Dŵr Cymru Welsh Water

Environmental Assessment of Nant-y-Moch Drought Permit (8203-2)

Final

March 2019

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NON-TECHNICAL SUMMARY

INTRODUCTION AND PURPOSE OF THIS REPORT

Welsh Water's Drought Plan provides a comprehensive statement of the actions Welsh Water will consider implementing during drought conditions to safeguard essential water supplies to customers and minimise environmental impact. It encompasses a number of drought management options that will only be implemented if and when required and includes drought permit / order options.

A drought permit or order is a management action that, if granted, can allow more flexibility to manage water resources and the effects of drought on public water supply and the environment.

The objective of this report is to provide an independent and robust assessment of the potential environmental effects of implementing a drought permit at Nant-y-Moch Reservoir, over and above those arising due to natural effects of drought and those which would occur under "normal" abstraction licence conditions.

Nant-y-Moch Reservoir is located in Welsh Water's North Ceredigion Water Resource Zone (WRZ) which covers the land around the coastal and inland area surrounding Aberystwyth. Water from Nant-y-Moch reservoir discharges into the Afon Rheidol to Dinas Reservoir.

The assessment also considers how the proposed drought permit may affect the environment in combination with the effects of other existing abstraction licences, environmental permits and other drought management plans.

This report is a 'shelf-copy' report which would be updated to support an application to Natural Resources Wales (NRW) for a drought permit at Nant-y-Moch, which may be required by Welsh Water in the future.

PROPOSED DROUGHT PERMIT DETAILS

In order to protect essential public water supplies within Welsh Water's North Ceredigion WRZ in the event of a future severe drought, Welsh Water would make an application to NRW for a drought permit to vary the conditions of its abstraction licence from Nant-y-Moch reservoir.

If granted, the drought permit involves a temporary pumped abstraction from Nant-y-Moch Reservoir, of up to 5Ml/d, to be transferred into the raw water main between Llyn Llygad Rheidol Reservoir and Bontgoch WTW, to support demands in the North Ceredigion WRZ. The drought permit has the potential to provide a substantial increase in water resource during a drought, for a period of up to six months.

This permit holds an all year period of implementation, as confirmed by water resources modelling carried out by Welsh Water.

The revised abstraction arrangements would legally be authorised for 6 months but would be removed sooner if water resources have returned to adequate levels to safeguard future water supplies, as agreed with the Welsh Ministers / NRW.

NEED FOR THE DROUGHT PERMIT

Application for a drought permit is a precautionary approach. Due to the time needed to determine a drought permit application, Welsh Water will potentially apply for a drought permit more frequently than it will be used.

The justification for the drought permit sought will be set out in a "Needs Statement". This will be produced by Welsh Water at the time of a potential future application, and will form part of the full drought permit application.

ALTERNATIVE SOURCES CONSIDERED

Details of alternative sources considered by Welsh Water will be completed at the time of application for the drought permit at Nant-y-Moch. This will demonstrate justification for the proposed drought option details applied for.

POTENTIAL IMPACTS OF DROUGHT PERMIT IMPLEMENTATION

The scope of the assessment has been defined by a screening and scoping exercise.

Summary of the Hydrological Assessment

The assessment has concluded there is **negligible** impact on water levels in Nant-y-Moch Reservoir as a result of implementing the drought permit. Flow in the Afon Rheidol downstream of the reservoir outflow is unlikely to be changed relative to the baseline drought scenario. Therefore, the hydrological impact of the drought permit has been assessed as being **none** on the Afon Rheidol downstream of the reservoir outflow.

Summary of the Environmental Features Screening

In accordance with national drought planning guidance, environmental assessment is neither required nor included for features where screening has identified a minor or negligible impact. Screening has not identified any environmental features for which environmental assessment is required. No environmental impacts have, therefore, been identified for any of the features identified in the screening exercise.

Cumulative Impacts

No cumulative effects of implementing the Nant-y-Moch drought order with other drought order / permit schemes have been identified. However, this should be reviewed at the time of any future application for a drought order at Nant-y-Moch Reservoir.

MITIGATION AND MONITORING

The environmental assessment has identified significant impacts of implementation of a drought permit at Nant-y-Moch. Consequently, in line with the DPG, an Environmental Monitoring Plan has been proposed. Potential mitigation measures have also been proposed and further discussion with NRW is required in order to develop suitable mitigation measures.

CONCLUSIONS

In summary, it has been concluded that the environmental effects on river flows, water quality and ecology of implementing a drought order at Nant-y-Moch, over and above those conditions that already exist under "normal", i.e. licensed, baseline conditions, with the onset of a natural drought, would be **negligible**.

Contents

1 INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

The objective of this Environmental Assessment Report (EAR) is to provide an independent and robust assessment of the potential environmental effects of the implementation of a drought permit by Dŵr Cymru Welsh Water (Welsh Water) to temporarily abstract from Nant-y-Moch Reservoir of up to 5Ml/d, to help to protect resource in the reservoirs in the Water Resources Zone during drought conditions. Nant-y-Moch Reservoir is operated by Statkraft Energy Ltd for the purposes of hydro-electric power generation, Welsh Water do not currently abstract any water directly from Nant-y-Moch Reservoir.

This EAR is a 'shelf-copy' report which would be updated in the event that Welsh Water needs to make an application during any future drought to Natural Resources Wales (NRW) for a drought permit at Nant-y-Moch Reservoir. A drought permit is a management action that, if granted, can help ensure essential water supplies are maintained to homes and businesses. The circumstances under which a drought permit may be required is set out in the Welsh Water Drought Plan.

The assessment presented in this EAR considers the effects of implementation of the all year drought permit. The drought permit has the potential to provide a modest increase in water resource during a drought, for a period of up to six months. The purpose of the assessment is to determine the environmental impacts of the drought permit over and above any effects arising from natural drought conditions.

The study area and focus of this environmental assessment of the Nant-y-Moch drought permit, covers the following waterbodies:

- Nant-y-Moch Reservoir (GB31037596)
- Rheidol - conf with Llechwedd-mawr to conf with Castell (GB110063041570)

This EAR includes discussion of the following:

- an assessment of the likely changes in river flow / water level regime due to implementing the proposed drought permit (**for a summary, see Section 4 of this report**)
- identification of the environmental features that are sensitive to these changes and an assessment of the likely impacts on these features (**see Section 5 of this report**)
- identification of mitigation measures that may be required to prevent or reduce impacts on sensitive features (**see Section 6 of this report**)

- recommendations for baseline, in-drought and post-drought permit monitoring requirements (**see Section 9 of this report**).

The environmental assessment has been conducted in accordance with Government regulations and using the Welsh Government / Natural Resources Wales (NRW) Drought Plan Guideline[1] (DPG); specifically Section 5 and Appendices I and J, and Welsh Government / Defra / NRW / Environment Agency guidance on drought permits and drought orders[2].

Consideration has been given to the potential impacts of drought permit implementation on statutory designated sites, including those designated under international law (Habitats Directive, Birds Directive and the Ramsar Convention) and national legislation (notably Sites of Special Scientific Interest (SSSIs).

In accordance with the DPG, the assessment also considers how the proposed drought permit may affect the environment in combination with the effects of existing abstraction licences, environmental permits and other relevant activities and plans. This is discussed further in Sections 3 and 7.

1.2 SUPPORTING STUDIES

The DPG identifies in Section 5.4 that EARs are required as supporting documents to any drought permit or drought order application. The circumstances for which an environmental assessment is required are set out in **Box 1** below.

Box 1: Drought Plan Guidance - requirement for environmental assessment

The DPG requires that all features that could be affected by implementation of a drought order /permit are listed in the EAR and that an assessment is made of how sensitive each feature is to the likely changes in hydrology, hydrogeology and geomorphology, due to implementing the drought order /permit.

The DPG requires a detailed environmental assessment for applications where sensitive features are likely to be subject to a major or moderate impact, or a minor impact where this applies to environmentally designated features. Further environmental assessment is **not** required for those drought orders / permits where there is certainty that there are no such impacted sensitive features.

This environmental assessment is based on data available at the time of writing and includes the environmental features and data types determined by Box 1 in Appendix I of the DPG (except where these are considered not to be relevant to this drought

[1] Natural Resources Wales (2017) *Water Company Drought Plan Technical Guideline*. Available at https://cdn.naturalresources.wales/media/684414/final-wc-drought-plan-guidance-2017.pdf?mode=pad&rnd=131656713580000000, Accessed 04 February 2019.
[2] Welsh Government / Defra / Natural Resources Wales / Environment Agency (2015) *Apply for a drought order or emergency drought order*, https://www.gov.uk/government/collections/apply-for-a-drought-permit-drought-order-or-emergency-drought-order Accessed 21 December 2018.

permit). Data were requested from key consultees (including NRW).

Where appropriate, this report also identifies areas where there are deficiencies in data availability and makes recommendations for future data / information gathering and monitoring. Welsh Water will continue to engage closely with NRW to ensure that adequate and sufficient data / information are collated and kept up-to-date in subsequent years to inform future environmental assessments.

1.3 CONSULTATION

Consultation is identified as an essential exercise in the preparation of the EAR. In preparing this 'shelf-copy' EAR for a drought permit at Nant-y-Moch Reservoir, consultation with regulators and wider stakeholders has been undertaken to gain feedback on potential adverse effects, gather data and discuss any required monitoring and / or mitigation measures.

Further consultation will be also be undertaken at the time of any future applications for the drought permit.

1.4 STRUCTURE AND CONTENT OF THE REPORT

This EAR comprises the following sections:

Section 1: Introduction

Section 2: Background to the Drought Permit

Section 3: Approach

Section 4: Hydrology and the Physical Environment

Section 5: Environmental Features Assessment

Section 6: Mitigation

Section 7: Cumulative Impacts

Section 8: Summary of Residual Impacts

Section 9: Environmental Monitoring Plan (EMP)

Section 10: Conclusions

2 BACKGROUND TO THE DROUGHT PERMIT

2.1 WELSH WATER'S SUPPLY SYSTEM

Welsh Water supplies water to more than 3 million people. The Welsh Water supply area covers the majority of Wales and a small part of England. It is split into 24 WRZ's (see **Figure 2.1**).

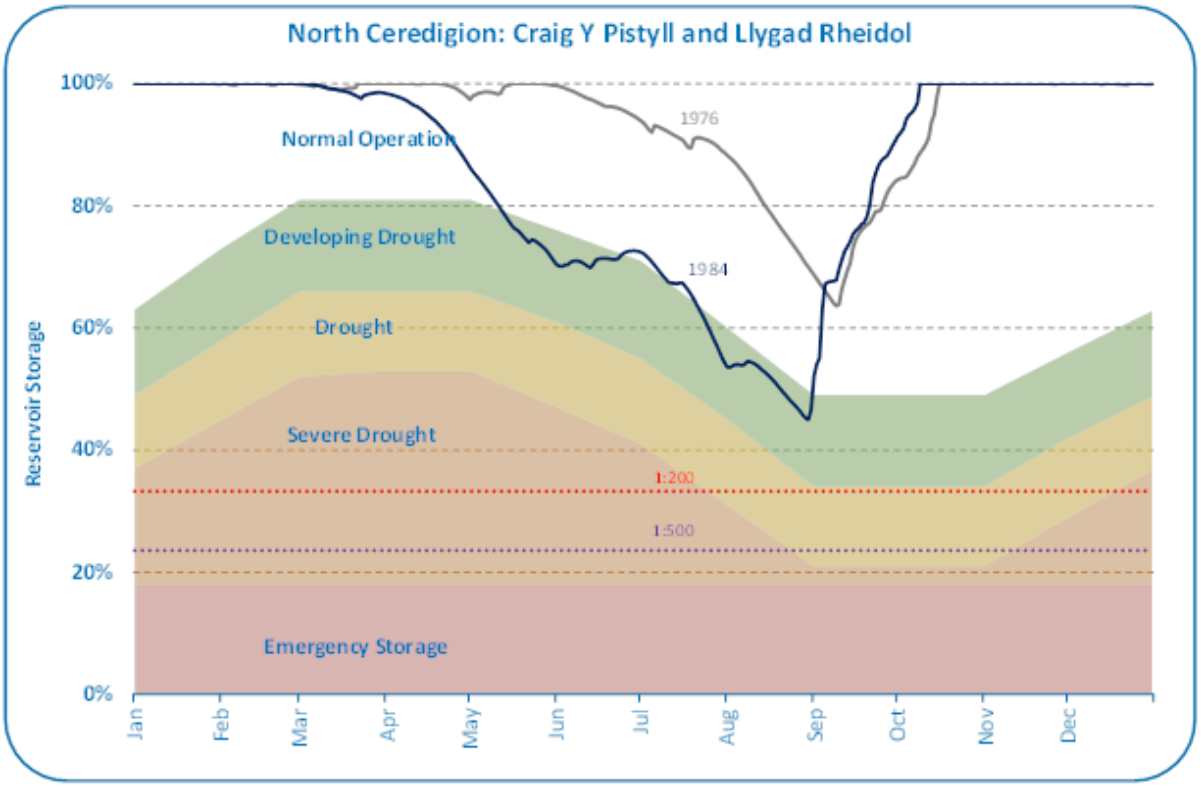
Figure 2.1 Welsh Water Water Resource Zones

The North Ceredigion WRZ covers the covers the land around the coastal and inland area surrounding Aberystwyth.

