Dŵr Cymru
Welsh Water

Draft Drought Plan 2020: Annex 1q – North Ceredigion WRZ

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1.1. North Ceredigion Water Resources Overview

North Ceredigion is our smallest water resource zone in South West Wales and comprises the coastal and inland areas surrounding and including Aberystwyth (see Figure 1).

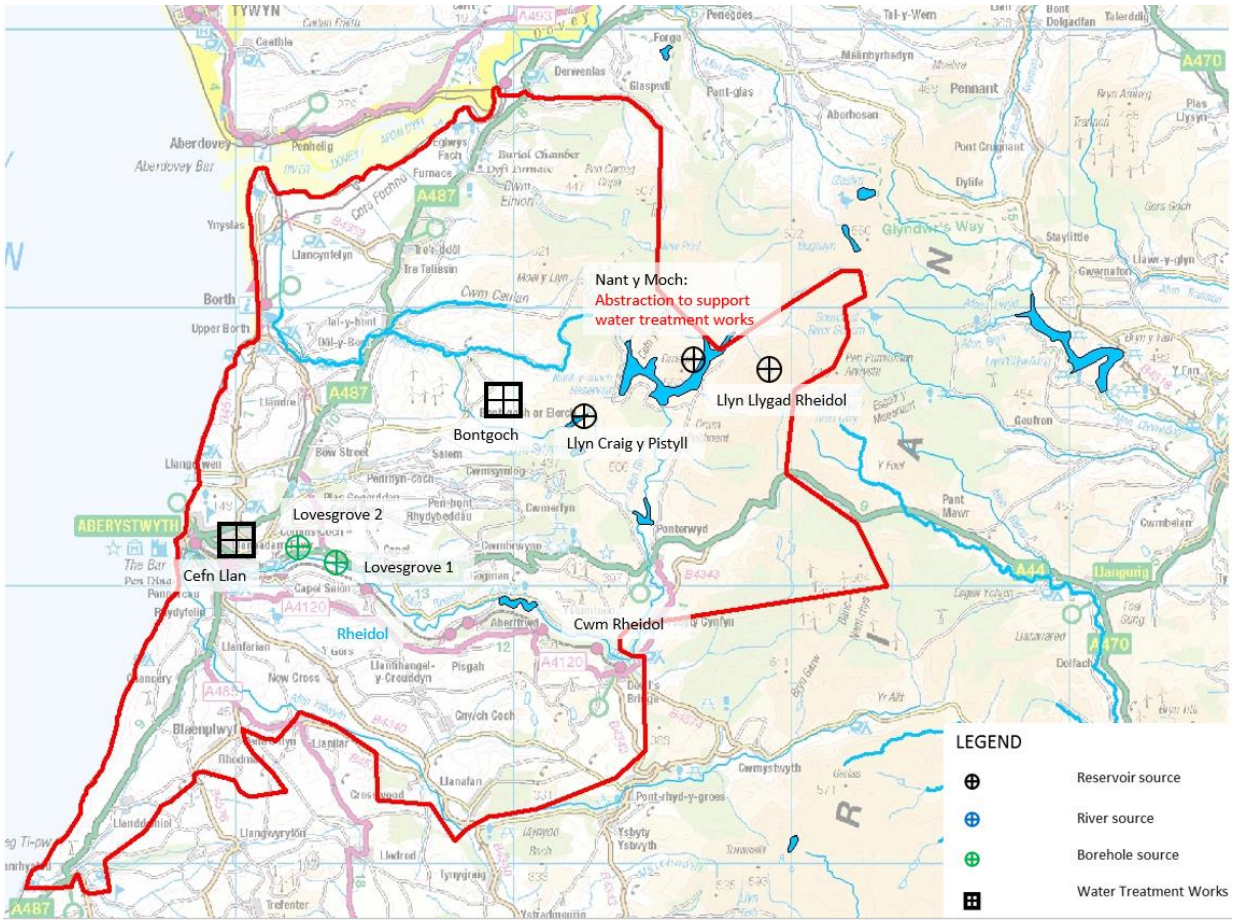

Figure 1 - Map of the North Ceredigion WRZ

The water resources within the zone consist of two impounding reservoirs and two stream sources in the north east of the zone, and two boreholes adjacent to the Afon Rheidol near Aberystwyth. A list of our raw water sources for the zone is presented in Table 1.

