

DRAFT DROUGHT PLAN

2019

STATEMENT OF RESPONSE

Prepared by the Water Resources Strategy Team

Hafren Dyfrdwy

October 2019



Statement of Response

Introduction

We published our draft Drought Plan 2019 and the accompanying Strategic Environmental Assessment (SEA), Habitats Regulations Assessment (HRA) and Water Framework Directive (WFD) Environmental Reports for consultation in July 2019. The consultation period has ended on 6th September 2019. We received comments on our draft Drought Plan from two stakeholders.

We received representations from the following organisations:

Organisation	Abbreviation
Natural Resources Wales/Cyfoeth Naturiol Cymru	NRW
Cheshire West and Chester Council	-

This is our Statement of Response (SoR) and it shows how we have addressed all of the comments and suggestions that we have received. In this document we list the comments that we received from each organisation, and in Chapter 2 we explain what we have done as a result. In some cases we have made changes to our draft Drought Plan, which will be reflected in the final version when it is published. In other cases, while we don't need to change our draft Drought Plan, we explain how we can address the comment separately.

Where we have revised our draft plan or the response requires further detail or evidence, we have provided this in Chapter 3 of this SoR document.

We will also update the Environmental Reports that accompanied our draft Drought Plan in line with the changes in our final Drought Plan.

1. Executive summary

We encouraged a wide range of stakeholders to respond to our draft Drought Plan. Our Drought Plan sets out how we will manage our resources and supply system in dry years, to maintain our service to customers.

In the consultation feedback there were some topics where NRW challenged us to include and illustrate more details in some areas in our final Drought Plan. The key themes that emerged through the stakeholder feedback were:

- *Pre-consultation Discussions and Stakeholder Engagement*
- *Drought Triggers for Groundwater Sources*
- *Practical implementation of supply-side drought management action*
- *Monitoring plan and mitigation measures*
- *Strategic Environmental Assessment and Habitats Regulations Assessment screening*
- *Implementation of Temporary Use Bans (TUBs)*

There were a small number of issues raised that have resulted in us adding more information to our Final Drought Plan. These were that we should:

- Include an overview of what discussions were made during consultation stages and how these influenced the development of the drought plan.
- Provide details on the practical implementation of the method of water abstraction from the Lower Pen-Y-Cae Reservoir for flow augmentation
- Update our drought plan to include detailed monitoring plan to assess the implementation of the supply-side drought management action (flow augmentation from the Lower Pen-Y-Cae Reservoir).

We explain in Chapter 2 how these challenges will be addressed in our final Drought Plan.

2. Hafren Dyfrdwy 2019 draft drought plan statement of response

Table 2.1 below explains how the issues raised in the responses will be addressed in our final Drought Plan.