The trigger levels for applying for a drought permit at Nant-y-Moch are based on the combined storage in Craig y Pistyll and Llygad Rheidol reservoirs falling below a defined threshold level as shown in **Figure 2.2** (orange shading labelled 'severe drought'). Welsh Water's assessment in its draft Drought Plan 2020 indicates that drought conditions severe enough to require an application for this drought option are unlikely to occur more frequently than at a return period of around once every 200 to

500 years. Fuller details of the work undertaken to assess this risk are provided in Annex 1 to the draft Drought Plan 2020.

Figure 2.2 North Ceredigion WRZ : Craig y Pistyll and Llygad Rheidol Drought Action Zones and Historic Droughts



2.2 DESCRIPTION OF EXISTING ARRANGEMENTS AT NANT-Y-MOCH RESERVOIR

Welsh Water do not currently abstract any water directly from Nant-y-Moch Reservoir, although they do abstract from two of the reservoir's inflow streams (Maesnant Stream and Nant-y-Moch Stream), and also from the nearby Llyn Llygad Rheidol reservoir located in the upper catchment above Nant-y-Moch Reservoir.

Nant-y-Moch Reservoir is operated by Statkraft Energy Ltd for the purposes of hydro-electric power generation. It forms part of a 55Mw scheme in the Afon Rheidol valley, the Cwm Rheidol scheme. The scheme includes three reservoirs (the others being Dinas Reservoir and Cwm Rheidol Reservoir further downstream) and three hydro-electric generating stations.

Statkraft Energy Ltd's licence (number 22/63/1/0024, variation 1) to abstract water from Nant-y-Moch Reservoir for the purposes of hydro-electric power generation includes the following conditions:

- 171,000 million litres (Ml) authorised to be abstracted from Nant-y-Moch Reservoir per annum

- Provision of a minimum uniform statutory compensation water discharge of 13.638Ml/d from Nant-y-Moch Reservoir to the Afon Rheidol.

Details of Statkraft's operating arrangements are currently not known, although it is understood that up to 160Ml/d may be released from Nant-y-Moch Reservoir to drive a 13Mw hydro-electric plant as the water passes downstream via the Afon Rheidol to Dinas Reservoir. The abstraction licence also includes statutory compensation flow requirements from Dinas Reservoir and Cwm Rheidol Reservoir to the Afon Rheidol downstream of each reservoir.

Welsh Water's licence (number 22/63/1/27/4) to abstract water under the Water Resources Act at Nant-y-Moch Stream includes the following conditions:

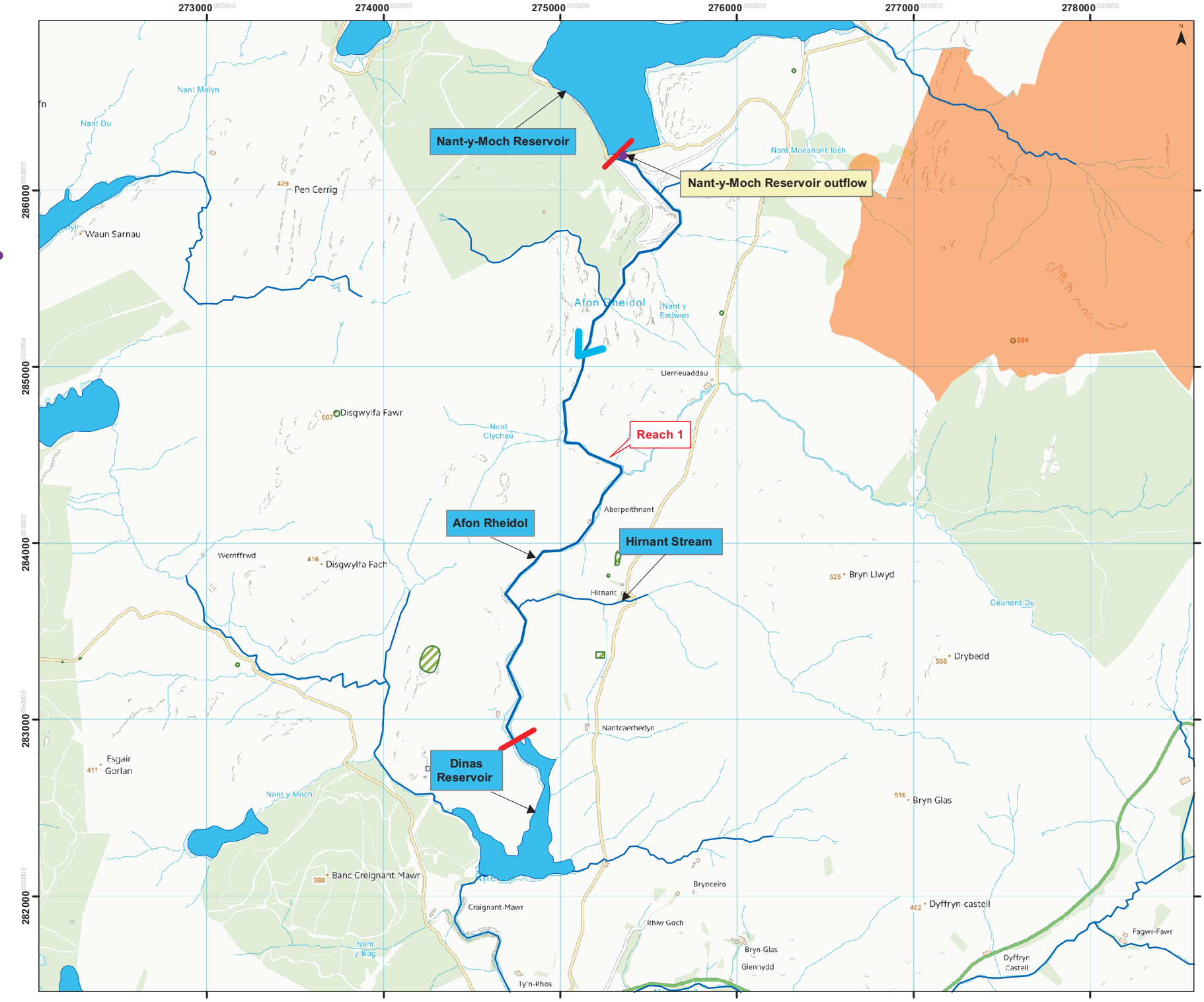
- 318.2Ml authorised to be abstracted from Nant-y-Moch stream per annum.
- At an abstraction rate not exceeding 6.82Ml/d.
- Subject to a prescribed flow of 0.1Ml/d downstream of the abstraction intake.

Welsh Water's licence (number 22/63/1/0005) to abstract water under the Water Resources Act 1991 at Llyn Llygad Rheidol Reservoir includes the following conditions:

- 1,569 million litres (Ml) authorised to be abstracted from Llyn Llygad Rheidol per annum.
- At an abstraction rate not exceeding 5Ml/d.

Water abstracted from Llyn Llygad Rheidol Reservoir is transferred in a pipeline, 9.5km west of the study area to Bontgoch water treatment works (WTW) for treatment and public supply for the North Ceredigion Water Resource Zone (WRZ). During dry weather conditions, water from the Maesnant and Nant-y-Moch Stream intakes is also transferred into this pipeline.

The study area is illustrated on **Figure 2.3**.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Nant-y-Moch Reservoir
Nant-y-Moch Reservoir outflow
Reach 1
Afon Rheidol
Hirnant Stream
Dinas Reservoir
Nant Melyn
Nant Du
Pen Cerrig
Waun Sarnau
Nant Maesnant Isaf
Afon Rheidol
Nant y Fedwen
Llerneuaddau
Disgwylfa Fawr
Nant Clychau
Aberpeithnant
Wernffrwd
Disgwylfa Fach
Hirnant
Bryn Llwyd
Ceunant Du
Drybedd
Nantcaerhedyn
Esgair Gorlan
Nant-y-Moch
Bryn Glas
Banc Creignant Mawr
Craignant-Mawr
Brynceiro
Rhiw Goch
Dyffryn castell
Fagwr-Fawr
Nant y Bog
Bryn-Glas
Glennydd
Dyffryn Castell
Ty'n-Rhos
Legend
Abstraction
Hydrological Reach
Water Courses
Flow Direction
Reservoir
Site of Special Scientific Interest
Scheduled Ancient Monuments
RICARDO
Dŵr Cymru Welsh Water
1:20,000
Note: All locations are approximate
This drawing incorporates Ordnance Survey Information
© Crown copyright and database rights 2019
Project Title: Welsh Water Drought Plan Environmental Assessment
Figure Title: Study Area: 8203_2 Pumped abstraction from Nantymoch (a HEP reservoir) into the raw water
Figure Number: Figure 2.2
Date: February 2019

2.3 WELSH WATER'S DROUGHT PLANNING PROCESS

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

> *4(b) for a revised drought plan –*
>
> *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.*

2.4 STATEMENT OF THE NEED FOR DROUGHT PERMIT

This section will be completed at the time of application for a drought permit.

2.5 DROUGHT PERMIT– REGULATORY ARRANGEMENTS

In periods of unusually low rainfall, when water resources become scarce, the Water Resources Act 1991, as amended by the Environment Act 1995 and the Water Act 2003, allows for three mechanisms for temporarily augmenting water supplies from rivers, lakes, reservoirs and groundwaters: drought permits; ordinary drought orders; emergency drought orders.

Drought permits are granted by NRW, and allow a water company powers to abstract from specified water sources, or to modify or suspend the conditions set out in existing abstraction licences. Drought orders are granted by the Welsh Ministers and give powers either to a water company or to NRW to abstract from specified water sources, or to modify or suspend the conditions set out in existing abstraction licences, but also to allow the discharge of water to specified places, modify or suspend conditions relating to a discharge or prohibit or limit particular non-essential uses of water as set out in the Drought Plan (Wales) Direction 2017. Emergency drought orders grant the same powers as a drought order, but in addition, confer powers to prohibit or limit water uses as specified by the water company and allow the set up and supply of water by means of standpipes and/or water tanks or rota cuts.

Drought permits and orders may be granted for a period of up to six months and they can be extended for up to a further six months.

As part of the drought order/permit application process, water companies are required to prepare an Environmental Report setting out anticipated effects of the proposal, including the effect on other abstractors and sufficient information to inform assessments, where applicable, in relation to the Habitats Directive, Countryside and Rights of Way Act (CRoW), and the Water Framework Directive (WFD).

Further information on the requirements for the environmental assessment and reporting according to legislation and national guidance are provided in Section 3.

