

The impacts on the designated site as a result of a reduction in velocity and water quality in the main stem of the River Thames are considered to be of negligible magnitude, temporary and reversible. Overall, the significance of impact is considered to be **negligible**.

The overall confidence in the available data on Binsey Green SNCI and it's subsequent assessment has been classed as **medium** due to the low availability of data on the species and habitat that make up the site.

A summary of the impacts is provided in **Table B4-10**.

Table B4-10 Summary of Impacts on Binsey Green SNCI, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Binsey Green SNCI	Habitat degradation as a result of decreased river velocity in the River Thames	County	Negligible	Negligible

B4.1.2.5 Bypass Swamp SNCI

The physical environment assessment has identified that the main channel of the River Thames will be subject to reductions in velocity only.

The wetland habitats are unlikely to be impacted by a reduction in flow, as they will support slow-flowing habitats. The water level is the critical factor for the site, and therefore as this is not impacted on by the drought permit, impacts on the site are not anticipated.

The risk of water quality deterioration in the impacted reaches is high (associated with risk to SRP), and the abstraction and consented discharge pressures in Reach 1 have been identified as high risk. However, the impacts of these pressures are unlikely to be extensive and considering the proximity of this site to the nearest pressure the impacts are likely to be no greater than low. Impacts on the site due to water quality deterioration are anticipated to be of **minor** magnitude.

The overall confidence in the available data on Bypass Swamp SNCI and it's subsequent assessment has been classed as **low** due to the low availability of data on the species and habitat that make up the site.

A summary of the impacts is provided in **Table B4-11**.

Table B4-11 Summary of Impacts on Bypass Swamp SNCI, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Bypass Swamp SNCI	Habitat degradation as a result of water quality pressures in the River Thames	County	Low	Minor

B4.1.2.6 Fiddler's Elbow Marsh SNCI

The physical environment assessment has identified that the main channel of the River Thames will be subject to reductions in velocity only. None of the distributaries (including the Oxford Watercourses) of significance are considered likely to influence the site.

The wetland habitats are unlikely to be impacted by a reduction in flow velocity as they will support slow-flowing habitats. The water level is the critical factor for the site, and therefore as this is not impacted on by the drought permit, impacts on the site are not anticipated.

The risk of water quality deterioration in the reaches is high and there are abstraction and consented discharge pressures that will pose a risk where these occur. The abstraction and consented discharge pressures in Reach 1 have been identified as high risk. However, the impacts of these pressures are unlikely to be extensive and considering the proximity of this site to the nearest pressure, impacts are likely to be no greater than low.

Impacts on the site due to water quality deterioration are anticipated to be of **low** magnitude, with a **minor** impact

The overall confidence in the available data on Fiddler's Elbow Marsh SNCI and it's subsequent assessment has been classed as **low** due to the low availability of data on the species and habitat that make up the site.

A summary of the impacts is provided in **Table B4-12**.

Table B4-12 Summary of Impacts on Fiddler's Elbow Marsh SNCI, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Fiddler's Elbow Marsh SNCI	Habitat degradation as a result of reduction in flow velocity in the River Thames	County	Low	Minor

B4.1.2.7 *Thames Cut SNCI*

The physical environment assessment has identified that the main channel of the River Thames will be subject to reductions in velocity only.

The wetland habitats are unlikely to be impacted by a reduction in flow velocities, as the site has become disconnected from the River Thames. The water level could be a critical factor for the site, but as river levels are not impacted on by the drought permit, physical environment impacts are not anticipated.

The risk of water quality deterioration in the impacted reaches is high and abstraction and consented discharge pressures in Reach 1 have been identified as high risk. However, as the site has become disconnected from the river, impacts are not anticipated.

The overall confidence in the available data on Thames Cut SNCI and it's subsequent assessment has been classed as **low** due to the low availability of data on the species and habitat that make up the site.

A summary of the impacts is provided in **Table B4-13**.

