



# **Southern Water Draft Drought Plan 2018**

## **Annex 5 Environmental Monitoring Plan**

November 30, 2017  
Version 1



### 6.3.3 North Arundel

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		<b>Key locations</b>	<b>Monitoring and trigger setting</b>	<b>Trigger and monitoring to inform mitigation action</b>	<b>Mitigation actions triggered by monitoring</b>	<b>Monitoring and post-drought mitigation (where applicable)</b>	
Arundel Park SSSI	Habitat degradation as a result of decreased water levels or flows.	<p>To establish a baseline, monitoring should incorporate:</p> <p>Walkover surveys to further assess the level of groundwater and/or hydrological connectivity between the aquatic habitats (standing open water; canals; fens; marsh, swamp)</p> <p>Carry out a monitoring of standing water habitats using Common Standards Methodology<sup>35</sup> criteria for assessing habitat condition where appropriate.</p> <p>Repeat survey every 3 years</p> <p>Obtain any available site-specific water level/flow monitoring evidence.</p>	<p>Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during environmental drought.</p> <p>Carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition where appropriate.</p>	<p>Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during drought order implementation, if not already lost due to antecedent environmental drought conditions.</p> <p>Carry out appropriate monitoring of aquatic habitats using Common Standards Methodology criteria for assessing habitat condition in discussion with Natural England.</p>	<p>None applicable.</p>	<p>In year following drought order implementation, carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition.</p> <p>If existing habitats have been lost or damaged due to the drought order, consider scope for replanting / re-creation of habitats or consider compensatory habitat options, in dialogue with Natural England.</p>	<p>Southern Water in agreement with EA and NE</p>

<sup>35</sup> JNCC, Common Standards Monitoring Guidance for Freshwater Habitats and Species, Rivers and lakes guidance updated January 2014 and March 2015, respectively. ISSN 1743-8160 (Online)

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		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)
Fish community, including European eel and Bullhead	Reduction in extent or quality of important habitats, including potential exposure of marginal and bed substrates	Each waterbody to be surveyed for fish habitat as part of a wider low flow/low water level habitat walkover survey, including mapping of likely spawning and nursery habitat.	Walkover of key locations recording the number of spawning/nursery sites potentially affected if survey is undertaken at right time of year.	Additional walkovers if situation is expected to deteriorate in reaches/water bodies known to contain spawning habitats.	Consider any measures to locally improve water depth/flow over spawning habitat, e.g. temporary in-stream flow deflectors.	In the year following the drought order implementation, undertake fish surveys at the baseline monitoring sites to substantiate the level of impact.
Park Bottom tributary;	(spawning, nursery and cover habitats) in distributaries that are not level controlled	One walkover survey to be carried out for each waterbody once every 5 years.	Record extent of exposed marginal spawning and bed substrates.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	Repeat walkover of key locations recording the number of spawning/nursery sites potentially affected if survey is undertaken at right time of year.	Repeat walkover of key locations recording the number of spawning/nursery sites potentially affected if survey is undertaken at right time of year.
Swanbourne Lake; Mill Stream; WWT Reserve		Liaise with Environment Agency fisheries and ecology teams to determine key spawning and nursery habitat locations.	Photographs should be taken during each walkover		Record extent of exposed marginal spawning and bed substrates.	Record extent of exposed marginal spawning and bed substrates.
			As an alternative use historic survey data to provide an approximation, if available.			Photographs should be taken during each walkover.
			Appropriate trigger values would be set for level and flow for spawning habitats based on local circumstances, timing, seasonality and expert opinion.			Consider re-stocking options where appropriate and applicable in dialogue with the EA.

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Fish community, including European eel and Bullhead Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT Reserve	Fragmentation of habitats and increased significance of obstacles	Fish populations are not well understood as a result of lack of historic survey data.  Electric-fishing surveys to monitoring populations at 1 monitoring site for each water body: Park Bottom, Swanbourne Lake, Mill Stream; WWT Reserve.  1 survey round every 3 years at same sites (unless no fish at WWT Reserve)  Collate any further information from local knowledge and EA local staff, plus local biological records.	Walkover of key sections known to be susceptible to lower flows.  Known areas of dry habitats are typically avoided during the walkover, but recorded where observed to confirm and/or confirm existing knowledge  Electric-fishing surveys to monitoring populations at each of the four sites.	Additional walkovers, if situation is expected to deteriorate in stream sections / waterbodies known to contain high fish densities.  Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact.  Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA and WWT



