposits within limestone caves, where excavations have yielded human and a range of animal remains, including lion, spotted hyena and woolly mammoth, reflecting the great climatic oscillations that occurred during the last ice age. The area also boasts a number of Bronze Age ritual and burial monuments, often prominently placed on summits. However, Iron Age hillforts are more characteristic of the Clwydian Range. Holywell Common and Halkyn Mountain are notable for their historic lead and zinc mining from the Roman and Medieval periods. This area has seen a cultural mix evident in place-names which combine English and Welsh elements. Its great string of hillforts reflect a time when settlement was in defensive sites in the uplands rather than as later in open towns, villages and farms in the fertile valleys, yet the industrialisation which touched this area, particularly at Halkyn, at Brymbo and Bwlchgwyn and in the old lead mines of Esclusham, once again made the higher areas a focus of human activity, and also brought new ways of life into the area.

[76] Countryside Council for Wales (2012) Draft Regional Landscape Character Map for Wales

Area	Characteristics
Glannau Dyfrdwy a Wrecsam/Deeside and Wrexham	This border area, that has historically been under the influence of both England and Wales, includes several settlements and centres of population, the principal being the towns of Chirk, Wrexham; Mold, Flint and Holywell in the north and west, and the part-industrial, part-suburban centres of Queensferry, Connah's Quay, Mostyn Docks and Talacre on the shores of the Dee Estuary. Historically, much of this area has formed part of the hinterland of Chester and the varied geology present is reflected in the long history of mineral extraction and processing which has left a powerful mark on the landscape. In recent years the area has become an economic hub of the Welsh and regional English economy. However, it would be wrong to see this area as a purely industrial and commercial landscape as it includes some attractive traditional architecture and countryside too.
Dyffryn Dyfrdwy a Lllangollen/Llangollen and Vale of Dee	This deep, twisting valley provides a 'gateway' to North Wales and the past strategic importance of the Vale as a transport and communications corridor is visible in the landscape today. Thomas Telford's London to Holyhead post road (now the A5) follows the valley and has heavily influenced the location and shape of settlement in the area. The canal, which is carried across the Vale by the Pont Cysyllte aqueduct (a World Heritage Site) extends to the west of Llangollen, a town which acquired a significant industrial base in the textile industry as a consequence. Llangollen is also home to the International Eisteddfod Festival which brings tourists from around the world every year, making this an iconic cultural landscape.
Y Berwyn/Berwyn	Key elements of the historic landscape include prehistoric ritual and funerary monuments such as the cairns and round barrows, which are extensively concentrated in the most elevated areas. Settlement in the valleys is characterised by a few, compact, linear valley villages such as Llangynog. Much of the area is quiet, rural and has a very low level of development. There is also significant evidence of prehistoric and Medieval occupation in the Berwyn moorlands and in the Tanat valley.
Maelor Saesneg/Maelor	As rich agricultural land, this area has supported a series of large landed estates, whose investment in improved agriculture during the 19th century has left its mark in large numbers of planned farmsteads, small-holdings and estate cottages. The area is particularly notable for its evidence of Medieval field systems and cultivations patterns, as well as prehistoric tirual and funerary sites, such as the round barrow at Sutton Green. The area boasts a powerful cultural mix. Agriculture continues to dominate the landscape, however, is going through profound changes with typical large brick-built courtyard farms erected in the 19th century now falling into disrepair.
Montgomeryshire Hills	This area is comprised of an undulating landscape of upland ridges and deep valleys across upland and lowland habitats, which occupy the lower sections of the River Tanat, Vyrnwy, Banwy, Cain and Rhiw. To the northwest and southwest this area is flanked by the Berywn and Cambrian Mountains respectively. There are six protected landscapes including; the Gwaun Efail Wig, Gwaun Wern y Wig, Cors Ty-gwyn, Mawnog Gwaunynog, Coed Byrwydd and Dugwm Woods SSSI. These SSSIs cover a range of mire and woodland landscapes. Farming has been the driving influence on the visual profile of this area, creating a patchwork of lowland pastoral agriculture and hill sheep farming in the valleys, with blocks of deciduous woodland. Archaeological sites and settlements from the Roman and Medieval periods are prominent, including Bronze Age monuments and Iron Age hill forts in the Tanat Valley, in addition to historic parklands: Llangedwyn and Bodfach. Market towns and isolated villages are found along the river valleys and have developed as early as in the 16th century.
Aberdyfi Coast	The coastal landscape of this area is comprised of an open, soft coastline with extensive dunes, which is backed by the Dysynni and Dyfi estuaries. These estuaries are characterised by both sandy and muddy inter-tidal flats, a salt marsh and wetland grazing. Britain's largest coastal raised bog surrounds the Dyfi Estuary and is a protected area (NNR, SSSI). The Dyfi Estuary dunes (Ynys Las dunes) and salt marsh are of considerable ecological value and are thus protected as SAC, Ramsar, NNR and SSSI sites. Archaeological sites and settlements are principally from the Iron Age and include a Roman fort at Pennal. There are a number of modern small-scale seaside towns, the largest being the town of Aberdyfi, which developed