Table B4-13 Summary of Impacts on Thames Cut SNCI, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Thames Cut SNCI	Habitat degradation as a result of decreased river velocities in the River Thames	County	Negligible	Negligible

B4.1.2.8 *Heyford Hill Lane Pasture SNCI*

The Oxfordshire Biodiversity Action Plan identifies that the lowland meadows are sensitive to changes in hydrology and nutrient status, with grassland of this type significantly reliant on winter flooding. The physical environment assessment has identified that the main channel of the River Thames in the impacted reaches will only be subject to reductions in velocity.

The risk of water quality deterioration in the impacted reaches is high and the abstraction and consented discharge pressures in Reach 1 have been identified as high risk. However, as the water quality impacts would not occur during high flows when the site becomes flooded, water quality impacts are not anticipated to impact the site.

The impacts on the designated site as a result of a reduction in velocity and water quality in the main stem of the River Thames are considered to be of negligible magnitude, temporary and reversible. Overall, the significance of impact is considered to be **negligible**.

The overall confidence in the available data on Heyford Hill Lane Pasture and it's subsequent assessment has been classed as **low** due to the low availability of data on the species and habitat that make up the site.

A summary of the impacts is provided in **Table B4-14**.

Table B4-14 Summary of Impacts on Heyford Hill Lane Pasture SNCI, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Heyford Hill Lane Pasture SNCI	Habitat degradation as a result of decreased river velocity in the River Thames	County	Negligible	Negligible

B4.1.2.9 Thames Island near Streatley SNCI

Although the physical environment assessment has identified the risk to river habitats in Reach 1 to be minor, abstraction pressures in the reach pose a cumulative risk to river flows. Impacts on the main channel of the River Thames will be minor as the watercourse is level controlled.

The physical environment assessment has identified that the main channel of the River Thames in the impacted reaches will only be subject to reductions in velocity. The wetland habitats are unlikely to be impacted by a reduction in flow velocity as they will support slow-flowing habitats. The water level is the critical factor for the site, and therefore as this is not affected by the drought permit, impacts are not anticipated. Water quality impacts are anticipated to be of low magnitude.

The impacts on the designated site as a result of the flow pressure and water quality in the main stem of the River Thames are considered to be of low magnitude, temporary and reversible. Overall, the significance of impact is considered to be **minor**.

The overall confidence in the available data on Thames Island near Streatley SNCI and its subsequent assessment has been classed as **low** due to the low availability of data on the species and habitat that make up the site.

A summary of the impacts is provided in **Table B4-15**.

Table B4-15 Summary of Impacts on Thames Island near Streatley SNCI, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Thames Island near Streatley SNCI	Habitat degradation as a result of decreased river velocity in the River Thames	County	Low	Minor

B4.1.2.10 Coastal and floodplain grazing marsh

Floodplain grazing marsh is defined as periodically inundated pasture, or meadow with ditches which maintain the water levels, containing standing brackish or fresh water. As these habitats are periodically inundated, they are sensitive to drought and flood events. Coastal and floodplain grazing marsh is not a specific habitat but a landscape type which supports a variety of habitats. The ditches within these habitats are usually rich in plants and invertebrates. Sites may contain seasonal water-filled hollows and permanent ponds with emergent swamp communities, but not extensive areas of tall fen species like reeds. The principal environmental variables influencing vegetation include: salinity, water depth, substrate and successional stage.

Coastal and floodplain grazing marsh habitat has more extensive coverage adjacent to Reach 1. Aerial imagery indicates the presence of several channels and ditches associated with the floodplain grazing marsh in Reach 1. Low flows and water levels could therefore reduce aquatic habitat availability. This could impact on the fauna and flora assemblages associated with these ditches. Freshwater ditches often include various snail and mollusc species although the beetles *Graptodytes pictus*, *Gyrinus substriatus*, *Halipilus lineatocollis*, *Hydrophilus piceus*, *Laccobius colon*, *Laccobius minutus*, *Limnoxenus niger* and *Peltodytes caesus*, the bugs *Ilyocoris cimicoides*, *Plea minutissima* and *Sigara dorsalis*, the mayflies *Caenis robusta* and *Cloeon dipterum*,

the swimming caddis *Trienodes bicolor* are also known to occur in these habitats¹². These species are generally adapted to slow flowing water and are not sensitive to water quality changes.