2.6 REVIEW OF ALTERNATIVE OPTIONS

This section will be completed at the time of application for a drought permit, setting out the alternative options to the drought permit that Welsh Water has considered in addressing the risks to essential public water supplies due to drought.

2.7 PROPOSED DROUGHT PERMIT DETAILS

In order to protect essential public water supplies within Welsh Water's North Ceredigion WRZ in the event of a future severe drought, Welsh Water may need to make an application to NRW for a drought permit to vary the conditions of its abstraction licence from Nant-y-Moch Reservoir.

If granted, the drought permit involves a temporary pumped abstraction from Nant-y-Moch Reservoir, of up to 5Ml/d, to be transferred into the raw water main between Llyn Llygad Rheidol Reservoir and Bontgoch WTW, to support demands in the North Ceredigion WRZ. The drought permit has the potential to provide a modest increase in water resource during a drought, for a period of up to six months.

It is assumed for the purposes of this assessment that there would be zero flow in either Maesnant stream or Nant-y-Moch stream and no abstraction from those sources during a drought permit, with abstractions only occurring from Llyn Llygad Rheidol.

The temporary pumped abstraction will potentially influence water levels in Nant-y-Moch Reservoir and flows in the downstream Afon Rheidol.

Table 2.1 Nant-y-Moch Reservoir Existing and Proposed Drought Permit Abstraction

Abstraction Water Source	NGR	Normal Abstraction	Proposed Drought Permit Abstraction	Benefit Ml/d
Nant-y-Moch Reservoir	SN 75426 86228	Welsh Water's licence (number 22/63/1/27/4) to abstract water under the Water Resources Act at Nant-y-Moch Stream includes the following conditions: • 318.2Ml authorised to be abstracted from Nant-y-Moch stream per annum. • At an abstraction rate not exceeding 6.82Ml/d. • Subject to a prescribed flow of 0.1Ml/d downstream of the abstraction intake. Welsh Water's licence (number 22/63/1/0005) to abstract water under the Water Resources Act 1991 at Llyn Llygad Rheidol Reservoir includes the following conditions: • 1,569 million litres (Ml) authorised to be abstracted from Llyn Llygad Rheidol per annum. • At an abstraction rate not exceeding 5 Ml/d.	Temporary pumped abstraction from Nant-y-Moch Reservoir, of up to 5 Ml/d, to be transferred into the raw water main between Llyn Llygad Rheidol Reservoir and Bontgoch WTW, to support demands in the North Ceredigion WRZ.	5 Ml/d

[Note: it will probably be necessary to remove the NGR for any public domain version]

2.8 DROUGHT PERMIT PROGRAMME

Drought permits may remain in force for a period of up to six months, and they can be extended for up to a further six months.

Prevailing weather conditions and rainfall in the intervening period may delay the requirement for applications, or even result in no requirement to apply. A permit may be granted but not actually implemented if weather conditions improve or, equally, the permit may only be partially implemented.

2.9 DROUGHT PERMIT BASELINE

It is important for the assessment to establish the environmental "baseline" conditions that would exist in drought conditions but in the absence of the drought permit being implemented. For the purposes of this assessment, the "without drought permit" baseline includes the continuation of abstraction from two of the Nant-y-Moch Reservoir's inflow streams, (Maesnant Stream and Nant-y-Moch Stream), and also from the nearby Llyn Llygad Rheidol reservoir located in the upper catchment above Nant-y-Moch Reservoir.

3 APPROACH

3.1 INTRODUCTION

The DPG states that the environmental report must include:

i. the likely changes in flow, level, channel/riparian form and sediment due to implementing the action;
ii. the features that are sensitive to these changes;
iii. potential impacts on sensitive features;
iv. a plan of baseline, in-drought and post-drought monitoring; and
v. mitigation or compensation measures that may be required

Items i and ii above were subject to an initial screening process as part of the scoping exercise. Section 3.2 below describes the approach taken. This has provided the relevant study area and a list of features scoped into the environmental assessment which are the subject of this EAR.

Section 3.3 describes how the environmental assessment has been undertaken, including discussion of the general approach, guidance used, provision of data, assessment methodologies and consideration of mitigation and monitoring. Limitations to the environmental assessment are described in Section 3.4, 4 and 5.

To set the context of the studies, it should be noted that EAR considers the environmental impacts of implementing a drought permit during the worst environmental conditions (natural drought) that the permit could be implemented in.

In accordance with the DPG and the Habitats Regulations, the assessment considers how the proposed drought permit may affect the environment in combination with the effects of other existing abstraction licences, environment permits and other plans. This includes assessment of the potential cumulative effects of the following:

- Welsh Water's existing abstraction licences that operate within the hydrological zone of influence of the drought option, as well as other abstraction and discharge consents
- Assessment of cumulative impacts of the drought permit with other Welsh Water supply side and drought permit / order options within the hydrological zone of influence (including both intra- and inter- zone options)
- Other plans and projects of relevance, including:
    - Welsh Water's WRMP schemes which are scheduled to be implemented and become operational within the time period of the revised Drought Plan (i.e. before 2025)

- Drought options from other neighbouring water company Drought Plans, Natural Resource Wales Drought Plans
- National Policy Statements for Wastewater and Renewable Energy Infrastructure.

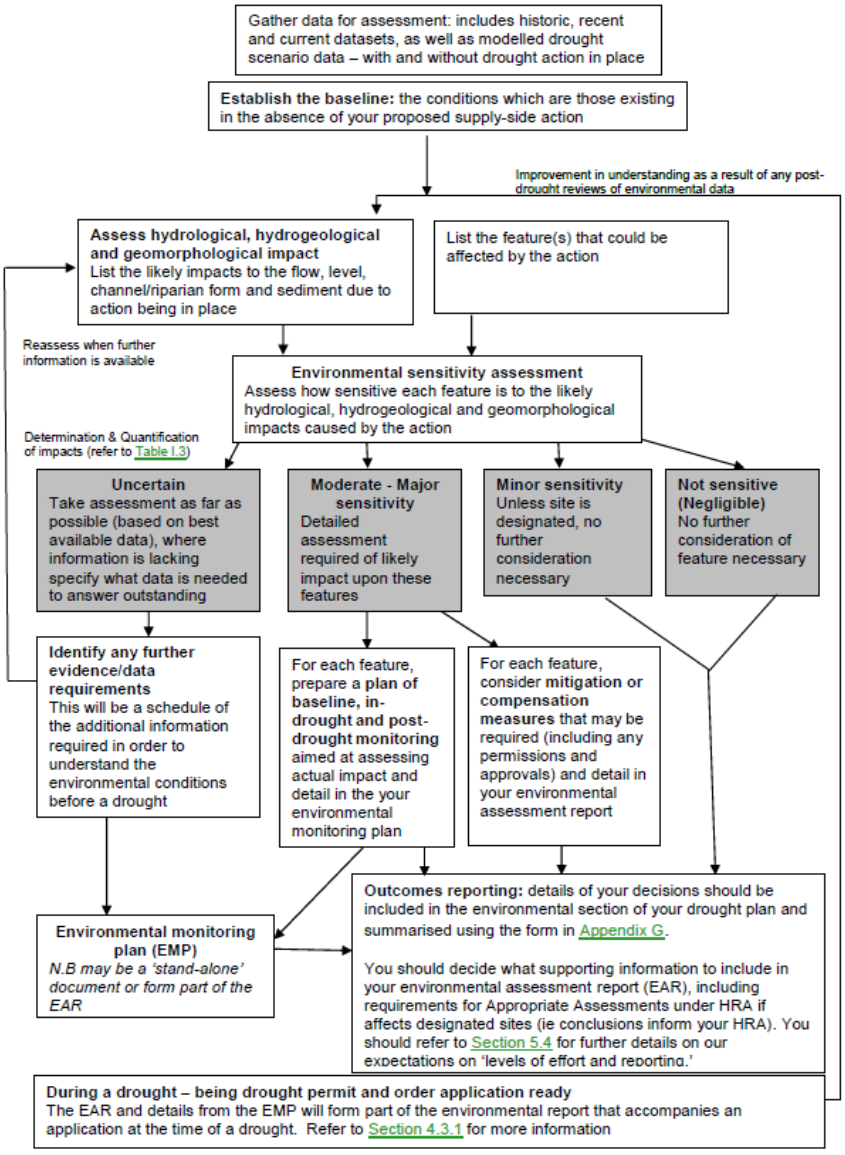
This is discussed further in Section 7.

3.2 APPROACH TO SCREENING AND SCOPING

3.2.1 Screening

Screening was undertaken using the DPG; specifically Section 5 and Appendix I. Figure 2 of the DPG (replicated in **Figure 3.1** below) identifies the environmental impact activities required.

Figure 3.1 Environmental Impact Activities Identified in the Drought Plan Guideline



The screening fulfils the requirement to "Assess how sensitive each feature is to the likely hydrological, hydrogeological and geomorphological impacts caused by the action". Stage 1 (hydrological impact) fulfils the requirement to "List the likely impacts to the flow, level, channel/riparian form and sediment due to action being in place". Stage 2 (environmental sensitivity) fulfils the requirement to "list the feature(s) that could be affected by the action" and to "Assess how sensitive each feature is to the likely hydrological, hydrogeological and geomorphological impacts caused by the action"

It is important to acknowledge the basis of the assessment; i.e. impacts of drought permit implementation should be considered in the context of what would occur without drought permit implementation (see Sections 2.2, 2.7 and 2.9).

The approach to undertaking Stages 1 and 2 is described below.

Stage 1 – Hydrological and Hydrogeological Impact

Consideration is required (by the DPG) of the likely impacts on the hydrology, hydrogeology and geomorphology of every river reach, wetland or lake area influenced by the proposed drought management action, specifically:

- identify the drought conditions which trigger the proposed action;
- identify any changes that the action is likely to bring about, specifying their length, severity and location in relation to existing natural and artificial features;
- describe the likely conditions in the absence of the proposed action;
- describe how the likely conditions would differ with the action in place compared to the same (or analogous) watercourse under natural conditions; and
- identify the extent of the area affected by the planned actions.

The hydrogeological and hydrological information is used together with information on the other environmental features in the study area from Stage 2 - Environmental Sensitivity (see below) to identify the environmental risk of implementing the drought permit.

Although the DPG informs the hydrometric data to be used as part of environmental features for consideration within the environmental assessment (see Box 1 Appendix I of the DPG), it does not provide a methodology for identifying the hydrological impact. A bespoke assessment has therefore been undertaken.

The full hydrological assessment approach is set out in **Appendix A**.

The output from these studies provides an understanding of the scale of change in the

hydrological characteristics as a result of implementing the drought permit. Where changes have been identified, the potential significance of adverse or beneficial impacts has been assessed.

Quantitative and qualitative measures have been used to grade the impacts on surface waters. The assessment has identified the potential severity of impact based on the following criteria:

- **Positive or Negative Impact** – all impacts are considered to be negative unless otherwise stated in the feature assessment.
- **Extent** – the extent of the impact is covered as part of the magnitude consideration.
- **Magnitude** – the magnitude of the impact is identified as**:**
  - *High*: There is a long-term large-scale (i.e. catchment) change in the physical environment.
  - *Medium*: There is a short-term large-scale change or long-term short-scale (i.e. reach) change in the physical environment, however, no changes in the overall integrity of the physical environment.
  - *Low*: There is a short-term small-scale change in the physical environment, but its overall integrity is not impacted.
  - *Negligible*: No perceptible change in the physical environment.
- **Duration** – the duration of impact is considered to be for 6 months, which is the duration for which a drought option is implemented, unless otherwise stated.
- **Reversibility** – all hydrological impacts are considered to be reversible**.**
- **Timing and Frequency** – the drought option could be implemented at any point in the year, unless otherwise stated. The assessment is based upon the operation of a single drought permit, with subsequent applications for a drought permit required to consider cumulative effects of multiple drought permit.
- **Probability** – all impacts are considered to be probable, unless otherwise stated.