Table 2.1 Hafren Dyfrdwy 2019 draft drought plan statement of response

Organisation	Comment	Our Response
NRW	<p><i>During its preparation of the draft plan, Hafren Dyfrdwy consulted Natural Resources Wales and other statutory consultees. However, it is not clear how the company has taken on board any of these discussions when preparing its draft plan. The company should provide an overview of what was discussed and how these influenced the development of its draft plan.</i></p> <p><i>The company should also include further clarification in the final plan on what discussions have been held with customers and other interest groups.</i></p>	<p><i>Between the 19th November and 31st December 2018 we carried out a pre-draft Drought Plan consultation process with our major stakeholders who included Consumer Council for Water (CCWater), NRW, Environment Agency (EA), Ofwat, Welsh Government, Severn Trent Water, United Utilities and Dŵr Cymru Welsh Water. The aim of the pre-draft consultation process was to obtain our stakeholders views on the previous plan, so that we could use these to shape and improve this plan. During this consultation process, various areas of the drought plan have been discussed particularly with NRW, which were used in shaping and improving the plan. The issues discussed include:</i></p> <ul style="list-style-type: none"> <i>- Drought vulnerability assessment for our water resource zones</i> <i>- Drought resilience modelling</i> <i>- Supply side drought management actions - augmentation of the River Dee with water from our Lower Pen-y-Cae Reservoir</i> <i>- Geographical area supplied by HAFREN DYFRDWY and our new water resource zones</i> <i>- Updates to control curves for our upland reservoirs in the Wrexham water resource zone</i> <p><i>A number of improvements have been made to the Drought Plan to reflect these discussions, legislative and regulatory changes that have occurred since the previous plan, and to comply with the latest guidelines and codes of practice. These changes include:</i></p> <ul style="list-style-type: none"> <i>- Drought vulnerability assessment has been carried out for our water resource zones in line with the latest NRW Water Company Drought Plan Technical Guideline issued in December 2017 and the associated guidance notes.</i> <i>- Revisions to reflect the geographical area supplied by HAFREN DYFRDWY and our new water resource zones.</i> <i>- Control curves for our upland reservoirs in the Wrexham water resource zone have been updated, which was carried out in line with our WRMP19.</i> <i>- Our proposed drought management and communication plan has also been updated. This details how we will manage droughts and communicate with our customers and other stakeholders during a drought situation.</i>

		<ul style="list-style-type: none"> - A Water Framework Directive report has been produced and our Strategic Environmental Impact Assessment Screening Report and a Habitats Regulations Assessment Screening Report have been updated to identify any potential adverse effects that the drought options we have considered may have on the environment. <p>In addition, we have carried out customer research for our PR19 and Water Resources Management Plan 2019 (WRMP19) to explore customer views on various areas including leakage, resilience and water efficiency using a range of insight sources. We have engaged stakeholders on topics such as catchment management. We have used research techniques ranging from deliberative research, co-creation, in-depth discussions with customers in vulnerable circumstances, quantitative research including stated preference research and our regular customer tracker. We have also reviewed complaints data as many of the service issues are amongst the top causes of complaints, including leakage. More detail on our wider customer engagement approach and what we have learned is provided in Appendix E of our WRMP19, available here:</p> <p>https://www.hdcymru.co.uk/content/dam/hdcymru/about-us/wrmp/2019-final/Appendix-E-Testing-the-plan-fWRMP.pdf</p> <p>Section 1.5 in the final Drought Plan will be updated to include the above and further consultations made on the draft drought plan.</p>
NRW	<p>For the groundwater trigger in the main report (page 18-20) there is little detail on the monitoring that the company currently use or will use. The trigger zones labelled A-F are not linked with the drought stages (normal, developing drought, drought and severe drought) in figure 13. Therefore, it is difficult to know which actions will be taken by the company as the drought develops.</p> <p>For the final plan, the company should provide more details on</p> <ul style="list-style-type: none"> • i) how they monitor the groundwater, • ii) quantify the drought triggers they use and 	<p>Figure 13 will be updated in the final plan to link trigger zones labelled A-F with the drought stages (normal, developing drought, drought and severe drought).</p> <p>Column three in Figure 13 of the drought plan describes all the various drought management actions that will be taken by the company as drought develops and each trigger zones are crossed.</p> <p>We are currently assessing options that could be used to develop a system for monitoring groundwater levels and to quantify triggers used to inform drought management actions based on a combination of the following factors:</p> <ul style="list-style-type: none"> - Demand on the groundwater source - River flow and rainfall levels