The risk to river habitats associated with the drought permit are related to changes in velocity and as such, hydrological impacts where habitats are connected will be limited. The deterioration of the water quality due to increased concentrations of SRP would be of concern in both reaches as this will encourage macrophyte growth and increase the occurrence of fast-growing opportunistic taxa, epiphytes and filamentous algae. It is noted that these habitats are most likely periodically flooded and as such, water quality will most likely show seasonal variation.

B4.1.2.11 Lowland fens

Lowland fens are peatlands which receive water and nutrients from the soil, rock and ground water as well as from rainfall: they are minerotrophic. Two types of fen can broadly be distinguished: topogenous and soligenous. Topogenous fens are those where water movements in the peat or soil are generally vertical. They include basin fens and floodplain fen. Soligenous fens, where water movements are predominantly lateral, include mires associated with springs, rills and flushes in the uplands, valley mires, springs and flushes in the lowlands, trackways and ladder fens in blanket bogs and lags of raised bogs.

Lowland fen habitats are associated with Reach 1 of this drought permit. These fens appear to be floodplain fen, but are limited in extent within the impacted reaches. During low flow periods it is possible that these fen habitats are linked to groundwater levels in the underlying gravels. The water level is the critical factor for the site, and therefore as this is not affected by the drought permit, impacts are not anticipated. Impacts of water quality in the main River Thames are anticipated to have negligible impact on the site.

B4.1.2.12 Reedbeds

Reedbeds are wetlands dominated by stands of the common reed *Phragmites australis*, wherein the water table is at or above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them. Reedbeds are amongst the most important habitats for birds in the UK. They support a distinctive breeding bird assemblage including six nationally rare Red Data Birds, provide roosting and feeding sites for migratory species (including the globally threatened aquatic warbler (*Acrocephalus paludicola*), and are used as roost sites for several raptor species in winter. Five GB Red Data Book invertebrates are also closely associated with reedbeds¹³.

Reedbeds are associated with Reach 1 of this drought permit. They form within marginal areas of the Thames, with water level being a critical factor. If water levels drop too low, reduction in the quality of the reedbed habitat is expected, along with knock on effects on invertebrates. The water level is not affected by the drought permit, so impacts are not anticipated. Impacts of water quality, driven by SRP associated with reduced flushing rates. in the main River Thames are anticipated to have negligible impact on reedbeds.

Summary

The impacts of the drought permit on the floodplain and grazing marsh, lowland fen, and reedbed habitats associated with the River Thames are considered to be of low magnitude in Reach 1, and temporary and reversible in both reaches. Overall, the significance of impact in Reach 1 are considered to be **Negligible**.

A summary of the impacts is provided in **Table B4-16**.

¹² Drake, C.M, Stewart, N.F., Palmer, M.A. & Kindemba, V. L. (2010) The ecological status of ditch systems: an investigation into the current status of the aquatic invertebrate and plant communities of grazing marsh ditch systems in England and Wales. Technical Report. Buglife – The Invertebrate Conservation Trust, Peterborough.

¹³ UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008

Table B4-16 Summary of Impacts on NERC Act Section 41 Priority Habitats, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Coastal and floodplain grazing marsh	- Reduction in species abundance and distribution as a result of sedimentation - Changes to species composition as a result of reduced water quality.	Regional	Negligible	Negligible
Lowland fen	- Reduction in species abundance and distribution as a result of sedimentation - Changes to species composition as a result of reduced water quality.	Regional	Negligible	Negligible
Reedbed	Changes to species composition as a result of reduced water quality	Regional	Negligible	Negligible

B4.1.3 NERC and other protected species/Notable Species

B4.1.3.1 Macroinvertebrates – Depressed River mussel and Fine-lined pea mussel

Consultation during the production of the previous Farmoor EARs identified the likely two NERC Section 41 priority species within the Farmoor drought permit zone of hydrological influence: depressed river mussel (*Pseudanodonta complanata*), and fine-lined pea mussel (*Pisidium tenuilineatum*).