The hydrological impact assessment is described fully in **Appendix B**.

Section 4 provides a summary of the hydrology and physical environment assessment as a result of implementing a drought permit at Nant-y-Moch Reservoir.

Stage 2 - Environmental Sensitivity

With the extent and level of flow impact mapped, using GIS and other data sources, potentially sensitive receptors (sites / features) located within the extents of impact

have been identified. Potentially sensitive features investigated in the screening have been drawn from Box 1 in Appendix I of the DPG. These include:

- designated biodiversity sites (Local Nature Reserve (LNR), National Nature Reserve (NNR), Marine Protected Areas, National Parks, Areas of Outstanding Natural Beauty (AONB), SSSI, Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar) and Environment (Wales) Act Section 7 species / habitats which are located on or within 500m of the impacted reaches;
- protected species;
- ecological communities (fish, bryophytes & lichen, macro-invertebrates, macrophytes, algae) and, where identified, Water Framework Directive (WFD) status of designated waterbodies which contain the impacted reaches;
- invasive non-native species;
- sensitive ecological features as advised by NRW;
- wider features which should be taken into account in determining the potential impacts of drought option implementation – specifically socio-economic & health, amenity & aesthetics, recreation, navigation, architectural & archaeological heritage.

Each of the identified sensitive receptors within the extent of impact have been listed, alongside a brief summary of their potential susceptibility to flow impacts. For designated sites, this has included an indication as to whether the sites have water dependent qualifying interests.

The environmental sensitivity of each site has been identified according to the ecological and nature conservation interests of the area and, in particular, the proximity of and / or connectivity with the designated protected area. Each site has been assessed according to whether the extent of hydrological influence includes or is considered to affect a designated or protected site. Designated or protected sites outside the extent of hydrological influence are considered not to be influenced by the drought permit.

The outcome of Stage 1 and Stage 2 of the screening exercise are presented in Sections 4 and 5 respectively.

3.2.2 Scope

The screening exercise establishes the study area for the Nant-y-Moch Reservoir drought permit together with identification of relevant, sensitive environmental features within those study areas (based on the risk of them being impacted by the drought permit during the period of its operation).

As set out in **Figure 3.1**, the environmental sensitivity screening identifies the outcome for each listed feature. Four outcomes are possible from the screening: uncertain; moderate-major sensitivity; minor sensitivity; not sensitive (negligible); and identifies appropriate next steps. Sections 4.2 and 5.2 present the findings which show that a number of features were identified as either: 1) uncertain; 2) moderate-major sensitivity; or 3) minor sensitivity in a designated site and in accordance with the DPG are features for which further assessment work will be required. These features alone form the scope of monitoring, environmental assessment, and consideration of mitigation actions.

The DPG states that environmental assessment, mitigation and / or monitoring is not required for features where screening has identified a minor (unless a site is designated) or negligible impact. However, the requirement for assessment, monitoring and / or mitigation has been reviewed on a case-by-case basis. In some cases, mitigation and / or monitoring has been recommended where minor impacts are identified, where considered appropriate on a precautionary basis.

3.3 APPROACH TO ASSESSING IMPACTS, MITIGATION AND MONITORING

3.3.1 General Approach

The assessment approach is in accordance with legislation, national regulations and guidance, including:

- NRW (2017) Water Company Drought Plan Technical Guideline (DPG)
- Welsh Ministers (2017) The Drought Plan (Wales) Direction
- Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Assessment
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland[3]
- UKWIR (2007, updated 2012) Strategic Environmental Assessment – Guidance for Water Resources Management Plans and Drought Plans. Prepared by Cascade Consulting
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)
- Council Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds

[3] CIEEM, Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial. Freshwater and Coastal. September 2018.

- The Convention on Wetlands of International Importance especially as Waterfowl Habitat , December 1975
- Conservation of Habitats and Species Regulations 2017
- The Countryside and Rights of Way Act 2000.

All aspects of the drought permit of potential environmental significance are considered in the environmental assessment.

The DPG states that a water company should clearly show what evidence and data have been used in decision making, that uncertainties should be identified, and which additional data requirements are provided for through the environmental monitoring plan.

In accordance with the DPG the approach to the assessment addresses the following: i) potential effects on each sensitive receptor; ii) definitions for impacts (adverse / beneficial); iii) the data requirements; iv) assessment methodology (including the treatment of uncertainty where the complete data requirements are not available).

This EAR presents the environmental baseline, i.e. habitats and environmental pressures (including flow and water quality) in the study identified zone of hydrological influence without the drought permit in place, utilising a description of the catchment, geomorphology, anthropogenic features and water quality. Key changes to the physical environment as a result of implementing the drought permit have been identified and described and, where appropriate, this information is used to frame and support the assessments of features which have been scoped in further to the screening and scoping exercise (see Section 3.2).

3.3.2 Assessment Methodologies

The aim of the Environmental Assessment is to provide:

- A clear summary of the outcome of each assessment (per feature) from which NRW can readily identify the significance of the impact when determining the drought permit application
- Identification of those predicted impacts which are to be taken forward to consider additional monitoring and mitigation actions.

The assessment considers the environmental impacts of implementing the drought permit against baseline operating conditions of Welsh Water's abstraction licence in advance of drought permit implementation. Environmental sensitivity has been assessed considering the context of the timing of drought permit implementation. **It is important to acknowledge the basis of the assessment; i.e. impacts of drought permit implementation are assessed against what would occur without drought permit implementation**.

The impact assessment for sensitive features is feature specific and is dependent on the availability and resolution of available data. Where possible, quantitative assessments have been undertaken. However, for many features, it is acknowledged that the assessments are qualitative and based on professional judgement, and using, where relevant, experience of local knowledge and reference to literature. This introduces uncertainty into the impact assessment. A precautionary approach has been used to assigning impact significance where data are absent or found not to be robust.

The assessment of impacts on designated sites has been undertaken using professional judgement with reference to conservation objectives and condition status of habitats and species, for which a site has been designated. The ecological assessment has been undertaken recognising the IEMA[4,5] and the CIEEM study guidelines[6]. The assessment of impacts on other environmental receptors e.g. recreation and landscape has been carried out largely by qualitative expert judgement.

Assessment of impacts on specific features has then been undertaken. Specific assessment methodologies have been developed for key environmental features. These are set out in **Appendix C** (assessment methodologies for the ecological assessment of Environment (Wales) Act Section 7 species, designated sites and other flora and fauna).

Other abstractors, including other water company abstractions, are features that have been reviewed within the assessment. This has been undertaken to determine whether other abstractors could potentially be affected by changes to surface water flows and levels as a result of implementation of the drought permit.

3.3.3 Mitigation and Monitoring

Section 5.3 of the DPG identifies the specific requirements for mitigation of serious impacts on the environment as a result of implementing a drought management measure. The assessments undertaken in this EAR confirm the features requiring consideration of mitigation and appropriate monitoring triggering mitigation. Appropriate mitigation actions identified are both available and practicable.

The DPG also identifies the specific requirements for monitoring. The assessments undertaken in this EAR inform the features requiring consideration for monitoring prior to, during, or after implementation of the drought permit.

The mitigation and monitoring proposals (see Sections 6 and 10) will act as a safeguard that responds and is responsive to both predicted and unpredicted drought impacts.

[4] IEMA (2004) Guidelines for Environmental Impact Assessment.
[5] IEMA (2011) Special Report – The State of Environmental Impact Assessment Practice in the UK
[6] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland.

Future data collection and monitoring can then be focused to identify the aquatic ecosystem interaction to better quantify the potential impacts where gaps in the evidence base are identified and ensure the appropriate targeting of monitoring and mitigation response. The EMP will need to be finalised in agreement with NRW.

3.4 LIMITATIONS OF THE ASSESSMENT AND UNCERTAINTIES

The DPG states that a water company should clearly show what evidence and data have been used in decision making, that uncertainties should be identified, and which additional data requirements are provided for through the environmental monitoring plan.

The assessment presented in this document draws on available information from surveys and investigations undertaken by Welsh Water, NRW, as well as other bodies over a number of years. Reference has also been made to wider studies from published and grey literature, i.e. academic literature that is not formally published, where appropriate.

Specific details are provided on the quality of the data collected and used in the assessment. Where uncertainties remain with respect to the quantification and prediction of impacts, the limitations and any assumptions made are included in the relevant technical sections (Sections 4 and 5).

Overall, it is considered that the conclusions are based on information that is robust and valid at the time of writing. However, it should be noted that this EAR would be updated to support any future actual application, including a review of data.

4 NANT-Y-MOCH RESERVOIR DROUGHT PERMIT - HYDROLOGY AND THE PHYSICAL ENVIRONMENT

4.1 INTRODUCTION

Consideration of hydrology and the water physical environment sets the context for the potential range of environmental effects of the drought permit. **Appendix B** sets out an assessment of the potential impacts on the physical environment of Nant-y-Moch Reservoir during the period of implementation of the drought permit. The "without drought permit" baseline is set out in Section 2.9.

The water physical environment assessment includes consideration of hydrology and hydrodynamics; geomorphology; and water quality. The assessment has three key objectives:

1. It is used to "list likely changes in flow, level, channel/riparian form and sediment due to implementing the action' as required by the DPG and set out in Figure 2 of the DPG

2. It is used to support the screening and assessment of sensitive features (including ecological features and designated sites) as required by the DPG and set out in Section 5 of this report

3. Where sensitive features are the physical environment itself, it provides supporting technical information for their screening and assessment.

Each of these are summarised below.

4.2 SUMMARY OF STAGE 1 SCREENING

This fulfils the DPG requirements of Stage 1 of the screening of potential drought permit impacts, identifying the likely changes in flow/ level regime due to implementing the drought permit. The specific requirements of the DPG are summarised as:

- identify any changes that the drought permit is likely to bring about, specifying their length, severity and location in relation to existing natural and artificial features (e.g. flow, water level, channel dynamics and sediment changes);
- describe the likely conditions in the absence of the drought permit;
- describe how the likely conditions would differ with the drought permit in place compared to the same (or analogous) watercourse under natural conditions; and

- identify the extent of the area affected by your planned actions.

These requirements are addressed in the following sections.

1. The perceived extent of potential impact:

The study area (see **Figure 2.3**) is identified as the Nant-y-Moch Reservoir and the downstream Afon Rheidol catchment to the Dinas Reservoir impoundment.

2. The nature and duration of the potential impact:

A description of the likely conditions with the drought permit in place, in comparison to the baseline conditions (absence of the proposed action) is provided in **Appendix B**. Given the conditions of the proposed drought permit, the key areas for the assessment of the physical environment have been identified as:

- Change in river flows in the Afon Rheidol downstream of Nant-y-Moch Reservoir.

The **Appendix B** assessment has been summarised in **Table 4.1** in terms of the magnitude and duration of each of these potential physical environment impacts.

3. The length of the potential impact:

The **Appendix B** assessment has been summarised in **Table 4.1** in terms of the timing of each of the potential physical environment impacts. This permit holds an all year period of implementation.

4.3 SUMMARY OF POTENTIAL EFFECTS ON THE PHYSICAL ENVIRONMENT

The potential changes to the physical environment (water quality and geomorphology) due to implementation of the drought permit are summarised in **Table 4.1.** These impacts are presented in detail in **Appendix B**.

Table 4.1 Summary of Potential Hydrodynamic and Water Quality Impacts of the Drought Permit

Issue	Identified Impact
Nant-y-Moch Reservoir	
Water levels in Nant-y-Moch Reservoir *Negligible impacts during the summer/early autumn period*	• Negligible effect on water levels in Nant-y-Moch Reservoir
Afon Rheidol (Reach 1)	
Flows in the Afon Rheidol *No impacts*	• No change anticipated to the flow regime downstream of Nant-y-Moch Reservoir

4.3.1 Support to the Screening and Assessment of Sensitive Features

The assessment included in **Appendix B** has provided information to support the screening and assessment of sensitive features in Section 5. This includes information on short and long term (acute and chronic) direct and indirect, cumulative, and permanent and temporary effects. The assessment is also specific on the difference between the drought permit impacts and the baseline condition without a drought permit in place.