Site Name	Licence No.	Source Type	Status
Llyn Craig Y Pistyll	23/64/12/0001	Impounding reservoir	Operational
Nant Y Moch Stream	22/63/01/0027	Stream Abstraction	Operational
Maesnant Stream	22/63/01/0027	Stream Abstraction	Operational
Llyn Llygad Rheidol	22/63/01/0005	Impounding reservoir	Operational

Lovesgrove Borehole 1	22/63/01/0029	Groundwater Abstraction	Operational
Lovesgrove Borehole 2	Licence Exempt	Groundwater Abstraction	Operational

Table 1 - Licensed sources in the North Ceredigion WRZ

Bontgoch water treatment works is supplied by the two reservoirs Llyn Llygad Rheidol and Llyn Craig y Pistyll. Storage levels in the reservoirs are supplemented by abstraction from our intakes on the Maesnant and Nantymoch streams.

Cefn Llan water treatment works in Aberystwyth is supplied by the boreholes at Lovesgrove, which take water from the gravel deposits in the valley of the Afon Rheidol.

The amount of the zone which is supplied from the reservoirs and the boreholes is balanced to make best use of the available water during years of average and below average rainfall. There are no imports or exports of water.

1.2.Drought Management

The drought status of the zone is assessed by the reservoir storage position at any time in relation to the Drought Action Zones (DAZs), defined for the combined storage of Llyn Llygad Rheidol and Llyn Craig y Pistyll. The use of the DCLs are described in more detail in Section 2 of the main report and are shown below in Figure 2.