Depressed River mussel

Baseline macroinvertebrate monitoring information for the impacted reach received from the Environment Agency identified the presence of depressed river mussel in the River Thames but only pre-2009. The abundance of species present was very low, with only one or two individuals present, and it is not considered likely to represent the distribution and abundance of these species accurately.

The 2006 drought permit report¹⁴ identified the widespread presence of depressed river mussel between Farmoor and Teddington.

No depressed river mussel were recorded within Reach 1 during the EA baseline monitoring between 2013 and 2024. The SESRO monitoring program recorded 9 individual depressed river mussels within the Thames at five locations downstream of Reach 1, showing that they are present within the river system. No records of depressed river mussel were recorded within Reach 1 itself during the SESRO monitoring scheme.

Fine-lined pea mussel

Baseline macroinvertebrate monitoring information for the impacted reach received from the Environment Agency identified the presence of fine-lined pea mussel in the River Thames but only pre-2009. The abundance was very low, with only one or two individuals present, and it is not considered likely to represent the distribution and abundance of these species accurately.

The 2006 drought permit report¹⁵ identified the widespread presence of fine-lined pea mussel within the reach. No fine-lined pea mussels were recorded by the EA monitoring program between 2013 and 2024.

Assessment

A reduction in velocity in Reach 1 has the potential to impact macroinvertebrate species with sensitivities to low flow environments. However, the flow requirements for each of the NERC Act Section 41

¹⁴ Scott Wilson (2006) Farmoor Drought Permit - Environmental Report .

macroinvertebrate species, identified in research by Extence *et al*¹⁶, suggest that the NERC species present are unlikely to be significantly affected.

The impact of sedimentation due to reduced flow velocities is likely to result in short-term, temporary and reversible impacts. However, depressed river mussels occupy habitats where sediment accumulates and thus impacts on this species are not anticipated.

The risk of water quality deterioration in the reach is high risk in regards to SRP. The deterioration in water quality may result in a reduction in the abundance and distribution of pollution sensitive species. Fine-lined pea mussel has a BMWP score of 3 so is relatively tolerant of pollution and reduced dissolved oxygen levels. It should be noted that the pollution tolerance is based on family level tolerances and the water quality tolerances may differ at species level. *Pseudanodonta complanata* has a BMWP score of 6 so is considered to be moderately sensitive to pollution. However, the impacts associated with consented discharges will be spatially linked to the source of the pressure, with the population of the species in the reach as a whole unlikely to significantly alter.

Summary

The impacts of the drought permit on fine-lined pea mussel and depressed river mussel in the River Thames are considered to be of medium magnitude, temporary and reversible. Overall, the significance of impact in Reach 1 on fine-lined pea mussel and depressed river mussel is considered to be **Minor**. The ecological importance of the receptor has been classed as county.

The overall confidence in the notable macroinvertebrate data and subsequent assessment has been classed as **low** due to the small number of surveys completed where the species were observed.

A summary of the impacts is provided in **Table B4-17**.

Table B4-17 Summary of Impacts on fine-lined pea mussel and depressed river mussel, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Fine-lined pea mussel	Reduction in habitat quality or species diversity as a result of sedimentation	County	Medium	Minor
Depressed river mussel	- Reduction in extent and quality of in-stream and marginal habitats in some distributaries - Reduction in abundance or distribution as a result of reduced water quality.	County	Medium	Minor

B4.1.3.2 Fish

Brown trout were not recorded at any sites on the Thames within Reach 1, however their presence is known due to records both upstream and downstream.