4.3.2 Supporting Technical Information for Assessment of any Physical Environment Sensitive Features

As described in Section 5, several sensitive features relate to the physical environment, rather than ecology or human interaction (e.g. landscape, recreation). The assessment included in **Appendix B** has provided supporting technical information for their screening and assessment in Section 5.

5 NANT-Y-MOCH RESERVOIR DROUGHT PERMIT ENVIRONMENTAL FEATURES ASSESSMENT

5.1 INTRODUCTION

In compliance with the DPG, environmental sensitivity screening has been undertaken within the zone of hydrological influence. As set out in **Box 1** above, further environmental assessment is neither required nor included for features where screening has identified a minor (where there are no environmentally designated sites) or negligible impact.

Points of interest referred to throughout the text in Section 5 are indicated on **Figure 2.3**.

5.2 SUMMARY OF STAGE 2 SCREENING AND SCOPING

5.2.1 Designated Sites and Other Sensitive Fauna and Flora

In accordance with the DPG, **Table 5.1** identifies designated biodiversity sites (including LNR, NNR, SSSI, SAC, SPA), Environment (Wales) Act Section 7 species / habitats and other sensitive receptors that could be affected by the drought permit. Susceptibility to the flow / level impacts resulting from the drought permit (see Section 4) is identified according to whether interest features of the site or the species are water dependent. Sensitivity is then determined according to professional judgment based on susceptibility and the level of hydrological impact at the location.

Table 5.1 Designated Sites and Other Sensitive Receptors Within the Zone of Influence of the Nant-y-Moch Reservoir Drought Permit

Site/Feature and designation	Hydrological Impact at Location (Major, Moderate, Minor)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, Moderate/ Major, Minor, Negligible)	Further Consideration Required (Yes/No)
Afon Rheidol Reach 1				
Notable Species - Fish Atlantic Salmon *Salmo salar* Sea/Brown Trout *Salmo trutta*	Negligible	Changes to velocity, depth, wetted width may restrict the access of migratory fish to spawning tributaries or to dry spawning gravels. Reductions in flow are short term and are not anticipated to significantly alter habitat and availability for the resident fish community.	Negligible	No
Macrophyte community	Negligible	The negligible hydrological impacts associated with drought permit implementation is not anticipated to reduce the availability of habitats and/or change the composition of the macrophyte community.	Negligible	No
Phytobenthos community	Negligible	The negligible hydrological impacts associated with drought permit implementation is not anticipated to reduce the availability of habitats and/or change the composition of the phytobenthos community.	Negligible	No
Benthic macroinvertebrate community	Negligible	The negligible hydrological impacts associated with drought permit implementation is not anticipated to reduce the availability of habitats and/or change the composition of the macroinvertebrate community.	Negligible	No
Notable Species – Mammals Otter *Lutra lutra* Water voles *Arvicola terrestris*	Negligible	Otter are water-dependent, foraging in, over or adjacent to water for fish and aquatic invertebrates. However these species are not expected to be significantly impacted by the drought permit implementation, as habitat availability and quality for otter is not anticipated to be significantly altered.	Negligible	No
Invasive flora and fauna	Negligible	The negligible hydrological impact is not anticipated to change the status of invasive flora and fauna	Negligible	No

5.2.2 WFD Waterbody Status

Table 5.2 identifies the WFD status classification of the WFD waterbodies that may be impacted by implementation of the drought permit. Waterbodies classified as overall high / good status / potential, and / or high / good ecological status for fish or macroinvertebrates are likely to be more sensitive to flow impacts. **Table 5.2** summarises the risk to WFD status and indicates where further assessment has been carried out as reported in Section 5.3 below.

Table 5.2 WFD Status Classifications

Waterbody Name	**Nant-y-Moch Reservoir (GB31037596)**		**Rheidol - confwith Llechwedd-mawr to confwith Castell (GB110063041570)**	
Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Negligible		None	
Heavily Modified Waterbody (Y/N)	Yes		Yes	
RBMP Cycle	RBMP2 (2015)[7]	2018 C2 Interim[8]	RBMP2 (2015)	2018 C2 Interim
Ecological	Moderate	Moderate	Moderate	Moderate
Fish	Not classified	Not classified	High	High
Macrophytes	Not classified	Not classified	Not classified	Not classified
Phytobenthos	Not classified	Not classified	Not classified	High
Macro-invertebrates	High	Good	Good	Good
Total P/ Phosphate	Moderate	Good	High	High
Ammonia	High	High	High	High
Dissolved Oxygen	Not classified	Not classified	High	High
pH	Not classified	Not classified	Moderate	High
Sensitivity (Uncertain, Moderate/ Major, Minor, Not sensitive)	Not sensitive		Not sensitive	
Further Consideration Required (Y/N)	No		No	

5.3 FEATURES ASSESSMENT

The hydrological impact of the drought permit has been assessed as negligible. Screening has not **identified** any environment features for which environmental assessment is required. No environmental impacts have, therefore, been identified for any of the features identified in screening (see **Section 5.2**).

[7] NRW (2017) https://drive.google.com/file/d/0B2hsDbbdxz1tZHItRU9lNkg1YWs/view.
[8] NRW (2018 https://drive.google.com/file/d/14w17jL05sNuToVELqMCK_yc6DdHU7STb/view.

6 NANT-Y-MOCH RESERVOIR DROUGHT PERMIT– MITIGATION

The hydrological impact of the drought order has been assessed as negligible. Screening has not identified any environment features for which environmental assessment is required and, therefore, no mitigation is required during drought order implementation.

7 CUMULATIVE IMPACTS

In accordance with the DPG and the Habitats Regulations, consideration has been given to how the proposed drought permit may affect the environment in combination with the effects of existing abstraction licences, environmental permits and other plans. This includes assessment of the potential cumulative effects of the following:

- Welsh Water's existing abstraction licences that operate within the hydrological zone of influence of the drought option, as well as other abstraction licences and discharge permits, as identified in NRW Review of Consents reports;
- Assessment of cumulative impacts of the drought permit with other Welsh Water supply-side and drought order / permit options within the hydrological zone of influence (including both intra- and inter- zone options);
- Other plans and projects of relevance, including;
    - Any Welsh Water WRMP schemes which are scheduled to be implemented and become operational within the time period of the Drought Plan (i.e. before 2025).
    - Drought supply-side and drought order / permit options from NRW Drought Plans.
    - National Policy Statements for Wastewater and Renewable Energy Infrastructure.
- Environmental monitoring before, during and after drought permit implementation (see Section 9).

If a drought permit application is progressed in the future, the potential for cumulative effects will be reviewed and revised to reflect any changes which are relevant to the timing of the drought permit specified in the application.

Welsh Water's existing abstraction licences and other abstraction licences and discharge permits

The assessment of hydrological impacts presented in **Appendix B**, and summarised in Section 4, has considered how the proposed drought permit may affect the environment in combination with the effects of existing licences and consents. Therefore, no relevant licences or consents have been identified as relevant for assessment of cumulative effects.

Other relevant Welsh Water drought permit / orders

No cumulative effects of implementing the Nant-y-Moch drought order with other drought order / permit schemes have been identified. However, this should be

reviewed at the time of any future application for a drought order at Nant-y-Moch Reservoir.

Welsh Water WRMP schemes

No WRMP schemes identified with cumulative impacts.

NRW Drought Plans

No cumulative impacts of options in NRW Drought Plan with a drought permit at Nant-y-Moch are anticipated. However, this should be reviewed at time of future application for a drought permit.

National Policy Statements for Wastewater and Renewable Energy Infrastructure

No cumulative schemes have been identified for assessment.

Environmental Monitoring

Recommendations for environmental monitoring before, during and after drought permit implementation have been made in the EMP which is presented in Section 9 of this EAR. The EMP has been developed in consultation with NRW.

It is assumed that all monitoring activities will be undertaken with the best interests of the site in mind, and in discussion and agreement with NRW. Where activities which require in-river working are proposed, a method statement for the survey will be prepared and agreed with NRW in advance of the survey.

Assuming rigorous implementation of the method statements, there will be no adverse impacts of the monitoring on hydrology, water quality or ecology, and no adverse impacts of environmental monitoring on the site are anticipated.

8 NANT-Y-MOCH RESERVOIR DROUGHT PERMIT - SUMMARY OF RESIDUAL IMPACTS

The residual impact on environmental features is dependent on the effects observed during environmental monitoring, and the mitigation measures that are taken forward and their timely and effective application once the trigger for their need has been identified.

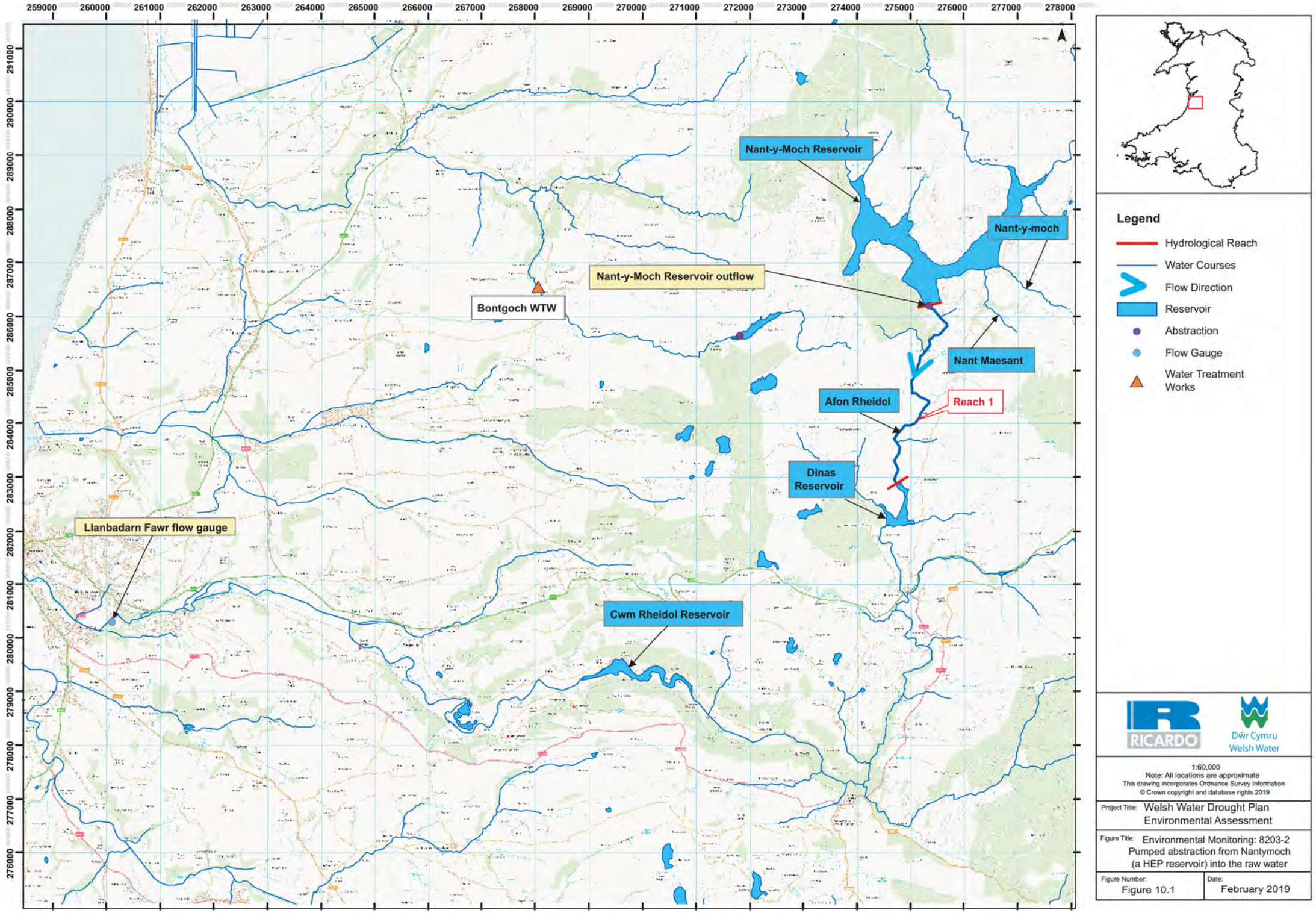
At this stage, no mitigation measures have been identified as required as the hydrological influence of the drought order has been assessed as negligible (see Section 4).