Area	Characteristics
	significantly in the 17th and 18th centuries. The Aberdyfi Coast has an industrial heritage with historical mines and quarries and remains of the 18th century Dyfi blast furnace industry. The town of Aberdyfi is situated against a backdrop of the Yr Horon and Tarren Mountains. The upper valleys and lower valleys are dominated by hillside grazing and pastoral farmland, encircled by deciduous woodland, namely the Tnys Hir RSPB Reserve.
Upper Wye Valley	The Upper Wye Valley landscape is comprised of a mixture of woodland on the lower slopes and open moorland on the upper hillsides. The River Wye is protected as a SAC and SSSI along its entire length and drains the surrounding uplands and supports extensive grasslands and pastures. There are also lowland wetland habitats of considerable ecological value. Key settlements include the towns of Rhayader and Llangurig, which contain medieval remains of Rhayader castle. These towns underwent significant development in the 19th and 20th centuries, the Elan Village is a product of this and was built around the Elan Valley Reservoir, a prominent feature in this area.
Shropshire Hills	The Shropshire Hills is an agricultural landscape, with farming concentrated in the lower hills and hill sheep farming in the open moorland, upland areas. Offa's Dyke passes through this area. Key features include prehistoric and 13th century medieval fortifications in the town of Montgomery, field systems and quarries. As a result of the wealth of heath and grassland communities, large areas of the Shropshire Hills are protected as SSSI and NNR.
Radnorshire Hills	The Radnorshire Hills contains a varied topography, ranging from open heather moorland to an undulating upland landscape with steep-sided valleys. Offa's Dyke is an important boundary feature along the length of the eastern border of the Radnorshire Hills, whilst its western area merges into the Cambrian Mountains. Key features include Radnor Forest, Offa's Dyke and remnants of Medieval and post-Medieval settlements. Land-uses are predominantly pastoral farming. This area is also contains a wealth of prehistoric remains, ranging from Mesolithic to Iron Age hill forts. The scarce settlement in this area is concentrated in the lower valleys, with the small towns of Presteigne and Knighton at river crossing-points.
Severn Valley	This river valley is a major transport corridor, which includes farmland on the floodplains and valley sides. This landscape area shares the Offa's Dyke boundary and the Montgomery Canal SSSI runs along the length of the Severn. There are numerous prehistoric remains, including Roman forts and Medieval castles. The towns of Welshpool and Newtown are located at the head of the Severn, with the smaller town of Llanidloes further upland. Historically Welshpool was an exporter of ore and timber, whilst Llanidloes and Newtown were important 19th century textile industries. A significant factor behind the growth of these industries was the Montgomeryshire Railway. Currently, lowland pastoral farmland and wetland pastures dominate this landscape area.
Snowdonia	This area is predominantly a rural upland landscape and a key feature is the Snowdonia National Park. There are countless mountain ranges, with peaks of over 3000 feet. The mountainous areas are scarred due to industrial quarrying for slate and mining for zinc, manganese, copper and gold. Hill sheep farming and forestry cover the upper valleys, which are dominated by large areas of protected heather moorland and blanket bogs SSSIs and grassland. The Dysinni and Llugwy rivers run through these upland areas and there are numerous small lakes, including the Llyn Tegid at Bala, Wales' largest natural lake. Prehistoric remains and stone-built Iron Age, Roman period and medieval settlement remains are scattered throughout the southwest and northeast of Snowdonia. The scale and range of landscape types have made this area a major tourist attraction, with numerous protected landscape areas: NNR and SSSI. This area is sparsely populated and its population is concentrated in the small towns of Dolgellau and Bala.
Cambrian Mountains	The Cambrian Mountains contain an abundance of peat bogs, open moorland and areas of forestry, lakes and reservoirs, which are contrasted with deep valleys and glacial features. These mountainous areas are scarred due to industrial quarrying of its mineral wealth beginning in the prehistoric period with Bronze Age copper working and significant led and silver mining in the 19th and 20th centuries. Currently hill sheep farming dominates this extensive upland plateau area, however this landscape area

Area	Characteristics
	is sparsely populated and settlements are limited to sheltered valleys and lower hillsides. The Clywedog Dam and Elan Valley Reservoir currently act as tourist destinations and are a valued recreational resource for fishing and sailing.

4.7.2 Future Baseline

The Planning Policy Wales was introduced in 2002 and sets out the land-use planning policy for Wales and is supplemented by a series of technical advice notes (TAN), in addition to the Wales Spatial Plan. Planning Policy Wales places great importance on five key planning principles[77], including "Growing our economy in a sustainable manner, making best use of resources, facilitating accessible and healthy environments, creating & sustaining communities, and maximising environmental protection and limiting environmental impact".

Recent and ongoing national economic difficulties may have a negative effect on removing heritage assets from the heritage at risk register. Climate change could have variable impacts on heritage assets in the future. Some types of assets and landscapes have already experienced and survived significant climatic changes in the past and may demonstrate considerable resilience in the face of future climate change. However, many more historic assets are potentially at risk from the direct impacts of future climate change[78].

4.7.3 Key Issues

The key issue arising from the baseline assessment for archaeology and cultural heritage is:

- The need to conserve or enhance sites of archaeological importance and cultural heritage interest, and their settings, particularly those which are sensitive to the water environment.

4.8 Landscape and Visual Amenity

4.8.1 Baseline

The Hafren Dyfrdwy's supply area, surrounding the River Dee and River Severn, consists of a variety of landscapes and settlements reflecting its history and development. Settlements include small villages and farming communities as well as larger towns and developed centres namely the historic market town of Wrexham. The passage of the River Dee has created the Cheshire Plains and undulating hills in the region.

The county of Wrexham has a truly diverse landscape shaped by a combination of the underlying geology, agriculture, forestry, its industrial past and the employment needs of its communities. It has, as part of the "Welsh Borderland", a landscape which reflects the often turbulent interaction between the English and Welsh cultures for example, Offa's Dyke.