	<ul style="list-style-type: none"> • iii) link these to the drought management actions. 	<p><i>It has not been possible in this SOR to complete this and provide details on groundwater monitoring and quantify the drought triggers. But we commit to complete this work and discuss it with NRW to agree suitable triggers and monitoring to include in the final drought plan.</i></p>
NRW	<p><i>The main report and the SEA screening report both state that the duration for the implementation of the augmentation of the River Dee with water from the lower Pen-Y-Cae reservoirs would be less than 6 months. However, the company states it as 'maximum of 7 days' in the HRA and the supplementary Water Framework Directive (WFD) documents. A period of 6 months means both HRA and WFD may have underestimated the potential impact, which has been classified as 'short-term'.</i></p> <p><i>The company should provide further clarification about the lead-in time and the duration of the implementation of the supply-side action. The HRA and WFD assessments will need to be amended to account for this duration if longer than the 7 days stated.</i></p>	<p><i>As drought conditions develop, decisions made by the Dee Consultative Committee (DCC) at different stages of the drought will be used to inform early planning of temporary pump installation process, which will be managed by our Drought Action Team (DAT). We plan to install the temporary pumping station and implement the flow augmentation with in a period of 7 days from the day of notification. The duration for augmentation is dependent on the storage in the Dee Storage System but assumed to be less than six months. The HRA and WFD assessments will be amended in line with this.</i></p>
NRW	<p><i>For each supply-side drought management action, water company should carry out an environmental assessment of the likely impacts from implementing the action. We acknowledge that for the augmentation of flow from the Lower Pen-y-Cae (the only supply-side action), the company has considered the potential environmental impacts. However, the draft plan currently contains insufficient information regarding the potential impacts, monitoring and mitigation measures.</i></p> <p><i>In particular, we acknowledge that WFD screening concluded this action may lead to temporary and reversible WFD deterioration risks for Lower Pen-y-Cae Reservoir and River Eitha. The company should identify within its final plan the specific monitoring and mitigation measures to reduce the risk. We would welcome discussions with Hafren Dyfrdwy to clarify our expectations for the environmental assessment as well as the</i></p>	<p><i>Please refer to section 3.2 in Chapter 3 for the details on the proposed monitoring plans and mitigation measures, which will be included in the final drought plan.</i></p>

	<i>monitoring plan and mitigation measures for this supply-side management action.</i>	
NRW	<p><i>Section 36 of the Flood and Water Management Act 2010 (inserted into the Water Industry Act 1991) allows water companies to implement a wider range of temporary water use restrictions during a drought. The Water Use (Temporary Bans) Order 2010 gives further information and requirements on the implementation of this legislation.</i></p> <p><i>We have assessed how the company has approached this legislation and incorporated the principles of the UKWIR Code of Practice (11/WR/33/3) into the draft plan. The company has considered how this legislation could affect its management of a drought and has incorporated the principles of it into its drought plan.</i></p> <p><i>The company has identified that they will implement all eleven TUBs restrictions at the same time. Hafren Dyfrdwy should include within its final plan how it has consulted their customers on the development of this policy. The company should also clarify when they implement TUBs how the representation process for their customers will be managed, what is expected from customers and how the company will consider any representations received.</i></p>	<p><i>We do have the option of phasing in the eleven restrictions, but implementation of all the restrictions at the same time was suggested based on the following points.</i></p> <ul style="list-style-type: none"> <i>• Phasing in restrictions would be difficult to communicate to our customers and lead to unnecessary confusion.</i> <i>• We do not think it is fair to imply that some activities are ‘more important’ than others by prohibiting them later on in the process.</i> <i>• This policy is in line with our neighbouring companies: United Utilities, Severn Trent and Dŵr Cymru Welsh Water.</i> <p><i>These points have been mentioned in the final drought plan. This policy is in line with our previous drought plan and no specific customer consultations have been carried out regarding this policy.</i></p> <p><i>Section 3.3.5 of the Draft Drought Plan states that as set out in the legislation and the UKWIR Code of Practice, we will allow exceptions to the TUB for certain customers that fall under the three exception categories. A copy of the proposed form that can be used by customers to make a representation has been provided in Appendix H (Temporary Water Use Exception Form) of the drought plan.</i></p> <p><i>Section 3.3.5 of the drought plan also includes information on what we consider when granting an exception to customers and specifies the responsible leads in the company to review representations received from customers.</i></p> <p><i>As discussed in section 3.3.5 of the drought plan, further details of how to make a representation will also be given in the notice that we will publish prior to imposing restrictions.</i></p> <p><i>Section 3.3.5 of the drought plan also includes the following to inform customers about the process of TUB objections.</i></p> <p><i>“There is no formal process for objecting to restrictions under a TUB, we will only introduce TUBs in very extreme circumstances when it is in the best interest of both</i></p>