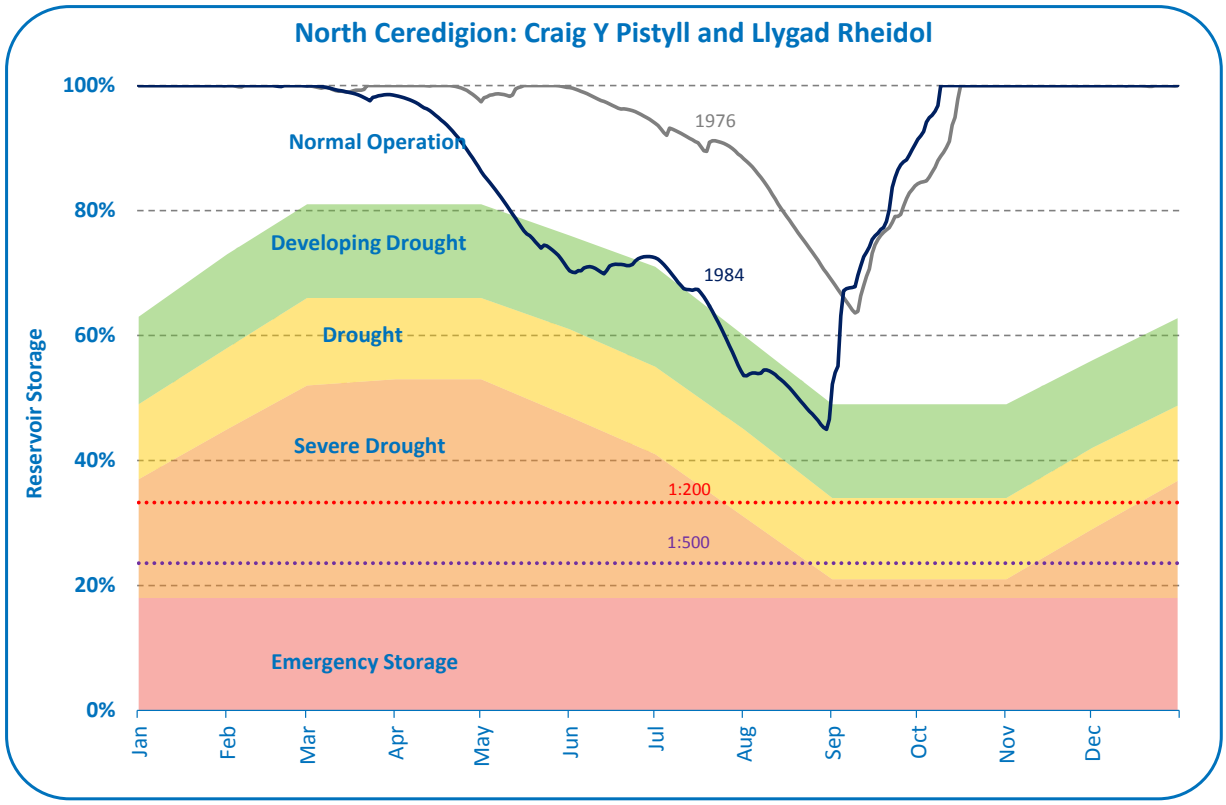

Figure 2 - LLR and CyP Drought Action Zone and results of scenario testing

1.3.Assessment of Drought Risk

The reported supply demand balance at WRMP19 showed the zone to be in a healthy position with a forecast 2.10 Ml/d surplus at 2024/25, increasing to 3.8 Ml/d by 2049/50. Application of the Drought Vulnerability Framework (DVF) screening methodology classified the WRZ as low risk to drought and so only a simple approach was required to test the system performance under more extreme drought events.

The flow record used for scenario testing covers the period 1952 – 2015 and so encompasses the known drought events of 1976, 1984, 1989 and 1995. Drought risk for the zone is undertaken through assessment of the combined storage position in Llyn Craig y Pistyll and Llyn Llygad Rheidol against the DCLs we have defined, as shown in Figure 2.

Using Extreme Value Analysis techniques, an estimation of the level of drawdown we could see at Llyn Craigypistyll and Llyn Llygad Rheidol combined, under a 1:200 year and 1:500 year drought return period scenarios were produced.

The results in Figure 2 show that even under these more severe drought events, reservoir levels would not fall below into the Emergency Storage action zone and so there no real risk of us needing to implement extreme supply side measures. The testing has however shown that reservoir levels could fall into the Severe Drought Action Zone and so we still need ensure that during a drought, we carefully manage our water resources.

To provide an additional level of drought resilience, we have retained one environmental supply side option to provide extra water resource, in the event that this is required. Section 1.5 provides details of this.

1.4.Drought Management of the WRZ

As the identified drought risk in the zone is low then our water resource management philosophy is to ensure we operate our water resources in line with our control curves and take all necessary actions in good time, in order to maintain this high level of drought resilience.

The following sections describe the operation of the zone as we move into a drought period and the actions that we will take to ensure that we minimise the impact on our customers. In the event of extreme drought, options to increase the quantity of water resource available for public water supply may be required – these are also outlined, with supporting summary information on the requirements of those options.

1.4.1. Normal Action Zone

During normal weather conditions we optimise our sources to minimise the cost of operations. In the North Ceredigion zone this means that we make maximum use of Bontgoch treatment works to gravitate supply to our customers. The supply extends throughout the zone to Aberystwyth, minimising the amount of pumping we have to do from the Lovesgrove borehole and at Cefn Llan WTW.

In the spring period as storage in Llyn Llygad Rheidol and Llyn Craig y Pistyll starts to decline, we begin abstracting from our intakes at the Maesnant and Nantymoch streams and pipe this water to Craig y Pistyll, to support the reservoirs.

If reservoir storages continue to decline despite the additional water from the two stream sources then we make small, stepped reductions in the supply area of Bontgoch and offset this by increasing the supply area of Cefn Llan. The first reduction which takes place is to stop the supply of water from Bontgoch into Aberystwyth, and increase Cefn Llan throughput to wholly support the town. The actions taken in the Normal Action Zone are arranged directly between Water Resources and local operations team, and do not require the involvement of a Gold or Silver incident centre to manage.

1.4.2. Developing Drought Action Zone

As combined reservoir storage moves into the developing drought action zone, the operations which may be necessary to preserve resource are less frequently undertaken. This increases the risk of the operations impacting our customers, and so to authorise these activities, the 'Gold' incident command centre may convene. In 2018 local action plans were provided to Gold command which instructed teams to commence a number of operations which are not routinely undertaken.

As reservoir storage continues to decline, we pump more water from the Cefn Llan system into areas normally supplied by Bontgoch, picking up demand from Aberystwyth University and holiday sites around Clarach.

Depending on levels of customer demand, and on instruction from Gold Command, we will start abstracting from our Lovesgrove 2 borehole to enable us to increase the output of Cefn Llan treatment works. Water from Cefn Llan is pumped further north towards Bontgoch, ultimately fully supplying the Borth area and its associated holidaymaker demand. This reduces Bontgoch treatment works to its minimum operating level and reduces as far as possible the demand on Llyn Llygad Rheidol and Llyn Craig y Pistyll.

1.4.3. Drought Action Zone

Once all changes to our water supply systems have been made and both Bontgoch and Cefn Llan treatment works are running at their sustainable maximum outputs, the operation of the zone will be fully optimised to preserve water resource.