In the Llandinam and Llanwrin and Llanfyllin WRZs, there are a variety of landscapes and settlements, ranging from the mountainous uplands of the Snowdonia National Park, to the coastal dunes, wetlands and bogs at Aberdyfi. Consequently, there are numerous small villages, with few larger towns, namely the towns of Welshpool and Newtown in the Severn Valley, Llangedwyn and Bodfach in Montgomeryshire, Rhayader and Llangurig in the Upper Wye Valley and the coastal town of Aberdyfi.

The Register of Landscapes of Special Historic Interest in Wales identifies the Vale of Llangollen, Eglwyseg Mountains and the Maelor region of Wrexham County as being of national importance, due to the preservation of previous land uses.

The landscape character network[79] defines landscape character as 'a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse'. Some landscapes are special because they have a particular amenity value, such as those designated as Areas of Outstanding Natural Beauty (AONB) or National Parks. Others

[77] Welsh Government (2018) Planning Policy Wales.
[78] English Heritage (2010) Climate Change and the Historic Environment
[79] www.landscapecharacter.org.uk, accessed 14th July 2006

may have an intrinsic value as good examples or be the only remaining examples of a particular landscape type. Some landscapes are more sensitive to development whereas others have a greater capacity to accommodate development. Assessments of landscape character and landscape sensitivity enable decisions to be made about the most suitable location of development to minimise impacts on landscapes. **Table 13** summarises the landscape character areas in the assessment area.

Nationally Designated Sites

AONBs are defined as 'precious landscapes whose distinctive character and natural beauty are so outstanding that it is in the nation's interest to safeguard them'[80]. They are designated under National Parks and Access to the Countryside Act, 1949, strengthened by the Countryside and Rights of Way Act, 2000. The primary purpose of an AONB is 'to conserve and enhance the natural beauty of the landscape.' There is one AONB within, or partially within, the assessment area, which is shown in **Figure 10**.