		<i>customers and the environment. Objection can be lodged as a judicial review under the Human Rights Act.”</i>
NRW	<p><i>We have assessed the Hafren Dyfrdwy’s HRA and SEA screening reports. It is our advice that the information provided by the company in relation to the Lower Pen-Y-Cae option is currently insufficient to conclude no likely significant effects as defined under the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004.</i></p> <p><i>We advise that the company provides further information on the location and method of abstraction as depending on where and how the option will operate, this could have impact on the water quality within the River Eitha and the main river Dee especially during the low flow periods when the dilution rates would be lower. The SEA and HRA assessments should be amended to reflect this information.</i></p> <p><i>We would welcome discussions with Hafren Dyfrdwy to clarify our expectations and the requirements for the HRA and SEA screening processes in order for us to agree with a conclusion of no likely significant effects.</i></p>	<p><i>When flow augmentation is required during a drought event, we plan to install a suitable temporary pumping station at the Lower Pen-Y-Cae Reservoir that enables us to abstract water from the top level of the reservoir. We plan to measure the daily volume of flow augmentation using the pumping rate/pump capacity. We will also carry out flow measurements downstream of the reservoir during the flow augmentation and collected data will be used to validate the use of pumping rate for measuring the flow augmentation. Pumped water will be conveyed to downstream of the Lower Pen-Y-Cae Reservoir through a pipe that will be placed over the spillway. These operational details of the flow augmentation option will be included in the final drought plan.</i></p> <p><i>To address the concerns raised by NRW about the no likely significant effects conclusion made in the draft drought plan under insufficient information provided, we will set out a set of commitments in the final drought plan as shown in Section 3.1 in Chapter 3.</i></p> <p><i>Please refer to section 3.2 in Chapter 3 for the details on the proposed monitoring plans and mitigation measures, which will be included in the Final Drought Plan.</i></p>
Cheshire West and Chester Council	<p><i>Thank you for your correspondence and copy of Hafren Dyfrdwy Draft Drought Plan (2019) for our consideration.</i></p> <p><i>Planning Policy at Cheshire West and Chester welcome continued liaison with Hafren Dyfrdwy and would like to make the following general comments.</i></p> <p><i>The Cheshire West and Chester Local Plan (Part One) Strategic Policies (adopted January 2015) provides the overall vision, strategic objectives, spatial strategy and strategic planning policies for the borough to 2030. It is considered that these strategic objectives and policies support and complement the proposed strategy within the Hafren Dyfrdwy Draft</i></p>	<p><i>Hafren Dyfrdwy would welcome continued liaison with Cheshire West and Chester Council. We would also like to confirm that Cheshire West and Chester Council is formally recognised as a stakeholder in our Drought Plan and will be contacted in all our future consultations.</i></p>

	<p><i>Drought Plan including policies to address water supply and demand and water efficiency measures.</i></p> <p><i>These objectives have been carried forward into the policies of the Local Plan (Part Two) Land Allocations and Detailed Policies which was prepared in liaison with Dee Valley Water. The Local Plan (Part Two) adopted July 2019, includes policies relating to water quality, supply and treatment; ensuring that water efficiency methods are optimised which are also in line with the principles set out within the Draft Drought Plan.</i></p> <p><i>We would welcome future consultation and liaison as we look to any implement and monitor Cheshire West and Chester's Local Plan.</i></p>	
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3. Additional information

3.1 Proposed assessment of the flow augmentation option

The single supply-side option in the Drought Plan relates to the augmentation of the River Dee using releases of water from the Lower Pen-y-Cae Reservoir via the Trefechan Brook, which would be required in severe drought conditions. Under normal conditions, additional water in Lower Pen-y-Cae Reservoir feeds the River Dee via Trefechan Brook, which is a tributary of the River Eitha. NRW has expressed concern about the effects of water released from the Lower Pen-y-Cae Reservoir on the downstream rivers during the implementation of the flow augmentation option. Particularly, NRW has mentioned that the information provided in relation to the flow augmentation from Lower Pen-Y-Cae option is currently insufficient to conclude no likely significant effects as defined under the Environmental Assessment of Plans and Programmes (Wales) Regulations 2004.