The impacts of reductions in flows in watercourses may be significant for brown trout if they limit habitat availability for spawning. Reach 1 of the River Thames is not considered to be optimal for spawning due to the influence of downstream impoundments and the laminar flow habitat along the reach. However, it is likely that small areas of sub-optimal habitat are available. It is likely that natural drought (i.e. without drought permit implementation) would limit any sub-optimal spawning habitat availability in advance of drought permit impacts however delay to watercourse recovery during egg incubation periods as a result of the permit may adversely influence recruitment as a result of reduced flushing of gravel. The spawning period of brown trout falls within the hydrological winter period, and therefore even with the implementation of the drought permit, there is still predicted to be suitable moderate velocity habitat suitable for spawning in the Thames, whether this be within the reach, or further upstream.

Only three individual European eel were recorded across all sites, and were each recorded at different site locations. Reduced flow velocity is unlikely to impact adult eel. A reduction in flow velocity may affect elver

¹⁶ Extence, C. A., Balbi, D. M. and Chadd, R. P. (1999) River Flow Indexing Using British Benthic Macroinvertebrates: A Framework for Setting Hydroecological Objectives. *Regulated Rivers: Research and Management* 15, pp 543 - 574.

ability to migrate upstream however this is unlikely to be to an extent greater than that caused by natural drought conditions. Furthermore, this upstream migration will occur in between April and October and is therefore unlikely to be during the period of implementation.

Bullhead (an Annex II species) were identified in Thames in low numbers, and the in the distributary channels in significant numbers, with 99 individuals recorded at 2 sites. They have been considered due to their sensitivity towards changes in habitat, notably low dissolved oxygen levels and sediment deposition¹⁷. Bullhead typically spawn around March and April with egg incubation taking place until the end of June. The potential for hydrological impacts to extend into this spawning period is highly unlikely.

Brook lamprey, an Annex II species, were not recorded in the main Thames channel. As a precaution, it is assessed that brook lamprey are present in low abundances within all the impacted reaches. Brook lamprey ammocoetes are sedentary filter feeders living in marginal silts. The reduction in flow due to the drought permit is related to velocity only in this reach, and therefore the abundance of marginal habitats should not be impacted.

Barbel are listed in Annex V of the Habitats Directive as a species of community interest. Barbel were recorded in the Thames in low numbers. Barbel typically require stretches of fast flowing watercourses with clean gravel and extensive macrophyte beds. Any reduction in flow velocities due to the drought permit could be significantly detrimental to the species, however impacts will have most likely already been realised prior to the drought permit being implemented due to drought conditions. Barbel are resident in the main stem of the Thames in reaches 1, 2 and 3 and typically move to the distributaries to spawn, with the juveniles preferring to live in these smaller watercourses.

The fish communities present may be affected by water quality deterioration. The water quality assessment has identified a high risk of water quality deterioration in regards to SRP, associated to low flushing rates, in Reach 1 which may impact the fish community.

The overall confidence in the fisheries data and subsequent assessment has been classed as **high** due to the number of surveys and the age of the most recent surveys completed. A summary of the impacts is provided in **Table B4-18**.