[87] http://www.landscapesforlife.org.uk/

Figure 10 Landscape Character of Hafren Dyfrdwy's Supply Area

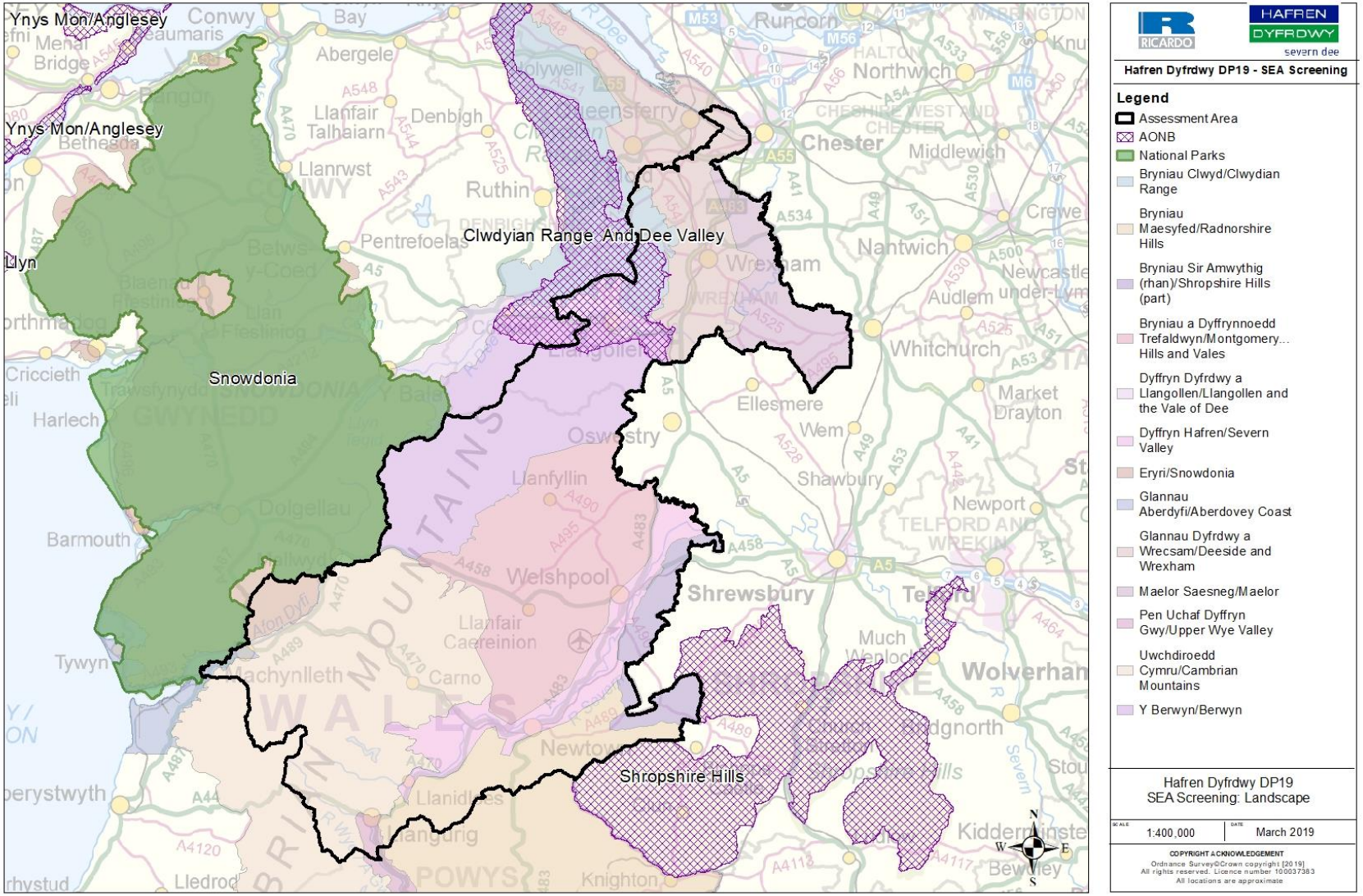


Table 13 Landscape Character Areas: Landscape characteristics

Area	Characteristics
Bryniau Clwyd/Clwydian Range	Extensive upland area which forms the broad ridge between the Vales of Clwyd and Llangollen, and the western part of the Cheshire plain. It includes a number of distinct areas of high ground, e.g. Moel Famau and Moel y Gamelin, which are areas of smooth, open, rounded and distinctively shaped heather-clad hills. By contrast, some peripheral hills to the north (Graig Fawr), east (Halkyn Mountain) and south (Eglwyseg Mountain), exhibit distinctive limestone characteristics, with cliffs and rocky outcrops in places.
Glannau Dyfrdwy a Wrecsam/Deeside and Wrexham	Lowland foothills slope down towards the lower Dee and Dee Estuary with Carboniferous Coal Measures interspersed with outcrops of Millstone Grit, Holywell shales and Cefn-y-Fedw sandstones. Local landform variation exists on the valley floor as a result of glacial till. The River Dee opens out into a broad estuary with tidal sand and mud flats with further dissection to the landscape by minor rivers. The land cover is mixed pasture with some arable and farm woodland.
Dyffryn Dyfrdwy a Llangollen/Llangollen and Vale of Dee	Key characteristics of this area include a major river valley which has produced a dramatic, twisting and beautiful deep valley. The landscape is largely tranquil and rural with a gentler, quieter valley character up-river and very enclosed, steep-sided valley character below Corwen with spectacular limestone outcrops north of Llangollen. Llangollen is home to the International Eisteddfod Festival which brings tourists from around the world every year, making this an iconic cultural landscape.
Y Berwyn/Berwyn	Key characteristics of this landscape include a series of deeply incised river valleys to the south-east; waterfalls including Pistyll Rhaeadr (the highest in Wales); moorland of the central and western 'massif' which is protected as being of significant ecological interest for moorland breeding bird species; and, the dominant heath and blanket bog which covers many of the summits and surrounding slopes. Llyn Vyrnwy is a large reservoir in the area and is surrounded by conifer plantations and mature sessile oak woodlands.
Maelor Saesneg/Maelor	The area includes 'English Maelor' to the west and 'Welsh Maelor' to the east and is an area that in many respects belongs to the border counties of Shropshire and Cheshire. It has witnessed centuries of Welsh and English influences, however, topographically it is very uncharacteristic of Wales. The rolling lowland is characterised by a unified agricultural landscape featuring arable and pastural farmland, marsh, woodland and meres. Prehistoric ritual and funerary sites and distinctive Medieval, moated, manorial sites occur within the area.
Shropshire, Cheshire and Staffordshire Plain	Clearance of the woodlands only began in the late Bronze Age and even then, settlement was concentrated on the drier lands of the Pennine Fringe and the Sandstone Ridges. The influence of the Romans can be seen through the notable roads built to cross the Plain particularly Watling Street which linked London to mid-Wales. Many of the market towns, and their churches, can be traced back to Norman times.
Wirral	This area is located on a peninsula formed by the Mersey and Dee estuaries. The low-lying but gently rolling platform is punctuated by low sandstone outcrops which dominates the geology along with overlying glacial till. The north Wirral coast features extensive beaches along the foreshore, while the large, funnel-shaped Dee Estuary lies between the Wirral peninsula and north-east Wales. Woodland is predominantly broadleaved, with cover on sandstone ridges, country parks and estates. The core of the area is mixed agricultural land and the fields are defined by intermittent clipped hedgerows.
Mersey Valley	This area consists of a wide, low-lying river valley landscape focusing on the River Mersey, its estuary, associated tributaries and waterways. The landscape is varied and extends from mosslands in the east to the wide estuary of the Mersey, with intertidal mud/sand flats and salt marsh in the west, amongst other important wetland habitats. Large-scale, open, predominantly flat, high-quality

Area	Characteristics
	farmland occurs between developments and the field pattern is regular and large-scale, often defined by hedgerows with isolated hedgerow trees.
Owestry Uplands	This small, yet distinct, landscape is characterised by steep-sided, flat-topped limestone hills and narrow, wooded valleys and streams. It forms the eastern edge of the Clwydian Hills which extend from Mid Wales. The hills rise quite steeply from gentle foothills crossing into the Shropshire, Cheshire and Staffordshire Plain NCA and overlook Oswestry, a typical market town of the Welsh Marches. Much of the area is deeply rural with small, irregular fields, copses, shelterbelts and woodlands. Scattered farms and hamlets are reached by narrow, winding and usually deeply sunken lanes. As the land rises, the irregular field pattern changes to a more rectilinear one with lower, frequently trimmed hazel hedges

4.8.2 Future Baseline

One of the core planning principles of the Planning Policy Wales is to take account of the different roles and character of areas. Built and natural environments should promote mental and physical wellbeing. An essential requirement is the need to protect open land, including the Green Belts, from development. In addition, the identification of local designations, such as green wedges, which provide a buffer between settlements and statutory designations and safeguard views into and out of the area. Hence all new development in the countryside should of a scale and design that respects the character of the area. The Planning Policy Wales states that great weight should be given to conserving landscape and scenic beauty in National Parks and AONBs, which have the highest status of protection in relation to landscape and scenic beauty. The Planning Policy Wales identifies that minerals development should not take place in National Parks and AONBs, except in exceptional circumstances and where it can be demonstrated they are in the public interest. Climate change and land use change (e.g. due to agricultural reform associated with the UK's exit from the EU and Common Agricultural Policy) may also, in the longer term, lead to changes to landscape character.