In view of this we propose to set out the following commitments in the final Drought Plan:

a) We will carry out water quality monitoring programme at different stages and locations to inform further assessment of environmental risks associated with the flow augmentation option (Please refer to section 3.2). Details on the frequency and number of samples to be taken along with the key parameters to be analysed, will be agreed with NRW before the final drought plan is published.

b) We will work with NRW to update the conditions included in the DGD regarding implementation of the flow augmentation option. We will also revise the text in the final drought plan to state that the flow augmentation option will only be implemented if it complies with the conditions described in the Dee General Direction (DGD).

3.2 Proposed monitoring plan and mitigation measures

During low flow conditions, Trefechan Brook is understood to be dry or has low flow, as there are no requirements for compensation flows from Lower Pen-y-Cae Reservoir. Thus, there would be higher stream bed losses during dry periods when augmentation would be required. We plan to do hydrological monitoring to quantify the volume of water that needs to be released from the Lower Pen-y-Cae Reservoir in order to ensure augmentation of flows in the River Dee by 0.4MI/d in stage 1 and 0.8MI/d in stage 2.

Hydrological monitoring will be conducted during dry and low flow period, which is a period during which the conditions will be representative of these occurring when the augmentation option is most likely to be implemented.

In addition, we also plan to carry out water quality monitoring programme in order to inform further assessment of environmental risks associated with the flow augmentation option. The water quality monitoring program will be conducted at different periods as described in detail in tables 3.1 and 3.2 below.

Table 3.1. Proposed monitoring plan to inform assessment and operation of the flow augmentation option

Feature	Site (see map below)	Monitoring
Hydrology	Trefechan Brook River Eitha	Hydrological monitoring will be conducted during dry and low flow period. Spot flows should be undertaken at selected locations to determine the contribution of flows from the Pen-y-Cae Reservoir to the downstream waterbodies.

		<p>The flows should be measured using standard flow monitoring techniques:</p> <ul style="list-style-type: none"> • The water width and bank full width should be measured. • The water width should be divided into 20 sections of equal width. • Water depth should be measured at the midpoint of each section. • Velocity should be measured at the midpoint of each section using, at 60% depth if depth was less than 0.76m and at 20% and 80% depth if depth was greater than 0.76m. • The discharge of each section should be determined by multiplying velocity, section width and section midpoint depth. The total flow in the channel should be then calculated by adding together each of the 20 section discharges. <p>Daily measurements will be made during the hydrological monitoring period that will be conducted during dry and low flow conditions.</p> <p>Spot flows will be collected from different sites (Figure 3.1 shows location of the different sites):</p> <ul style="list-style-type: none"> • Trefechan Brook - upstream of confluence with the River Eitha (site 2) • River Eitha – upstream and downstream of the confluence with the Trefechan Brook and upstream of the confluence with the River Dee (sites 3, 4 and 5)
Water Quality	Lower Pen-y-Cae Reservoir	<p>Water quality monitoring will include the measurements of the following variables:</p> <ul style="list-style-type: none"> • Dissolved oxygen (concentration and percentage saturation) • Conductivity • Alkalinity • Turbidity • pH levels • Chlorophyll-a <p>A detail list of determinants to be measured will be agreed with NRW before the final drought plan is published.</p> <p>Monthly water quality sampling will be collected from the Lower Pen-y-Cae Reservoir for a 6-month period during a period representative of when the scheme is most likely to be implemented (April-September). To provide a baseline understanding of the reservoir water quality profile, these samples will be collected from the Lower Pen-y-Cae Reservoir even if Lower Pen-y-Cae Reservoir is spilling. Detail timelines for taking these samples will be agreed with NRW before the final drought plan is published.</p> <p>All samples from the Pen-y-Cae Reservoir will be collected at three different depths (surface, middle and bottom) of the reservoir (i.e. 3 samples to be collected at a time from the reservoir).</p>