9 ENVIRONMENTAL MONITORING PLAN (EMP)

The hydrological impact of the drought order has been assessed as negligible. Screening has not identified any environment features for which environmental assessment is required and, therefore, no feature specific monitoring will be required.

However, it is recommended that current hydrological monitoring should continue to be carried out during the development of drought conditions and implementation of the drought order, in order to monitor the adherence (or otherwise) of the river system to that expected from the baseline assessment in Section 4. Such monitoring is mapped on **Figure 10.1,** and should include:

- Daily water level in Llyn Llygad Rheidol reservoir.
- Daily abstractions from Llyn Llygad Rheidol for public water supply.
- Daily abstractions from Nant-y-Moch and Maesnant streams.
- Llanbadarn Fawr flow gauge, Afon Rheidol; daily river flow.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Reach 1
Dinas Reservoir
Llanbadarn Fawr flow gauge
Cwm Rheidol Reservoir
Legend
Hydrological Reach
Water Courses
Flow Direction
Reservoir
Abstraction
Flow Gauge
Water Treatment Works
RICARDO
Dŵr Cymru Welsh Water
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Note: All locations are approximate
This drawing incorporates Ordnance Survey Information
© Crown copyright and database rights 2019
Project Title: Welsh Water Drought Plan Environmental Assessment
Figure Title: Environmental Monitoring: 8203-2 Pumped abstraction from Nantymoch (a HEP reservoir) into the raw water
Figure Number: Figure 10.1
Date: February 2019

10 CONCLUSIONS

This EAR provides an assessment of the potential environmental impacts relating to the implementation of the Nant-y-Moch drought permit. If granted and implemented, the drought permit would enable Welsh Water to temporarily abstract from Nant-y-Moch Reservoir of up to 5Ml/d, to help to preserve resource in the reservoirs in the WRZ during drought conditions.

The scope of the assessment has been defined by an impact screening and scoping exercise. In accordance with the DPG, the screening exercise involved two stages: a hydrological impact assessment (Stage 1) and the identification of the environmental features that could be affected by the drought order (Stage 2).

The hydrological impact assessment identified a **negligible** impact on flows in the Afon Rheidol and a **negligible** impact on Nant-y-Moch Reservoir.

The DPG states that environmental assessment is not required for features where screening has identified a minor (if there are no designated environmental sites) or negligible impact. Screening has not identified any environment features for which environmental assessment is required. No environmental impacts greater than negligible have, therefore, been identified for any of the features identified in the screening exercise. In light of this and in accordance with the DPG no mitigation or feature specific monitoring is identified. However, hydrological monitoring has been recommended during the development of drought conditions and implementation of the drought order, in order to monitor the adherence (or otherwise) of the river system to that expected from the assessment presented in this EAR.

No cumulative effects of implementing the drought order with other existing licences, consents and plans are currently anticipated. However, this should be reviewed at the time of any future application for a drought order at Nant-y-Moch.

APPENDIX A
HYDROLOGY AND HYDROGEOLOGY METHODOLOGY

A.1 HYDROLOGICAL AND HYDROGEOLOGY IMPACT METHODOLOGY (STAGE 1 SCREENING)

Consideration is required (by the DPG[1]) of the likely changes in flow / level regime due to implementing the drought management action, specifically:

- the perceived extent of potential impact
- the nature and duration of the potential impact
- the timing of the potential impact.

The hydrogeological and hydrological information is used together with information on the other environmental features in the study area from Stage 2 - Environmental Sensitivity (see Section 3.2.1 in main report) to identify the environmental risk of the drought order / permit.

Although the DPG informs the hydrometric data to be used as part of environmental features for consideration within the environmental assessment (see Box 1 Appendix H of the DPG), it does not provide a methodology for identifying the hydrological impact.

Cascade has developed a flexible approach[2] to identifying the spatial extent of the study area from hydrological information and characterising the hydrological impact within the study area, in terms of the scale, nature, duration and timing of impacts, although this is only appropriate to apply to reaches that do not dry naturally. A hydrological methodology for watercourses that naturally dry for part of the year is also presented that characterises the hydrological impact within the study area, in terms of the scale, nature, duration and timing of impacts. These are presented below.

Perennially flowing watercourse hydrological methodology

This methodology is applied to watercourses that flow throughout the year and that are potentially impacted on by the drought order / permit.

Core to this approach is the use of relevant long term flow statistics to inform the scale of hydrological impact and thereby delimit the zone of influence in the downstream river system. To determine these, potential reductions in flow resulting from implementation of the drought order / permit are compared with flows without the drought order / permit in place (i.e. the additional abstraction advocated by the drought order / permit over and above the existing abstraction). This helps to determine the scale of potential impact at any particular site/ feature using the matrix in **Figure A.1** or **Figure A.2** depending on the altitude of the waterbody and whether it is classified as lowland or upland[3]. Where possible, the hydrological assessments presented in previous EMPs and EARs of the drought options have been used to

1 Welsh Government / Defra / NRW / Environment Agency (2011). Water Company Drought Plan Guideline. June 2011.
2 Hydrological impact approach used in previous drought plan environmental assessments for water companies including Thames Water, Yorkshire Water and United Utilities
3 The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. ISBN 978-0-85521-192-9.
The Directions set out the principles of classification of surface water and groundwater bodies, including the use of 80m above Ordnance Datum as the altitude that differentiates water quality requirements for upland and lowland biology. Where there are ambiguities, or thresholds are crossed, upland is assumed to apply to ensure a precautionary assessment.

help identify the spatial extent of the study area from hydrological information and characterising the hydrological impact within the study area.

Figure A.1 Hydrological Assessment Matrix (Upland)

		Summer Q99		
	% reduction in flow	<10%	10-25%	>25%
Summer Q95	<10%	Negligible	Minor	Moderate
	10-25%	Minor	Moderate	Major
	>25%	Moderate	Major	Major

Figure A.2 Hydrological Assessment Matrix (Lowland)

		Summer Q99		
	% reduction in flow	<10%	10-25%	>25%
Summer Q95	<20%	Negligible	Minor	Moderate
	20-50%	Minor	Moderate	Major
	>50%	Moderate	Major	Major

Figure A.1 illustrates that at the time of implementation of a drought order / permit, upland river systems of relevance to each of these proposed options will exhibit high sensitivity to changes in low flow (represented by Q_{95}, summer[4]) and very high sensitivity to changes in extreme low flow (represented by Q_{99}, summer). As illustrated by **Figure A.2**, lowland rivers of relevance to each of these proposed options are considered to be less sensitive to reductions in summer low flows (summer Q_{95}), but similarly sensitive to reductions in extreme summer low flows (summer Q_{99}).

Figures A.1 and **A.2** are appropriate for the assessment of hydrological impacts on low flow regimes in watercourses during the spring, summer and autumn. However, in some cases there is a need to assess the impacts of drought order schemes on watercourses during the winter. For example, a reduction in compensation release may remain in force during the winter high flow period, to increase the probability of reservoir refill prior to the following year's spring/summer drawdown period. During the winter season, watercourses have relatively lower sensitivity to changes in low flow, and moderate sensitivity to changes in moderate flow. This can be reflected by the use of the matrices in **Figures A.3** and **A.4** for the assessment of drought order / permit schemes which are only likely to impact on a watercourse during the winter. The categorisation of impacts as negligible, minor, moderate or major is based on the percentage reduction in year round low flow (Q95) and year round median flow (Q50).

Figure A.3 Hydrological Assessment Matrix (Upland / Winter)

		Year round Q95		
	% reduction in flow	<10%	10-25%	>25%
Year round Q50	<10%	Negligible	Minor	Moderate
	10-25%	Minor	Moderate	Major
	>25%	Moderate	Major	Major

[4] Flow statistics indicate the proportion of days a flow is equalled or exceeded. Therefore Q95 indicates flow equalled or exceeded on 95% of days in the measured record (equivalent to an average of 347 days per year)

Figure A.4 Hydrological Assessment Matrix (Lowland / Winter)

		Year round Q95		
	% reduction in flow	<10%	10-25%	>25%
Year round Q50	<20%	Negligible	Minor	Moderate
	20-50%	Minor	Moderate	Major
	>50%	Moderate	Major	Major

The matrices are used to identify 1) the overall study area – which extends downstream of the abstraction until the hydrological impact has reduced to negligible; 2) reaches with similar scales of impact within the overall study area; and 3) the scale of hydrological impact within each reach. Typically reaches have been delimited by the addition of flow from a significant tributary or discharge; although the similarity of geomorphological characteristics of the reach may also be important in reach specification. The matrices can be applied to a variety of upland or lowland catchments respectively including those dominated by groundwater, and can be applied until the tidal limit.

In addition to the information provided by summary flow statistics in the matrix, information on the timing, duration and relevant seasons of the drought order / permit impacts have been informed by licence details and river gauging data have also been used to characterise the likely nature of the drought order / permit impacts.

If the drought order / permit does not impact on the magnitude of low flows in a watercourse, but does cause changes in the duration of low flow periods (which can be quantified), then the matrix in **Figure A.5** may be appropriate. The assessment is based on the percentage increase in the number of days for which flow is at or below the low flow (Q95) value. Typically this would be the case when the low flow regime in a watercourse downstream of a reservoir is protected by a statutory compensation release from the reservoir, but the reservoir may be drawn down below top water level for longer periods due to increased direct abstraction under the drought order / permit conditions.

If low flows in a watercourse are adversely affected in both magnitude and duration, then the impacts on magnitude are always used to determine the significance of hydrological impacts, using the appropriate matrix from **Figures A.1** to **A.4** inclusive. **Figure A.5** is only used when the impacts on low flows are on duration only.

Figure A.5 Hydrological Assessment Matrix (Low Flow Duration)

Percentage increase in low flow duration	Significance
<5%	Negligible
5-10%	Minor
10-25%	Moderate
>25%	Major

Intermittently flowing watercourse hydrological methodology

This methodology is applied to watercourses, potentially impacted on by the drought order / permit, that flow for most of the time but seasonally or occasionally ceasing to flow in response to decreased water availability e.g. due to increased evapotranspiration or bed seepage. . Such watercourses are identified from previous investigations and available data. Examples of watercourses where this methodology would be applied include winter bournes or watercourses that dry along their route due to losses to underlying aquifers. The impact classification of this methodology is as follows:

- Major - If the drought order / permit resulted in sections drying that did not dry up anyway
- Moderate - If the drought order / permit resulted in sections drying earlier (by more than a week) and / or recovering later (by more than a week) and hence flow reduction occurring in the channel for more than a week
- Minor - If the drought order / permit resulted in sections drying earlier (up to a week) and/or recovering later (by up to a week) and hence flow reduction occurring in the channel for up to a week OR if the drought order / permit were a secondary flow driver (e.g. flow through gravels being primary cause of flow losses rather than the drought order / permit)
- Negligible - No significant impact

In addition to the derived classifications, information on the timing, duration and relevant seasons of the drought order / permit impacts have been informed by licence details, available data and findings of previous investigations. These have been used to characterise the likely nature of the drought order / permit impacts.