4.8.3 Key Issues

The key sustainability issue arising from the baseline assessment for landscape and visual amenity is:

- The need to protect and improve the natural beauty of the region's AONBs, National Parks and other areas of natural beauty.
- The need to protect and improve the character of landscapes and townscapes.

5 Option and Screening Assessment

The screening process set out in Regulation 9 and Schedule 1 of the SEA Regulations includes two sets of criteria for determining the likely significance of effects on the environment. These relate firstly to the characteristics of the Drought Plan, and secondly to the characteristics of the effects and of the area likely to be affected. This assessment is informed by characteristics of the Drought Plan (see Section 2) the review of the environmental baseline (see Section 4) and the likely environmental effects of each drought management option which are presented in Sections 5.1 and 5.2 below. The potential for cumulative effects are discussed in Section 5.3. Hafren Dyfrdwy's judgments against the two sets of criteria for determining the likely significance of effects on the environment are presented in Section 5.4.

5.1 Demand-side measures

Assessment of the demand management options are presented in Table 14 below. In summary the potential effects regarding demand management actions will be associated with carbon emissions due to vehicle use and embodied carbon in materials; air quality due to vehicle emissions; congestion and nuisance due to transport of materials, street works and operational activities. These effects are either of low magnitude or short or temporary duration such that their significance is judged to be minor.

Water efficiency measures and increased leakage management will have sustained beneficial environmental effects due to reduced demands on water resources, reduced energy requirements for pumping and water treatment, and improved public awareness of the importance of water efficiency.

The demand side drought actions applicable in the most severe drought conditions could have greater duration and permanence with respect businesses and the local economy. However, the probability of these actions being implemented is extremely low.

Table 14: Demand Management Options – Likely Environmental Effects

Option	Likely Environmental Effects
Water efficiency measures	During normal operational conditions Hafren Dyfrdwy's may ask their customers to try and reduce the amount of water they use through various efficiency measures, these include: fitting a cistern displacement device, reducing the time spent in the shower, turning off the tap whilst cleaning their teeth etc. Hafren Dyfrdwy's will also carry out water efficiency property surveys and education within schools. Potential adverse environmental effects would include: • Greenhouse Gas Emissions – due to vehicle movements to enable visits to customer properties but at a small scale using standard sized cars so CO_2 emissions will be low. • Air Quality – small, localised, temporary increases in air emissions transport of personnel to home visits. Potential beneficial environmental effects would include: • Water Resources - due to reduction of water demand and associated abstractions, with indirect benefits to wider environment. • Public awareness – help promote the more efficient use of water by households by offering bespoke home visits providing water efficiency advice and retrofitting of water efficiency devices.
Increased leakage management	An additional action that Hafren Dyfrdwy can take to reduce the demand for water during a drought, is to increase leakage management activities. This would involve increasing the number of resources that are allocated to finding and fixing leaks. Potential adverse environmental effects would include:

Option	Likely Environmental Effects
	• Resource Use - due to minor use of materials for leakage repair. • Air Quality - localised intermittent increases in air emissions and dust arising from LGVs for transport of personnel and materials. • Greenhouse Gas Emissions - due to embodied carbon in materials, and emissions from transport fuel use. • Transport - due to local congestion and disruption associated with transport and disruption from street works. • Nuisance - Construction activities associated with leakage detection and repair activities may result in short term, localised minor nuisance effects associated with traffic and noise. • Local Economy - due to local disruption associated with street works. Potential beneficial environmental effects would include: • Water Resources - due to reduction of water demand and associated abstractions, with indirect benefits to wider environment. • Air Quality - due to reduced emissions associated with reduced energy consumption (from pumping and treatment). • Greenhouse Gas Emissions - due to reduced energy requirements for pumping and treatment; due to help toward increase resilience to climate change as the overall loss of water from the system will be reduced, reducing the water demand on the supply system.
Voluntary use restriction	As a drought becomes more severe Hafren Dyfrdwy would ask their customers to make voluntary use restrictions, these primarily include not using a hosepipe or sprinkler. A voluntary use restriction is not compulsory. Potential adverse environmental effects are considered very limited considering it is a request for reductions in water use on a voluntary basis. Potential beneficial environmental effects would include: • Water Resources - due to reduction of water demand and associated abstractions, with indirect benefits to wider environment. • Air Quality - due to reduced emissions associated with reduced energy consumption (from pumping and treatment). • Greenhouse Gas Emissions - due to reduced energy requirements for pumping and treatment; due to help toward increase resilience to climate change as the overall loss of water from the system will be reduced, reducing the water demand on the supply system. • Public awareness – help promote the more efficient use of water by households.
Temporary water use restrictions	As the drought becomes more severe, Hafren Dyfrdwy may have to introduce Temporary Use Bans (TUBs). Potential adverse environmental effects would include: • Recreation - domestic recreational impacts, for example people not being able to refill or maintain a domestic swimming pool or water gardens with a hosepipe or sprinkler. • Local Economy – the temporary use ban would include an exemption for commercial businesses in respect of the activities such as washing of private cars and washing of windows, however, there may be indirect effects to businesses which benefit from the sale of certain water-using appliances, such as hosepipes and sprinklers.