We also plan to carry out monitoring and mitigation measures during the implementation of the flow augmentation option. Details of the proposed monitoring and mitigation programme and associated triggers and indicators for the implementation of the flow augmentation stage are identified in Table 3.2 below.

Table 3.2. Proposed monitoring and mitigation during the implementation of the flow augmentation option

Feature	Site (see map below)	Monitoring	Trigger	Proposed mitigation action(s)
Walkovers	Lower Pen-y-Cae Reservoir Trefechan Brook River Eitha River Dee	Walkover survey during low flow conditions - Mapping of sensitive habitats, communities, species and any monitoring sites that are required in order to improve understanding of the baseline communities.	N/A	N/A
Water Quality	Lower Pen-y-Cae Reservoir Trefechan Brook River Eitha River Dee	<p>Weekly water quality monitoring will be undertaken of the following variables:</p> <ul style="list-style-type: none"> • Dissolved oxygen (concentration and percentage saturation) • Conductivity • pH levels • Temperature <p>Water quality samples will also be collected on a monthly basis and, in addition to the above listed variables, detailed analyses of water samples will be undertaken. A detail list of determinants to be measured will be agreed with NRW before the final drought plan is published.</p> <p>Samples will be collected at the following sites (location of all sites are marked in Figure 3.1):</p> <ul style="list-style-type: none"> • Pen-y-Cae Reservoir – samples will be collected at three different depths (surface, middle and bottom) of the reservoir (i.e. 3 samples to be collected at the reservoir – site 1). • Trefechan Brook - upstream of confluence with river Eitha (site 2) • River Eitha – upstream and downstream of the confluence with the Trefechan Brook and upstream of the confluence with the River Dee (sites 3, 4 and 5) • River Dee - upstream and downstream of the confluence with the River Eitha (sites 6 and 7) 	N/A	N/A

Algae	Lower Pen-y-Cae Reservoir	Regular visual checks will be made for the presence of scumming using Centre of Ecology and Hydrology's CEH 'Blooming Algae' app on phone ¹ . If the visual check suspects an algal bloom to be potentially harmful, undertake numerous spot samples to determine levels of chlorophyll <i>a</i> , key nutrients, and cyanobacteria cell counts.	Sample reveals algal species to be dominated by non-harmful species.	Report any algal blooms to NRW. For smaller reservoirs such as Lower Pen-y-Cae, the installation of barley straw bales around margins can prevent further algal growth (reliant on the breakdown of the bales which can take time to occur). This will be undertaken alongside aeration as bales may reduce dissolved oxygen levels during breakdown. Initial dosage rate is ~500 kg/ha. Dead aquatic and non-aquatic vegetative will also be removed, which may be contributing towards elevated nutrient levels.
			Sample reveals algal bloom to contain harmful species.	In addition to the mitigation measures for non-harmful algal blooms; Temporary suspend any recreational activities undertaken in/near the reservoir (e.g. angling and water sports). Make local stakeholders, public and farmers aware of the threats of harmful algal blooms to animals and livestock.
Fish	Lower Pen-y-Cae Reservoir	Fish are stranded or deemed at risk of being cut off from more suitable habitats within the reservoir as water levels recede and the reservoir bed becomes increasingly exposed, leading to the formation of separate 'pool' features.	Fish grouped up in noticeably high densities within areas of the reservoir that are reduced in size/shallow in depth, and/or disconnected from the main remaining body of water.	Rescue and relocate fish to more suitable habitats within the reservoir, or a pre-arranged holding facility/waterbody. Suitable sites for relocation will be agreed with NRW prior to implementation of the flow augmentation option. Temporarily suspend any angling.