¹⁷ Conserving Natura 2000 Rivers Ecology Series No.: 4 Ecology of the Bullhead

Table B4-18 Summary of Impacts on NERC Act Section 41 notable fish species

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Brown / sea trout	- Migratory species may be impacted by flows (in terms of velocity) where impacts occur within the main migration periods (sea trout and European eel). There is a moderate risk to changes in flow velocity in this reach. - Reduced flow velocity (moderate risk) could impact the movement of brown trout individuals to spawning grounds. - Reduced flow velocity may impact the ability of migratory European eel (elver) to access impacted reaches.	Regional	Medium	Moderate
European eel	- Stranding of individuals is unlikely as longitudinal connectivity will not be impacted and level controlled for navigation for much of the impacted reach. - Juvenile lamprey are known to be poor swimmers and require flows for downstream movements to find suitable habitat for burrowing and feeding. Reduced flow velocity (moderate risk) could impact the movement on individuals to spawning and nursery grounds in the upstream sections of the impacted reach. Lamprey ammocoetes are sedentary filter feeders living in marginal silts. As such they will be particularly susceptible to the reduction in flows and wetted width.	Regional	Low	Minor
Brook lamprey	It is noted that depth of water is not critical to bullhead and the species is also widespread within the catchment. However, the species is sensitive to increased siltation. There is a minor, temporary and reversible risk of increased siltation in this reach.	Regional	Low	Minor
Bullhead	The habitat within this reach of the River Thames is considered to be significant for barbel. Up until the 1990s the Thames was famous for its populations of Barbel. Barbel will make use of existing weir pool habitats, to spawn where habitat is suitable.	County	Low	Minor
Barbel	- Hydrological assessment deems the risk of a reduction in dissolved oxygen to be low. There is a low risk of fish mortality due to oxygen stress. - The fish communities present may be affected by water quality deterioration. The water quality assessment has identified a high risk of water quality deterioration in regards to SRP, associated to low flushing rates, in Reach 1 which may impact the fish community.	County	Low	Minor

B4.1.3.3 Macrophytes- *Ranunculus* sp.

Impacts on *Ranunculus* sp during implementation may occur in relation to a reduction in the flushing of dead plant matter which may inhibit growth the following year. However, this would also be the case in a natural drought scenario. The drought permit implementation is unlikely to extend into late spring or early summer the following year during the key growing period, whereby water quality impacts including increased concentrations of SRP may impact the species.

Impacts on the *Ranunculus* species within Reach 1 are therefore considered to be low in during the growing period, and negligible throughout the rest of the year.

The impacts likely to arise from the physical environment changes as a result of a the Farmoor drought permit are summarised in **Table B4-19**.

Table B4-19 Summary of impacts on *Ranunculus* species within Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
<i>Ranunculus</i> sp.	Reduction in growth as a result of impacts on water levels and flows Changes in growth due to increased SRP	County	Low (April and May only) Negligible (rest of the year)	Minor

B4.1.4 WFD receptors

B4.1.4.1 Macroinvertebrates

The assessment of impacts on the macroinvertebrate community should be considered in the context of the watercourses under baseline conditions. The River Thames which comprises the entirety of Reach 1 is a large lowland river which does not dry up during drought conditions.

Reductions in flow velocity can impact macroinvertebrate communities either through physical habitat loss though changes to habitat parameters (e.g. flow, sediment dynamics, water quality). These changes can result in reductions in populations or regime shifts in community structure (e.g. from a predominance of species adapted to fast flowing environments, to a predominance of those species adapted to slower flowing environments). In lotic environments macroinvertebrates can quickly recolonise once suitable flow conditions are restored by immigration from upstream habitats and local refugia (e.g. pools, subsurface habitats).

In the autumn period, flow reductions may have an impact on macroinvertebrate species with a spring emergence, as the majority of these species lay their eggs in autumn with the eggs overwintering in the watercourse and emerging the following spring. The impacts could limit the recruitment of the species in the watercourses. Given the size and nature of the Thames, there will always be aquatic habitat available for invertebrate species. There will be no changes to the wetted widths in the main channel of the River Thames and therefore the availability and quality of marginal habitat which invertebrates use should not be impacted. The recovery of the macroinvertebrate community within marginal habitats is likely to be rapid following the cessation of drought permit.

Macroinvertebrate adults can emerge as early as March (e.g. Large Dark Olive Mayflies *Baetis rhodani* and March Brown Mayfly *Rhithrogena germanica*) and as late as September (e.g. *Trichoptera Hydropsyche* sp. and Autumn Dun *Ecdyonurus dispar*), although the majority of macroinvertebrates will emerge between May and July. The drought permit could potentially impact on those macroinvertebrate species with characteristic emergence stages in Autumn, thus potentially limiting recruitment of these species in the watercourse the following year. However this is likely to be of low magnitude in Reach 1.