Reservoir hydrological methodology

More recently Cascade has developed a similar approach to categorise the significance of hydrological impacts of drought order / permit operations on reservoirs. The assessment requires an estimate of the relative change in duration of reservoir drawdown (i.e. the period for which water in the reservoir is below top water level), and the percentage decrease in the minimum reservoir level reached during the drawdown period. These two parameters are then compared against the reservoir impacts hydrological assessment matrix in **Figure A.6**.

This approach would be a suitable method to assess the impacts of a drought order / permit which involves significant changes to the reservoir water level regime (that would not normally be experienced during a drought without any additional measures implemented). For example, a drought order / permit may involve increasing daily or annual licensed abstraction limits to allow an increased rate of direct abstraction from the reservoir. This may enable some or all of a reservoir's emergency storage volume to be utilised, but is likely to lead to both lower water levels and increased periods of time below top water level.

Figure A.6 Hydrological Assessment Matrix (Reservoir Impacts)

	% Increase in duration of reservoir drawdown			
% Decrease in minimum reservoir level	<5%	5-10%	10-25%	>25%
<5%	Negligible	Negligible	Minor	Moderate
5-10%	Negligible	Minor	Moderate	Major
10-25%	Minor	Moderate	Major	Major
>25%	Moderate	Major	Major	Major

Additional Considerations

For groundwater schemes, hydrogeological data, where available, has been reviewed to inform the study area and duration of any impacts (noting impacts on groundwater may extend beyond the six month period of drought order / permit implementation - see below). An increase in groundwater abstractions would lead to an increased cone of depression in groundwater levels for groundwater abstraction. This impact can affect other non-surface water receptors such as other wells, springs or groundwater dependent ecosystems. It could also mean that surface water impacts would extend upstream of the abstraction point or, in significant instances, to other watercourses some distance from the abstraction.

For groundwater abstractions, the impact of a drought order / permit could extend beyond the six month period (time limited) of abstraction depending on the local hydrogeology of the area. During drought situations, where there is limited recharge to the aquifer system, the abstraction can be mainly at the expense of groundwater stored in the aquifer. This can, in the long run, delay groundwater level recovery and have a knock on effect on baseflow contributions to watercourses. Flows could, therefore, be reduced for longer than the six month period during which the drought order / permit could be implemented and, as such, has been considered as part of the assessment described in this report.

APPENDIX B
HYDROLOGY AND PHYSICAL ENVIRONMENT ASSESSMENT

B1 INTRODUCTION

This appendix assesses potential impacts on the physical environment of the Nant-y-Moch reservoir and the downstream Afon Rheidol catchment during implementation of the Nant-y-Moch drought permit.

For the purposes of this assessment, the "without drought permit" baseline assumes continuation of abstraction from Nant-y-Moch Reservoir for the purposes of hydro-electric power generation within the constraints of the existing licence held by Statkraft. The assessed drought permit involves a temporary pumped abstraction by Welsh Water from Nant-y-Moch Reservoir of up to 5Ml/d, to help preserve storage in the reservoirs during drought conditions.

B.1.1 Welsh Water's Existing Operations

Welsh Water do not currently abstract any water directly from Nant-y-Moch Reservoir, although they do abstract from two of the reservoir's inflow streams (Maesnant Stream and Nant-y-Moch Stream), and also from the nearby Llyn Llygad Rheidol reservoir located in the upper catchment above Nant-y-Moch Reservoir.

Nant-y-Moch Reservoir is operated by Statkraft Energy Ltd for the purposes of hydro-electric power generation. It forms part of a 55Mw scheme in the Afon Rheidol valley, the Cwm Rheidol scheme. The scheme includes three reservoirs (the others being Dinas Reservoir and Cwm Rheidol Reservoir further downstream) and three hydro-electric generating stations.

Statkraft Energy Ltd's licence (number 22/63/1/0024, variation 1) to abstract water from Nant-y-Moch Reservoir for the purposes of hydro-electric power generation includes the following conditions:

- 171,000 million litres (Ml) authorised to be abstracted from Nant-y-Moch Reservoir per annum
- Provision of a minimum uniform statutory compensation water discharge of 13.638Ml/d from Nant-y-Moch Reservoir to the Afon Rheidol.

Details of Statkraft's operating arrangements are currently not known, although it is understood that up to 160Ml/d may be released from Nant-y-Moch Reservoir to drive a 13Mw hydro-electric plant as the water passes downstream via the Afon Rheidol to Dinas Reservoir. The abstraction licence also includes authorised abstraction quantities from Dinas Reservoir and statutory compensation flow requirements from Dinas Reservoir and Cwm Rheidol Reservoir to the Afon Rheidol downstream of each reservoir:

- 232,500 million litres (Ml) authorised to be abstracted from Dinas Reservoir per annum
- Provision of a minimum uniform statutory compensation water discharge of 36.368Ml/d from Dinas Reservoir to the Afon Rheidol during the period October to March inclusive, or 54.552Ml/d during the period April to September from 8am to

8pm

- Provision of a minimum uniform statutory compensation water discharge of 159.110Ml/d from Cwm Rheidol Reservoir to the Afon Rheidol

- 223,287 Ml/year authorised to be abstracted in aggregate from Nant-y-Moch Reservoir, Dinas Reservoir, Afon Castell, Nant y Bog, Afon Llywernog and Nant Bwa Drain.

Welsh Water's licence (number 22/63/1/27/4) to abstract water under the Water Resources Act at Nant-y-Moch Stream (see **Figure B1.1**) includes the following conditions:

- 318.2Ml authorised to be abstracted from Nant-y-Moch Stream per annum.
- At an abstraction rate not exceeding 6.82Ml/d.
- Subject to a prescribed flow of 0.1Ml/d downstream of the abstraction intake.

Welsh Water's licence (number 22/63/1/0005) to abstract water under the Water Resources Act 1991 at Llyn Llygad Rheidol Reservoir (see **Figure B1.1**) includes the following conditions:

- 1,569 million litres (Ml) authorised to be abstracted from Llyn Llygad Rheidol per annum.
- At an abstraction rate not exceeding 5Ml/d.

Water abstracted from Llyn Llygad Rheidol Reservoir (see **Figure B1.1**) is transferred in a pipeline, 9.5km west of the study area to Bontgoch water treatment works (WTW) for treatment and public supply for the North Ceredigion Water Resource Zone (WRZ). During dry weather conditions, water from the Maesnant and Nant-y-Moch Stream intakes is also transferred into this pipeline, and the combined flow is diverted into Craig y Pistyll reservoir.

B.1.2 Welsh Water's Proposed Drought Permit Operations

The drought permit involves a temporary pumped abstraction from Nant-y-Moch Reservoir, of up to 5Ml/d, to be transferred into the raw water main between Llyn Llygad Rheidol Reservoir and Craig y Pistyll reservoir, to support storage in the reservoirs in the North Ceredigion WRZ. The drought permit has the potential to provide a modest increase in water resource during a drought, for a period of up to six months.

It is assumed for the purposes of this assessment that there would be zero flow in either Maesnant Stream or Nant-y-Moch Stream and no abstraction from those sources during a drought permit, with abstractions only occurring from Llyn Llygad Rheidol.

The temporary pumped abstraction will potentially influence water levels in Nant-y-Moch Reservoir and flows in the downstream Afon Rheidol. The study area is shown on **Figure B1.1**.

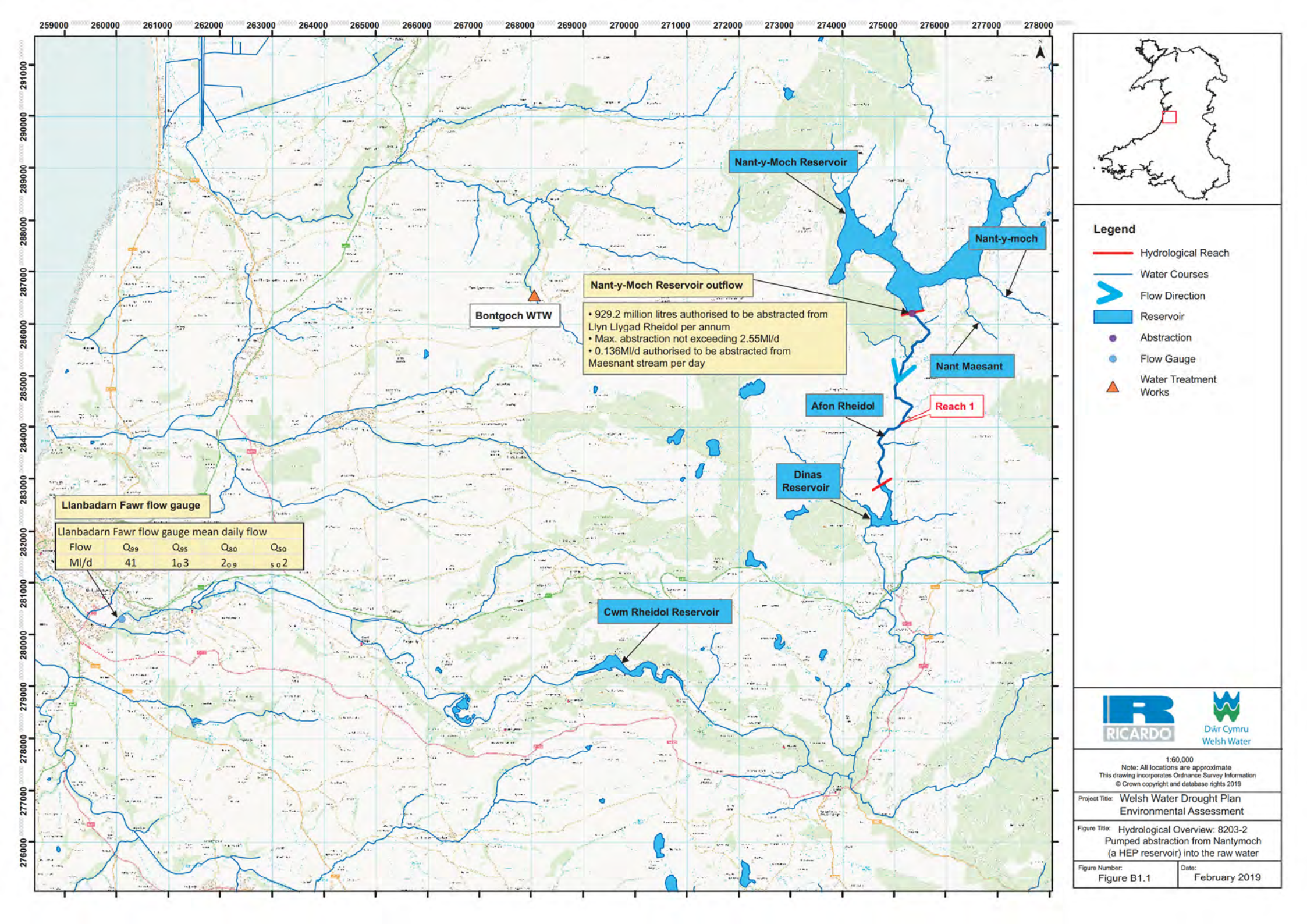
The physical environment includes consideration of hydrology and hydrodynamics;

geomorphology; and water quality. The assessment has three principle objectives:

1. It is used to "list the likely impacts to the flow, level, channel/riparian form and sediment due to action being in place" as required by the DPG[1] and set out in Figure 2 of the DPG.
2. It is used to support the screening and assessment of sensitive features (including ecological features and designated sites) as required by the DPG and set out in Section 5 of this report.
3. Where sensitive features are the physical environment itself, it provides supporting technical information for their screening and assessment.

This appendix is set out in the following sections:

[1] Natural Resources Wales (2017) *Water Company Drought Plan Technical Guideline.* Available at https://cdn.naturalresources.wales/media/684414/final-wc-drought-plan-guidance-2017.pdf?mode=pad&rnd=131656713580000000, Accessed 04 February 2019.