Option	Likely Environmental Effects
	Potential beneficial environmental effects would include: • Water Resources - due to reduction of water demand and associated abstractions, with indirect benefits to wider environment. • Air Quality - due to reduced emissions associated with reduced energy consumption (from pumping and treatment). • Greenhouse Gas Emissions - due to reduced energy requirements for pumping and treatment.
Restrictions on non-essential use through a drought order	Within the drought plan Hafren Dyfrdwy only consider the option of applying for a Drought Order to prohibit or limit the use of water. The main aim of this type of Drought Order is to extend existing restrictions that have been imposed on domestic customers, through the implementation of TUBs, to non-domestic customers. Potential adverse environmental effects would include: • Recreation - domestic recreational effects for example people not being able to refill or maintain a domestic swimming pool or water gardens with a hosepipe or sprinkler. • Recreation/tourism/visual amenity - there may be minor effects associated with the setting of tourist attractions, for example water features and parks/gardens associated with popular tourist sites. • Local Economy - the ban carries the risk of some economic effects on businesses that benefit directly or indirectly from certain water uses that would be prohibited under the ban (e.g. window cleaning businesses, some sports and leisure facilities, garden and landscape orientated businesses). Potential beneficial environmental effects would include: • Water Resources - due to reduction of water demand and associated abstractions, with indirect benefits to wider environment. • Air Quality - due to reduced emissions associated with reduced energy consumption (from pumping and treatment). • Greenhouse Gas Emissions - due to reduced energy requirements for pumping and treatment.

5.2 Supply-side measures

The supply-side option aimed at augmenting flows in the River Dee is the only supply side measure included in the Drought Plan 2019. In a drought, the Dee General Directions (DGD) define the principles and detail the conditions under which the prescribed flows and abstractions within the catchment must be reduced. During a drought, Hafren Dyfrdwy are required to further reduce their abstractions (below 'Safe yield allocations') by specified volumes depending on the storage in the Dee Storage System. How these reductions are made is determined by Hafren Dyfrdwy, they can be through reducing abstraction i.e. using less water and asking our customers to use less water, or by augmenting the River Dee with water from a different source. The preferred choice is to augment the River Dee using water from the Lower Pen-y-Cae Reservoir via the Trefechan Brook, a tributary of the Afon Eitha. The preparation and implementation time for augmentation of the River Dee with water from Lower Pen-y-Cae Reservoir would be less than a week. It is assumed that there is no new infrastructure required, however, a temporary pumping station at Lower Pen-y-Cae Reservoir may be required over the preparation period to enable augmentation of the River Dee.

Assessment of the supply option is presented in Table 14 below. In summary, during a severe drought this option would require the augmentation of flows by up to 0.8Ml/d. As no new permanent infrastructure is anticipated the likely environmental effects are limited to the area of influence

downstream of Lower Pen-y-Cae Reservoir and the small increase in flows (up to 0.8Ml/d) associated with this option. Abstraction would be within the existing Lower Pen-y-Cae Reservoir abstraction licence limit and would not extend beyond the minimum operating volume of the reservoir. It should also be noted that under baseline conditions the additional water in Lower Pen-y-Cae Reservoir (which is not abstracted for use) feeds the River Dee via Trefechan Brook, therefore the supply side augmentation does not represent a new source of water to the downstream watercourses. Therefore, the effects identified relate to the release of the water from Lower Pen-y-Cae Reservoir during dry periods and the quality of that water during such times. As identified by the HRA screening appraisal no Likely Significant Effects (LSE) are expected on the River Dee and Bala Lake SAC, the Berwyn and South Clwyd Mountains SAC/SPA or the Dee Estuary SAC/SPA/Ramsar as a result of the implementation of the augmentation of the River Dee with water abstracted from the Lower Pen-y-Cae Reservoir.

The SEA screening assessment in Table 15 below identifies that potential effects regarding Lower Pen-y-Cae Reservoir include moderate effects relating to water quality, fish and phytoplankton. The effects downstream in the Trefechan Brook include moderate adverse effects regarding water quality and minor adverse effects on aquatic ecology (macroinvertebrates, macrophytes and fish). Further downstream, in the Afon Eitha to the confluence with the Dee effects are considered to be limited to water quality effects only. As identified by the WFD assessment, further information is required in order to establish whether these effects have the potential for deterioration between WFD status classes for fish, macro-invertebrates or macrophytes and phytobenthos. There may be minor adverse effects as a result of those relating to water quality and ecology that relate to local users/activities associated with the reservoir and downstream watercourses such as those that relate the recreational use of the reservoir. The identified adverse effects would be short term, temporary and reversible. The option would result in beneficial effects that relate to the conservation of water resources within the Dee catchment which is essential to help maintain public water supplies during a period of drought.

Table 15: Screening of Supply Side Option for Impacts on European Sites

Option	Likely Environmental Effects
Augmenting the River Dee using water from Lower Pen-y-Cae Reservoir	Potential adverse environmental effects would include: • Water - levels in Lower Pen-y-Cae Reservoir would decrease at a faster rate than if the drought option was not in operation, however, abstraction would be within licence limits and would not extend beyond the minimum operating volume of the reservoir therefore the risk is minimal. • Water – potential for adverse effects regarding water quality in Lower Pen-y-Cae Reservoir. The WFD assessment identifies temporary deterioration risk between Chemical Status classes may occur, noting that this would be reversible. The WFD assessment also identifies that deterioration in Ecological status cannot be determined in the absence of information. • Water – the augmentation may introduce water of poorer quality to the Trefechan Brook (although this may be dry during times of drought) and the River Eitha which is considered to result in moderate adverse effects regarding water quality. • Water – downstream of the River Eitha the change (increase) in flows is considered small scale and unlikely to result in adverse effects – the option could release flows of up to 0.8Ml/d, this equates to 0.2% of the Q_{95} flow (Q_{95} = 530Ml/d) downstream of the confluence with the River Dee. • Biodiversity fauna and flora - as identified by the HRA screening appraisal, the abstraction and flow augmentation releases are not likely to have any LSE on the River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid SAC. • Biodiversity fauna and flora – the reduction in Lower Pen-y-Cae Reservoir levels and water quality could result in moderate adverse effects on fish and phytoplankton (including an increased risk of algal blooms). The drought plan includes mitigation measures for such effects and if necessary, aeration systems would be installed to increase oxygen levels and minimise fish distress. Prior to the implementation of the augmentation scheme, any requirements regarding the translocation of fish (including the selection of suitable receptor sites) will be agreed with NRW.