In the event that dry weather continues and our forecasts indicate that reservoir storage will cross into the Sever drought action zone then we will start preparations to request a drought order from Welsh Government. The permission from Welsh Government would enable us to take additional water from the Nantymoch HEP reservoir, a third party reservoir not currently utilised for public water supply, to preserve water within our reservoirs.

To support this request, we will commence environmental monitoring in line with our Environmental Assessment Report (Appendix 25) and submit our application for the option – summary information about this is provided in Section 1.5.

1.4.4. Severe Drought Action Zone

As reservoir storage enters the Severe Drought Action zone, subject to receiving the necessary permissions from Welsh Government, we will implement our Drought Order scheme. As set out in Section 1.5, the option available to us is to apply for permission to abstract water from Nantymoch HEP. This option will augment our supply to Bontgoch treatment works and further reduce the supply required from Llygad Rheidol and Craig y Pistyll, thus preserving storage in our reservoirs which will enable us to maintain customer supplies for longer.

1.5.Supply-side drought management action

Table 2 provides the information required by Appendix G of NRW's Water Company Drought Plan Technical Guideline (Dec 2017). The table summarises the key information from within the associated Environmental Assessment Report including any potential environmental impacts, risks to the scheme implementation and any necessary mitigation that may be required.

Action Implementation Assessment	**Name:**	**Pumped abstraction from Nantymoch reservoir**
	Trigger(s)	The combined storage of Llyn Llygad Rheidol and Llyn Craig y Pistyll crosses into Severe Drought Action Zone.
	Deployable Output or yield of the action	5 Ml/d yield
	Location	Nantymoch reservoir
	Implementation timetable	**Preparation time:** We assume a decision from NRW within 14 days of submitting the Drought Permit application. We would allow four weeks for commercial agreement with Statkraft, the reservoir owners, and for access agreements to lay the temporary pipe. The practical implementation of the option could potentially be effected within two weeks. **Time of year effective:** The option could be implemented at any time of year. **Duration:** Drought permits are valid for up to six months, but would be removed sooner if water resources in the North Ceredigion WRZ returns to adequate levels sooner than this.
	Risks associated with action	The application, as applied for, is not approved.
	Other considerations	Commercial agreement with the owners of Nantymoch reservoir, Statkraft, and access agreement from landowners along the pipeline route will need to be sought.
Environmental Assessment: alone & in-combination	**Risk to the Environment**	Reduced storage in Nantymoch reservoir
	Summary of likely environmental impacts	The EAR has concluded that there is potential for negligible impact on levels in Nantymoch reservoir, and no impact in of the Afon Rheidol, downstream. . Because these impacts are negligible, further environmental assessment has not been required.
	Baseline information used	**Hydrological data:** • Llyn Llygad Rheidol reservoir level data • Llyn Llygad Rheidol abstraction data • Nant-y-Moch and Maesnant streams abstraction data • NRW flow gauge on the Afon Rheidol at Llanbadarn Fawr **Ecological data:** Baseline ecological data has not been required because the EAR concluded there to be negligible impact on levels in Nantymoch reservoir and flows in the Afon Rheidol.
	Summary of additional monitoring requirements	Screening has not identified any environment features for which environmental assessment is required and, therefore, no feature specific monitoring will be required. However, the EAR recommends that current hydrological monitoring should continue during the development of drought conditions and implementation of the drought order to monitor and confirm baseline conditions.
	Mitigation & Compensation measures	The mitigation measures that could be considered at the on-set of drought, during implementation of the drought permit and post-drought permit implementation include: • Temporary reduction or cessation of the terms of the Drought Order/Permit • Fish distress monitoring with triggers and response plan • Protection of 'spate flows' • Reduction of fish predation • Physical in-river works • Provision of alternative compensation flows

		• Provision of alternative water supplies if other water users are at risk of derogation. Potential mitigation measures have also been proposed and further discussion with NRW is required in order to develop suitable mitigation measures.
	Impact on other activities	Due to the concluded negligible impact on levels in Nantymoch reservoir and no impact on flows in the Afon Rheidol, there is no expected impact on landscape, recreation or amenity.
	Any permissions or approvals required and constraints that apply	Commercial agreement with the owners of Nantymoch reservoir, Statkraft, and access agreement from landowners along the pipeline route will need to be sought.

Table 2 - Option 8203-2 Pumped abstraction from Nantymoch reservoir