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Fish community including European eel and Bullhead Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT Reserve	Increased mortality (density dependent) as a result of increased predation and competition	<p>Key locations</p> <p>Fish populations are not well understood as a result of survey data. Survey and data as set out in above row.</p>	<p>Monitoring and trigger setting</p> <p>Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment.</p> <p>Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.</p>	<p>Trigger and monitoring to inform mitigation action</p> <p>Additional walkovers, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities.</p>	<p>Mitigation actions triggered by monitoring</p> <p>Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels.</p> <p>Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements.</p> <p>Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.</p> <p>Consider possible in-stream measures or adjustments to improve habitat conditions.</p> <p>In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]</p>	<p>Monitoring and post-drought mitigation (where applicable)</p> <p>In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact.</p> <p>Consider re-stocking options where appropriate and applicable in dialogue with the EA.</p>	Southern Water in agreement with EA and WWT

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Fish community including European eel and Bullhead Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Impacts on growth and/or alteration to feeding and migration	<p>Key locations</p> <p>Fish populations are not well understood as a result of lack of historic surveys.</p> <p>Surveys and data as above rows for fish.</p>	<p>Monitoring and trigger setting</p> <p>Monitoring this potential impact is not feasible during a drought (involves post drought monitoring of the fish population – see other column).</p> <p>No monitoring is advised during drought as this may cause further stress.</p>	<p>Monitoring this potential impact is not feasible during a drought (involves post drought monitoring of the fish population – see other column).</p> <p>No monitoring is advised during drought as this may cause further stress.</p>	<p>None - mitigating the impact of changes to feeding regimes and movement patterns is not considered feasible during drought permit implementation.</p> <p>Monitoring will help to determine overall health of fish population and inform measures to facilitate the recovery of the fish population.</p> <p>Consider re-stocking options where appropriate and applicable in dialogue with the EA.</p>	<p>Monitoring and post-drought mitigation (where applicable)</p> <p>Three years post drought order monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis.</p>	Southern Water in agreement with EA and WWT

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Fish community including European eel and Bullhead Park Bottom tributary; Mill Stream	Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities.	Fish populations are not well understood as a result of lack of historic survey data.  Data and monitoring as above rows for fish.	Surveillance walkover of key sections/water bodies with fish populations which are known to be susceptible to hydrological impacts (as informed by baseline surveys and data)	Surveillance walkover of key sections/water bodies with fish populations which are known to be susceptible to hydrological impacts (as informed by baseline surveys and data)	<p>Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.</p> <p>Consider possible in-stream measures or adjustments to barriers to support fish movement and/or improve habitat conditions.</p>	<p>In the 2 years following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact.</p> <p>This will assist with determining if fish have successfully migrated back to previously impacted reaches from non-impacted tributaries/reaches.</p> <p>In extreme cases, following consultation with the Environment Agency, restocking of flow sensitive fish species can be considered if recovery needs to be facilitated.</p>	Southern Water in agreement with EA