Option	Likely Environmental Effects
	• Biodiversity fauna and flora/water quality - the stream bed immediately downstream of the reservoir may initially be dry during times of drought, the release of 0.4-0.8Ml/d may have beneficial or adverse effects on the ecology of the downstream watercourses depending on the quality of the source water which is currently unknown. However, assuming water quality effects identified above regarding Lower Pen-y-Cae Reservoir there is the potential for minor adverse effects on the aquatic ecology (macroinvertebrates, macrophytes and fish) of the Trefechan Brook and to a lesser extent the River Eitha. There are no known issues relating to Invasive Non-native Species (INNS) which may be exacerbated by the operation of the supply option. • Recreation – if pumping is required there may be temporary minor disturbance to users of the reservoir (e.g. anglers and walkers). These effects would be mitigated as far as possible, such as by footpath diversions and screening. The potential for adverse effects to fish may adversely affect the angling resource of the reservoir. • Landscape and visual amenity - if a temporary pumping station is required by the option there is the potential for minor temporary adverse effects on visual amenity and users of the reservoir (e.g. anglers and walkers). • Air and climate - if a temporary pumping is required there would be minor temporary increases in air emissions including carbon dioxide. Potential beneficial environmental effects would include: • Population and human health - helps conserve water resources within the Dee catchment which is essential to help maintain public water supplies during a period of drought. • Population and human health/local economy - contributes to the maintenance of supply reliability in drought conditions, ensuring a resilient supply for customers and economic activity with no permanent adverse effects on the environment. • Landscape and visual amenity - the stream bed immediately downstream of the reservoir may initially be dry, the release of flows may therefore have some minor benefit regarding visual amenity.

5.3 Cumulative Effects

Cumulative effects associated with the Demand-side measures are limited to the likely cumulative beneficial effects on water resources and energy usage. Cumulative adverse effects are considered unlikely since any transport, congestion and nuisance effects will be localised.

The one supply-side measure will not result in any cumulative effects with the Demand-side measures and it does not conflict with the abstraction of water from Hafren Dyfrdwy water sources under normal licence conditions, including the management of the Dee Regulation Scheme. It should be noted that in drought conditions, the amount of water being abstracted from the environment would, in many cases, be less than the full licensed abstraction volumes due to restrictions in abstraction licences and/or lower availability of water in rivers, reservoirs and aquifers, precluding full abstraction.

5.4 Screening Assessment

Hafren Dyfrdwy's judgments against the two sets of criteria for determining the likely significance of effects on the environment set out in Regulation 9 and specified in Schedule 1 of the SEA Regulations (1. The characteristics of plans and programmes and 2. Characteristics of the effects and of the area likely to be affected) are shown in **Table 16**.

Table 16 Review of Hafren Dyfrdwy's Drought Plan in Relation to SEA Screening Criteria

Criteria for Determining the Likely Significance of Effects on the Environment[81]	Hafren Dyfrdwy's Response
1. Characteristics of the Hafren Dyfrdwy's Drought Plan, having regard to:	
The degree to which the Drought Plan sets a framework for projects and other activities, either with regard to the location, nature, size and operating conditions or by allocating resources.	The Drought Plan sets out the actions that the company will progress in order to continue during a period of drought, to discharge its duties to supply adequate quantities of wholesome water. These mainly relate to actions to control water demand including: measures to encourage customers to use water more efficiently; increased leakage detection activities; and voluntary use restrictions. In the most severe drought conditions actions to control water demand include temporary water use restrictions and restrictions on non-essential use through a drought order. The Drought Plan includes one supply side option which involves augmentation of the River Dee using water from Lower Pen-y-Cae Reservoir which means that abstractions can continue for longer further downstream. The Drought Plan does not set a framework for development of projects requiring construction of new supply schemes.
The degree to which the Drought Plan influences other plans and programmes including those in a hierarchy.	The Drought Plan and associated drought triggers are linked and consistent with the Hafren Dyfrdwy's WRMP19.
The relevance of the Drought Plan for the integration of environmental considerations in particular with a view to promoting sustainable development.	Drought plans set out how an undertaker will supply water to its customers during periods of low rainfall when water supply becomes depleted, whilst minimising any negative impacts, (including on customers, businesses and the environment) of its actions during a drought.
Environmental problems relevant to the Drought Plan.	The drought actions included in the plan mainly relate to measures to control water demand with limited potential for adverse effects to the environment, society or economy. The demand side drought actions applicable in the most severe drought conditions could have greater significance with respect businesses and the local economy. However, the probability of these actions being implemented is extremely low. The Drought Plan includes one supply side option which involves augmentation of the River Dee using water from Lower Pen-y-Cae Reservoir. This would not require construction of any new permanent infrastructure. Therefore, environmental problems relevant to the plan are relatively limited to the small area of influence downstream of Lower Pen-y-Cae Reservoir and the small increase in flows associated with this option. Abstraction would be within the existing Lower Pen-y-Cae Reservoir abstraction licence limit. The abstracted water would be released to augment flows in the River Dee via the Trefechan Brook and Afon Eitha. The abstraction and flow augmentation releases are not likely to have any significant effect on the River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid SAC. There is the potential for minor to moderate adverse effects mainly relating to water quality in Lower Pen-y-Cae Reservoir, the Trefechan Brook and Afon Eitha. However, the effects identified would be short term, temporary and reversible.