The baseline information shows a community that is generally unaffected by stress linked to low flow conditions. All sites had life EQR scores above 0.94 which is considered the threshold for stress due to low flow conditions. This includes a sample taken in October 2022 at site 184225 after an extended period of drought. This site still had a LIFE EQR score of 1.072 which exceeds the threshold stated above. This indicates that the invertebrates within the Thames were largely unaffected by the drought conditions, given the maintained rates of flow within the channel.

Species present in the Thames include several native bivalve species which are particularly prone to desiccation if levels drop low enough to expose areas of riverbed. But it is unlikely that hydraulic conditions in the main Thames channel would be low enough even under drought conditions to expose the deeper sections of the channel in which bivalve species primarily inhabit.

WHPT_{ASPT} scores provide a measure of the existing water quality of the environment of the River Thames based on the tolerances of the macroinvertebrate species present. The higher WHPT_{ASPT} scores identify a community that is representative of good water quality and lower ASPT scores are representative of poor water quality. WHPT_{ASPT} scores across the sites have generally increased from 2013, with four of the five sites having WHPST_{ASPT} EQR scores classified as 'high', and the fifth site being classified as 'good'.

The macroinvertebrate communities present may be affected by water quality deterioration. The water quality assessment concluded there is a high risk to water quality deterioration in regard to SRP, associated to low flushing rates, in Reach 1. The risk of water quality deterioration as a result of changes in dissolved oxygen is considered low risk, and ammonia been identified as negligible.

Considering the length of the impact, the medium magnitude, and the temporary and reversible water quality impacts in Reach 1, the overall significance of impacts has been assessed as **Minor**. An impact summary is provided in **Table B4-20**.

The overall confidence in the invertebrate data and subsequent assessment has been classed as **moderate** due to the inconsistency of surveys over the study period, and the age of the most recent surveys completed.

Table B4-20 Summary of impacts on macroinvertebrate community, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Macroinvertebrates	- Loss of spring/autumn emerging species - Loss of suitable egg laying habitat for spring emergence species - Reduction in species diversity and abundance as a result of reduced recruitment - High risk to water quality associated to SRP	County	Medium	Minor

B4.1.4.2 Fish

Information was not currently available to provide a quantitative assessment utilising the Fisheries Classification System (FCS2) to an equivalent WFD status. Therefore, assessment has been undertaken by professional judgement using baseline information provided by the Environment Agency.

The assessment of impacts on the fish community should be considered in the context of the watercourse under baseline conditions. Brown trout typically spawn in November, with egg incubation taking place up until March. The drought permit is considered to have a moderate impact on flow velocity in this reach, however there will be no changes to river levels. This may manifest as some reductions in high velocity habitat, however moderate velocity habitat utilised for spawning will still remain. The magnitude of impact considers the likelihood of desiccation, which in this reach is negligible, the likelihood of changes in spawning in habitat, which is low, and the resilience of the population to recover from this, which is high. Most other species present will spawn in spring; outside of the likely period of drought permit implementation. Overall, impacts due to delay to spawning in Reach 1 are summarised as low magnitude respectively, during the spawning period (November to April).

Delay to the upstream passage of migratory European eel (elver) into reaches may be affected if the delay to flow recovery extends into spring (April), with the possibility of individuals congregating at the downstream end of obstacles being at an increased predation risk.

The fish communities present may be affected by water quality deterioration. The water quality assessment has identified a high risk of water quality deterioration in regards to SRP, associated to low flushing rates, in Reach 1 which may impact the fish community. The impact is deemed to be no greater than medium magnitude.

Considering the baseline status of fish species and the likely resilience of species present, the impacts of water quality deterioration and flow impacts on fish, the drought permit implementation is considered to have no greater than medium magnitude in Reach 1.

The overall confidence in the fisheries data and subsequent assessment has been classed as **high** due to the number of surveys, the consistency of surveys, and the age of the most recent surveys completed. The ecological importance of the receptor in the River Thames is deemed to be regional. This is because the River Thames mainstem is as important conduit for migratory fish species on a regional scale.