Nant-y-Moch Reservoir
Nant-y-moch
Nant-y-Moch Reservoir outflow
Bontgoch WTW
• 929.2 million litres authorised to be abstracted from Llyn Llygad Rheidol per annum
• Max. abstraction not exceeding 2.55Ml/d
• 0.136Ml/d authorised to be abstracted from Maesnant stream per day
Nant Maesant
Afon Rheidol
Reach 1
Dinas Reservoir
Llanbadarn Fawr flow gauge
Llanbadarn Fawr flow gauge mean daily flow
Flow | Q99 | Q95 | Q80 | Q50
Ml/d | 41 | 103 | 209 | 502
Cwm Rheidol Reservoir
Legend
Hydrological Reach
Water Courses
Flow Direction
Reservoir
Abstraction
Flow Gauge
Water Treatment Works
RICARDO
Dŵr Cymru Welsh Water
1:60,000
Note: All locations are approximate
This drawing incorporates Ordnance Survey Information
© Crown copyright and database rights 2019
Project Title: Welsh Water Drought Plan Environmental Assessment
Figure Title: Hydrological Overview: 8203-2 Pumped abstraction from Nantymoch (a HEP reservoir) into the raw water
Figure Number: Figure B1.1
Date: February 2019

B2 HYDROLOGICAL IMPACT

B.2.1 Reference Conditions

B.2.1.1 Catchment Overview

Nant-y-Moch Reservoir

The Nant-y-Moch impounding reservoir is located on the northern slopes of Plynlimon Fawr, Ceredigion, within the North Ceredigion WRZ in mid Wales. The reservoir, opened in 1964, drains a catchment area of around 55km[2] which forms the headwaters of the Afon Rheidol, and has a storage capacity of approximately 25,000Ml.

The catchment headwaters are underlain by rocks of the Ashgill group of Upper Ordovician age (461-444Ma) which consist of mudstone, siltstone and sandstone lithologies. Superficial deposits in the catchment are very limited, with scattered peat deposits near the inlet of the Afon Hengwm to Nant-y-Moch Reservoir. The catchment is mantled by very acid loamy upland soils with a wet peaty surface.

Together with Dinas Reservoir and Cwm Rheidol Reservoir, lower down the Afon Rheidol river catchment, the Nant-y-moch reservoir forms part of the Cwm Rheidol hydro-electric power scheme. The scheme is the largest of its kind in England and Wales, and is capable of generating up to 55MW of electricity when all three stations are operating at full capacity[2].

Afon Rheidol

The Afon Rheidol rises in the Plynlimon uplands of northern Ceredigion, Wales, and flows for around 31km to its estuary in Cardigan Bay at Aberystwyth. At the tidal limit, the catchment area is around 182km[2].The flow regime of the Afon Rheidol is heavily influenced by operation of the Cwm Rheidol hydro-electric scheme.

A review of the flows and physical habitat characteristics of the Afon Rheidol has identified the study area for this assessment. The study area includes the Nant-y-Moch Reservoir and the Afon Rheidol between the reservoir outflow and the confluence with the Hirnant Stream, just upstream of the next reservoir in sequence, Dinas Reservoir, as listed in **Table B2.2** and identified on **Figure B1.1**. The potential hydrological impact of the drought permit has been reviewed separately for the reservoir and the single river reach, and is discussed in Section B.2.2.2.

B.2.1.2 Baseline Data Availability

Continuous monitoring is undertaken by Welsh Water to monitor its operations in the headwaters of the Nant-y-Moch and Llyn Llygad Rheidol Reservoirs:

[2] http://www.engineering-timelines.com/scripts/engineeringItem.asp?id=1013

- Daily water level in Llyn Llygad Rheidol reservoir, 2007 to date.
- Daily abstractions from Llyn Llygad Rheidol for public water supply, 2005 to date.
- Daily abstractions from Nant-y-Moch and Maesnant streams (abstractions have not occurred from Nant-y-Moch Stream in the last 5 years).

Continuous monitoring of flow in the Afon Rheidol is undertaken by Natural Resources Wales (NRW) at Llanbadarn Fawr (NGR: SN601803). However, it should be noted that this gauge is some 27km downstream of the Nant-y-Moch Reservoir impoundment and that the flow regime in the catchment is heavily influenced by flow releases made for the operation of the hydro-electric scheme. Available data include:

- Llanbadarn Fawr flow gauge, Afon Rheidol; daily river flow 1965 to 2014 (with data missing for the period 1984 – 1995 as the station was closed during this period).

The reference conditions of Nant-y-Moch reservoir and the Afon Rheidol are summarised below, based on the available hydrological data as listed above.

B.2.1.3 Hydrology

Nant-y-Moch Reservoir

Nant-y-Moch Reservoir is operated by Statkraft for the purposes of hydro-electric power generation. Data on reservoir levels, storage and outflows has not been available for the purposes of this assessment. The capacity of the reservoir is approximately 25,000Ml.

Afon Rheidol at Llanbadarn Fawr

Flow is measured in the Afon Rheidol at Llanbadarn Fawr (NGR: SN601803), at the lower end of the Afon Rheidol catchment and close to the tidal limit. A summary of the available daily flow data from 1965 to 2014 is given in **Table B2.1** below. It should be noted that there is some uncertainty over the low flow measurements at this gauge, due to the effects of shifting shoals.

Table B2.1 Summary of Recorded Mean Daily Flow in Afon Rheidol at Llanbadarn Fawr (1965 – 1984 and 1995 to 2014)

Percentage of time river flow equalled or exceeded	Mean daily flow Ml/d, per month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	All year
Maximum flow	14,602	8,899	14,342	3,300	5,720	17,971	5,158	5,668	7,603	12,960	8,182	9,677	17,971
10% (high flow)	2,255	1,862	1,391	1,002	747	745	877	822	1,296	1,991	2,485	2,298	15,90
50%	968	784	634	406	280	236	293	307	387	634	809	950	502
80%	506	459	281	206	147	156	157	157	170	349	421	489	209
90%	350	324	165	128	108	107	105	113	112	201	325	348	147
95% (low flow)	259	207	115	74	60	58	72	92	64	136	201	223	103
99% (extreme low flow)	149	73	43	34	37	32	38	36	40	71	103	105	41
Minimum flow	54	18	9	24	29	24	30	29	25	42	40	24	9

B.2.2 Hydrological Impact

B.2.2.1 Hydrological Zone of Influence

The study area includes the Nant-y-Moch Reservoir and the downstream Afon Rheidol catchment to the Dinas Reservoir impoundment, as listed in **Table B2.2** and identified on **Figure B1.1**. The potential hydrological impact of the drought permit has been reviewed separately for the reservoir and the single river reach, and is discussed below:

- Reach 1 is the Afon Rheidol, from the Nant-y-Moch reservoir outflow to the confluence with the Hirnant Stream (just upstream of Dinas Reservoir).

The potential hydrological impacts of the drought order option have been assessed for the single identified river reach, as summarised in **Table B2.2** at the end of this section.

B.2.2.2 Hydrological Impact Assessment

Nant-y-Moch Reservoir

The temporary pumped abstraction of up to 5Ml/d could continue for up to six months under the drought permit, however it is exceedingly unlikely to remain in place for this long, as Llyn Llygad Rheidol and Craig y Pistyll both respond well to rainfall – a duration of 2 – 3 months is more likely. Based on a theoretical use for six months, this would result in a total additional abstraction of up to around 910Ml from Nant-y-Moch Reservoir. This is equivalent to around 3.6% of the total storage capacity, and therefore the impact of the drought permit on water levels in the reservoir is assessed as being **negligible**.

Reach 1 – Afon Rheidol from Nant-y-Moch reservoir outflow to the confluence with Afon Hirnant

Reach 1 is the 3.5km stretch of the Afon Rheidol as it flows from the spillway at Nant-y-Moch Reservoir to the confluence with the Afon Hirnant, just upstream of Dinas Reservoir. The daily abstraction of 5Ml/d for public water supply is small compared to the existing hydropower abstraction regime at Nant-y-Moch Reservoir (flow releases of up to 160Ml/d). An overall reduction in storage of around 3.6% due to the implementation of the drought permit is unlikely to be of sufficient magnitude to make any discernible difference to the operation of the hydropower scheme or the highly artificial flow regime of the Afon Rheidol. It is assumed that the statutory compensation flow of 13.64Ml/d from Nant-y-Moch Reservoir to the downstream Afon Rheidol would continue in drought conditions, therefore there would be no reduction in the lowest flows to Reach 1 due to the drought abstraction.

In summary, the flow in Reach 1 is unlikely to be changed relative to the baseline drought scenario. Therefore, the hydrological impact of the drought permit has been assessed as being **none** on the Afon Rheidol downstream of the reservoir outflow.

B.2.2.3 Hydrological Impact Summary

One river reach has been considered for which the assessed hydrological impact is **none**, as the magnitude of the temporary abstractions from Nant-y-Moch Reservoir is unlikely to be sufficient to influence the operation of the reservoir and downstream flow regime. The relevant reach is shown in **Table B2.2**, along with the reservoir itself for which the impact has been assessed as **negligible** and comprises the zone of influence of the drought permit for environmental sensitivity screening (see **Figure B1.1**).

Table B2.2 Hydrological and Monitoring Reaches identified in the Study Area

Hydrological Reach		Reach boundary		Reach length	% flow reduction		Hydrological Impact
		Upstream	Downstream		Summer Q_{95}	Summer Q_{99}	
Nant-y-Moch Reservoir		n/a	n/a	n/a	n/a	n/a	**Negligible**
1	Afon Rheidol	Nant-y-Moch Reservoir Outflow	Afon Hirnant confluence	3.5km	0%	0%	**None**

B3 PHYSICAL ENVIRONMENT ASSESSMENT

Given that there is no adverse hydrological impact associated with the drought permit effects on the drought order on geomorphology and water quality are equally assessed as negligible. Similarly, there would be no flow pressures or water quality pressures that would pose an increased risk to any water-dependent environmental features within the vicinity of the Nant-y-Moch intake.

B4 PHYSICAL ENVIRONMENT IMPACT SUMMARY

Potential impacts on the physical environment associated with the Nant-y-Moch Pumped Abstraction Drought Permit are summarised in **Table B4.1.**

Table B4.1 Summary of Potential Changes to the Physical Environment of the Impacted Reaches from Implementation of Nant-y-Moch Pumped Abstraction Drought Permit

Nant-y-Moch Reservoir	
Water levels in Nant-y-Moch Reservoir *Negligible impacts during the summer/early autumn period*	• Negligible effect on water levels in Nant-y-Moch Reservoir
Afon Rheidol (Reach 1)	
Flows in the Afon Rheidol *No impacts*	• No change anticipated to the flow regime downstream of Nant-y-Moch Reservoir

B5 CUMULATIVE IMPACTS

The focus of this Environmental Assessment Report is the Nant-y-Moch pumped abstraction drought permit. The assessment, as described in previous sections, has considered how the proposed drought permit may affect the environment in combination with the effects of existing licences and consents. In accordance with the DPG the assessment also considers the potential cumulative effects of Welsh Water implementing other drought permits / orders within a similar timeframe. The potential for options to act in combination is set out in **Table B5.1**.

Consideration has also been given to the potential for cumulative impacts of drought options implemented by neighbouring water companies (see **Table B5.1**). Assessment of the potential for cumulative impacts of Welsh Water's supply side and drought permit / order options with drought options listed in neighbouring water companies' drought plans has also been undertaken as part of the Strategic Environmental Assessment (SEA) of Welsh Water's Draft Statutory Drought Plan. The SEA was informed by the most recent information available on the neighbouring water companies' drought plans.

Table B5.1 Cumulative Impacts of the Nant-y-Moch Pumped Abstraction Drought Permit with other Drought Options

Organisation	Potential In-combination Impacts	Further Consideration Required (Yes/No)
Welsh Water - other drought options in the North Ceredigion WRZ/ Afon Rheidol catchment	N/A	N/A
Natural Resources Wales - Drought options in the Afon Rheidol catchment	No previous drought order applications have been made in the South West Wales region.	No