[81] The Environmental Assessment of Plans and Programmes Regulations (Schedule 1) Available at http://www.opsi.gov.uk/si/si2004/20041633.htm. Accessed 20/11/2017

Criteria for Determining the Likely Significance of Effects on the Environment[81]	Hafren Dyfrdwy's Response
The relevance of the Drought Plan for the implementation of Community legislation on the environment (for example, plans and programmes linked to waste management or water protection).	The Drought Plan will have no adverse effects on European sites. The WFD screening assessment of the plan concluded that the demand management options are not likely to pose any WFD deterioration risks, either alone or in combination with other plans and projects. However, limited by lack of information, the assessment identified the potential for temporary and reversible WFD deterioration risks regarding Lower Pen-y-Cae Reservoir and River Eitha waterbodies. Further investigation to provide a higher degree of certainty for the assessment is required.
2. Characteristics of the effects and of the area likely to be affected, having regard, in particular, to	
The probability, duration, frequency and reversibility of the effects	With reference to the effects described in Section 5.1, potential effects regarding demand management actions will be associated with carbon emissions due to vehicle use and embodied carbon in materials; air quality due to vehicle emissions; congestion and nuisance due to transport of materials, street works and operational activities (meter reading). These effects are either of low magnitude or short or temporary duration such that their significance is judged to be minor. Water efficiency measures and increased leakage management will have sustained beneficial environmental effects due to reduced demands on water resources, reduced energy requirements for pumping and water treatment, and improved public awareness of the importance of water efficiency. The demand side drought actions applicable in the most severe drought conditions could have greater duration and permanence with respect businesses and the local economy. However, the probability of these actions being implemented is extremely low. The one supply side drought option would operate within in licence and have short duration (dependent on the storage in the Dee Storage System but assumed to be less than six months), temporary and reversible effects.
The cumulative nature of the effects of the Drought Plan.	Cumulative effects of the Drought Plan will encompass no further effects than those listed above. Transport, congestion and nuisance effects will be localised. The demand management actions will have a beneficial cumulative effect on water resources and energy usage.
The trans-boundary nature of the effects of the Drought Plan.	The Drought Plan recognises the scope for water trading with other companies. New imports from other companies are not included in the Drought Plan (or WRMP19) due to the forecast supply surplus and, although discussions with neighbouring companies regarding possible new exports have been ongoing during pre-consultation for the Drought Plan, no additional resources are proposed to provide any new bulk water transfers to other companies. The Drought Plan will therefore have no trans-boundary effects.
The risks to human health or the environment (e.g. due to accidents).	The Drought Plan is aimed at maintaining supply of wholesome water during a period of drought, thus seeking to minimise risks to human health.
The magnitude and spatial extent of the effects (geographical area and size of the population	The effects of the Drought Plan are unlikely to extend beyond Hafren Dyfrdwy's supply area. The population likely to be adversely affected by the deployment of demand

Criteria for Determining the Likely Significance of Effects on the Environment[81]	Hafren Dyfrdwy's Response
likely to be affected) by the Drought Plan.	management schemes at any one time is considered to be small. The demand side drought actions applicable in the most severe drought conditions could have greater spatial extent, however, the probability of these measures being implemented is extremely low and the situation is likely to be the same in the surrounding region and associated water companies.
The value and vulnerability of the area likely to be affected by the Drought Plan due to: Special natural characteristics or cultural heritage Exceeded environmental quality standards or limit values or Intensive land use And The effects of the Drought Plan on areas or landscapes which have recognised national, community or international protection status.	The Hafren Dyfrdwy's supply area encompasses sensitive areas of high value designated for cultural heritage, landscape and biodiversity. The proposed demand management actions will predominantly comprise street works and as such are unlikely to have significant effects on the quality or integrity of these areas. Any effects on setting potentially caused by street works would be temporary and mitigated through best construction practice. Disturbance of buried cultural heritage through excavation is very unlikely as leak repair will involve excavation of previously disturbed ground only, and will be limited in nature. HRA screening identified that abstraction and flow augmentation releases associated with the one supply side option are not likely to have any significant effect on the River Dee and Bala Lake/Afon Dyfrdwy a Llyn Tegid SAC. No significant effects to other areas or landscapes (such as Snowdonia or the Clwydian Range and Dee Valley AONB) which have recognised national, community or international protection status are anticipated.

6 Determination

Having referred to **Figure 1**, reviewed the relevant plans and policies and the environmental baseline, and subsequently having reviewed the characteristics of the Drought Plan 2019 against the criteria listed in **Table 15**, Hafren Dyfrdwy considers that SEA is not required for the Drought Plan 2019. This conclusion was agreed with Natural Resources Wales and Cadw (see Section 8 below) as part of the consultation on the draft Drought Plan and associated regulatory responses.

7 Consultation

As required under the provisions of the SEA Regulations in England and Wales, the following organisations were consulted as part of the SEA screening exercise:

- Natural Resources Wales (NRW)
- Cadw

Following consultation on the HRA, WFD and SEA screening reports for the draft Drought Plan 2019 and in in light of comments received from NRW regarding the Lower Pen-Y-Cae option further discussions were held with respect to both the SEA and HRA screening to address concerns raised. This resulted in some additional work and updates principally in relation to conditions described in the Dee General Direction. This has been reflected in this report and the updated HRA and WFD screening reports. A copy of this report has also been sent to each SEA statutory body.

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