<p>Fish community, including European eel and Bullhead</p> <p>Park Bottom tributary;</p> <p>Swanbourne Lake; Mill Stream; WWT reserve</p>	<p>Reduction in abundance or distribution as a result of reduced water quality.</p>	<p>Water quality is not well understood due to limited water quality data for the impacted sites.</p> <p>Collate any local water quality data that may be available (e.g. from WWT).</p> <p>Carry out water quality sampling at 1 site in each impacted water body at times of low flow/low water levels for: dissolved oxygen, pH, turbidity, suspended sediment, conductivity, temperature, ammonia and SRP</p> <p>2 surveys per year at times of low flow/water levels at the same survey sites.</p>	<p>Surveillance walkover of key sections with known water quality pressures and sections known to be susceptible to lower flows.</p> <p>At baseline water quality monitoring sites, measure dissolved oxygen, pH, turbidity, conductivity and temperature in the field using calibrated handheld equipment. Collect water quality samples to analyse for ammonia, suspended sediment and SRP and to confirm hand-held probe readings.</p> <p>Appropriate trigger values would be set for key water quality determinands (e.g. dissolved oxygen), level and flow based on local circumstances, timing, seasonality and expert opinion.</p> <p>Known areas of dry habitats are typically avoided during the walkover, but recorded where observed to confirm and/or confirm existing knowledge.</p>	<p>Surveillance walkover of key sections with known water quality pressures and sections known to be susceptible to lower flows.</p> <p>Measure dissolved oxygen, pH, turbidity, conductivity and temperature in the field using calibrated handheld equipment. Collect water quality samples to analyse for ammonia, suspended sediment and SRP and to confirm hand-held probe readings.</p> <p>Frequency = fortnightly, or more frequently if water quality is shown to be critical for fish.</p> <p>If DO saturation becomes critical for fish, deployment of automated water quality equipment that continuously monitors for dissolved oxygen in dialogue with EA.</p>	<p>Consider deployment of aeration equipment if critically low oxygen levels that could place fish in distress.</p> <p>Consider scope for improving quality of effluent or reducing inputs from the trout fishery and/or the Southern Water WSW discharge, if this would help address adverse water quality issues.</p>	<p>Carry out water quality surveys following baseline monitoring requirements. It is considered that water quality will return back to normal following cessation of the drought conditions that necessitated the drought permit implementation.</p> <p>No specific mitigation applicable post-drought permit implementation.</p>	<p>Southern Water in agreement with EA and WWT</p>
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		<b>Key locations</b>	<b>Monitoring and trigger setting</b>	<b>Trigger and monitoring to inform mitigation action</b>	<b>Mitigation actions triggered by monitoring</b>	<b>Monitoring and post-drought mitigation (where applicable)</b>	
Macrophytes Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve - Arundel	Reduction in abundance or distribution as a result of reduced water quality / habitat.	<p>Water quality is not well understood due to lack of water quality monitoring at these water bodies.</p> <p>Obtain local water quality data that may be available (e.g. from WWT)</p> <p>Carry out water quality surveys as noted above for fish.</p> <p>Macrophyte populations are not well understood as a result of lack of data.</p> <p>Collate any available local macrophyte data (e.g. from WWT).</p> <p>Carry out summer walkover and macrophyte surveys – 1 site at each water body. Identify any key point sources of nutrient loading.</p> <p>Repeat surveys every 3 years.</p>	<p>Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season)</p> <p>Carry out water quality sampling at same time (see fish section above for parameters).</p>	<p>Survey to be undertaken and macrophytes identified (if drought order implemented in plant growing season)</p> <p>Walkover survey to identify any key sources of nutrient loading.</p> <p>Carry out water quality sampling at same time (see fish section above for parameters).</p>	<p>Consider measures to address identified point sources of nutrient loading.</p> <p>Consider scope for improving quality of effluent or reducing inputs from the trout fishery and/or the Southern Water WSW discharge, if this would help address adverse water quality issues.</p> <p>Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.</p> <p>Consider possible in-stream measures or adjustments to improve habitat conditions.</p>	<p>Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts.</p> <p>Carry out water quality sampling at same time.</p> <p>No specific post-drought permit mitigation measures identified.</p>	Southern Water in agreement with EA and WWT

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Blue-green algae  Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Increased proliferation of blue green algal blooms at each of the four sites.	Lack of historic records.  Walkover surveys, fish surveys, water quality surveys and macrophyte surveys (see above) to record presence of blue-green algae. Where identified, water samples to be taken to analyse the algae and water quality conditions. Following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom, EA are to be notified.  Collate any historic evidence of blue-green algae from EA and other local knowledge to better assess risks.	Monthly walkover of key locations previously established. Visual assessment of algal blooms.  Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Monthly walkover of key locations previously established for visual assessment of algal blooms.  Samples to be collected from algal blooms which are suspected to contain blue green algae.  Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Mitigation of blue-green algal blooms should centre around reporting all blooms to the Environment Agency to ensure that appropriate action can be taken to inform the public.  If major risk identified, consider treatment of algal bloom if appropriate in dialogue with EA and water body owner/riparian owners.	Upon cessation of the drought order, baseline conditions will return. No further monitoring will be required post-drought order implementation.  Continue vigilance during standard baseline drought permit monitoring activities.	Southern Water in agreement with EA and WWT

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Macroinvertebrates  Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Water quality is not well understood due to lack of data for these waterbodies.	Seasonal monitoring of macroinvertebrates at the baseline survey sites.	Seasonal monitoring of macroinvertebrates at the baseline survey sites.	Consider scope for improving quality of effluent or reducing inputs from the trout fishery and/or the Southern Water WSW discharge, if this would help address adverse water quality issues.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA and WWT
		Carry out water quality surveys (see above).	Samples to be collected and identified to species level.	Samples to be collected and identified to species level.			
		Macroinvertebrate populations are not well understood as a result of lack of data.	Carry out water quality surveys at same time (see fish section above for relevant parameters).	Carry out water quality surveys at same time (see fish section above for relevant parameters).	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.		
		Collate available local records to improve baseline datasets.			Consider possible in-stream measures or adjustments to improve habitat conditions.		
		Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys. 1 site per water body, every year in spring and autumn. Identify to species level.					



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Water Vole Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Reduced habitat availability and/or food sources	Discuss with Sussex Wildlife Trust the available survey data for the impacted sites.  Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought permit implementation.  Repeat survey every 3 years.		Review baseline data and carry out further survey of water vole presence and habitat conditions.	Carry out further survey to assess any risk to local population.	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Sussex Wildlife Trust.  Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA and WWT