¹ <https://www.ceh.ac.uk/news-and-media/news/bloomin-algae-new-app-help-reduce-public-health-risks-harmful-algal-blooms>

		<p>Targeting monitoring of mean dissolved oxygen levels in-reservoir² using a calibrated in-situ probe (weekly) or through installation of a continuous probe³.</p> <p>Where an algal bloom is assessed as present in the reservoir during periods of hot weather, pay particular attention to dissolved oxygen concentrations in the morning⁴.</p>	<p>Reservoir contains only coarse fish (<i>no salmonids present</i>): Mean dissolved oxygen level drops below 4mg/l.</p>	<p>Deploy oxygenation units within these areas of the reservoir. This would increase oxygen levels and minimise fish distress.</p> <p>Temporarily suspend any angling.</p>
			<p>Fish seen to be gasping at the water's surface or showing signs of lethargy/turning on their side on the surface.</p>	<p>As a last resort, rescue and relocate fish to more suitable habitats within the reservoir, or a pre-arranged holding facility/waterbody.</p> <p>Any netting and transfer of fish would be arranged during the drought as soon as environmental conditions were below an acceptable standard.</p> <p>Prior to the implementation of the flow augmentation option, any requirements regarding the translocation of fish (including the selection of suitable receptor sites) will be agreed with NRW.</p> <p>Temporarily suspend any angling.</p>
		<p>Targeting monitoring of water temperature in-reservoir using a calibrated in-situ probe or through installation of a continuous probe.</p>	<p>Average temperature of water column exceeds 26°C for a period of 3 days or more⁵.</p>	<p>Rescue and relocate fish to any available areas within the reservoir that possess temperatures below the trigger level.</p>
		<p>Notable increase in the presence and feeding activity of piscivorous/scavenging birds, mammals and/or fish carcasses on the shore being fed upon.</p>	<p>Presence of predators around areas which are known or likely to contain high densities of fish as a result of 'crowding'.</p>	<p>Installation of artificial floating islands with anti-predation fish mesh/cage below surface.</p>

² Mean dissolved oxygen to be measured according to lake type as follows: Mixed lakes (no stratification) - 0.5m depth intervals throughout the water column. Stratified lakes - below the thermocline (sample to be taken from the hypolimnion)

³ Oxygen conditions in lakes are strongly influenced by depth and thermal stratification. It is necessary to take this into account when measuring oxygen conditions in lakes

⁴ Photosynthesis is more vigorous during strong sunlight, during hot weather, super-saturation (dissolved oxygen) of the water can occur in the late afternoon, but after nightfall the Concentration of dissolved oxygen falls rapidly, to the extent that by dawn fish survival is at risk

⁵ Based on the information provided by Turnpenny A.W.H. & Liney K.E. (2007) Review and development of temperature standards for marine and freshwater environments. Jacobs, on behalf of SNIFFER

			<p>Predators to note include:</p> <ul style="list-style-type: none"> • Piscivorous/scavenging birds, such as cormorant, goosander, gulls and heron. • Mammals, such as mink and otter. <p>Presence of fish carcasses with signs of predation.</p>	<p>Bird scarers, general human activity around lake (e.g. regular presence of monitoring teams/rangers).</p>
		<p>Marginal plants (e.g. reed beds) and/or marginal macrophyte located in the reservoir margin left exposed and unavailable to fish as levels recede.</p> <p>Access to marginal plants and macrophytes typically required between March and July (by mixed species of coarse fish).</p>	<p>Marginal plants and macrophytes exposed between March and July.</p>	<p>Introduce artificial floating island features 1 month prior to spawning period – floating islands should possess suitable spawning medium attachments (e.g. artificial spawning brushes).</p> <p>Temporarily suspend any angling during spawning season/s.</p>

Figure 3.1: Proposed location of monitoring sites