Table B4-21 Summary of impacts on fish community, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Fish	- Loss of or reduction in extent of spawning habitat for different species - Increased stress and predation on species in refuges as a result of delay in recovery of flows - High risk to water quality associated to SRP	Regional	Medium	Moderate

B4.1.4.3 Macrophytes

The main macrophyte growing season typically starts between April and extends until September and implementation of drought permit within this time frame is considered unlikely. Implementation of the drought permit in the Autumn period may result in water quality impacts through increases in SRP concentrations however direct impacts on the macrophyte community will be reduced due to this being outside the main growing period. Impacts on flow velocity are unlikely to impact the macrophyte community beyond that of natural drought. The overall impact on the macrophyte community in Reach 1 is considered to be low in April and September, and negligible throughout the rest of the year.

The overall confidence in the macrophyte data and subsequent assessment has been classed as **low** due to the only one survey being conducted within the reach.

A summary of the impacts is provided in **Table B4-22**.

Table B4-22 Summary of impacts on the macrophyte community, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Macrophytes	- Reduction in growth as a result of impacts on flow velocity - Changes in growth due to higher levels of SRP	County	Low (April and May only) Negligible (rest of the year)	Minor

B4.1.4.4 Diatoms

Due to an absence of data on the diatom community within the reach, the following assessment has been completed with a precautionary approach which considers more general impacts to diatom communities under the changes to the water quality and hydrological conditions.

Species composition of the diatom community is most dependent on nutrient levels (notably SRP), whilst flow and grazing pressure (e.g. by invertebrates) governs the 'thickness' of the diatom biofilm. Slowing of flows can shift the community away from sessile towards more motile taxa (i.e. that are able to live in a thicker biofilm) and those that grow on stalks.

The changes in velocity should not significantly alter the diatom community, however some increases in standing or slow water may potentially increase the thickness of the biofilm (as a result of reduced scour) and skewing the community to more motile taxa. This may, at most, result in short-term temporary and reversible alteration to the diatom community.

The principal concern regarding impacts on the diatom community is the potential for increased SRP due to reduced dilution. Nutrient enrichment can stimulate growth in some diatom species potentially altering the community structure.

The overall value of the diatom community is considered to be of local-only value. The impact magnitude is deemed to be medium and therefore the significance of impact is deemed to be Minor. The overall confidence

in the data and subsequent assessment has been classed as **low** due to the absence of available data on diatoms.

A summary of the impacts is provided in **Table B4-23**.

Table B4-23 Summary of Impacts on diatom community, Reach 1

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Diatoms	- Alteration to community composition as a result of delayed recovery of flows in the watercourse - No risk as a result of water quality	Local	Medium	Minor

B4.1.5 Invasive Species

The drought permit would lead to a reduction in flows that would manifest as a reduction in velocity. The changes to aquatic habitat may cause localised minor changes to the abundance of INNS that are already present. There is no pathway for new INNS to enter the River Thames as a result of the drought permit implementation. There is a general risk of INNS introduction associated with the monitoring and mitigation strategies, however this is not related to the abstraction. Surveyors and operators implementing the monitoring and mitigation activities will follow best practice protocols and biosecurity guidance as referenced in the EMP¹⁸.

Overall, the risk of increasing the proliferation of INNS is considered to be **Negligible**.

The overall confidence in the data and subsequent assessment has been classed as **medium** due to the availability of data on INNS within the reach.

B4.1.6 Summary of Impacts

Table B4-24 summarises the outcomes of the Environmental receptors assessment and includes deterioration to fish and macroinvertebrate receptors within WFD water bodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4-24 Summary of Impacts identified in Reach 1's environmental receptors assessment.

Reach	Reach 1	
	Significance of Impact/ Risk of Deterioration	Mitigation Required (Y/N)
Statutory Designated Sites		
Oxford Meadows SAC	Negligible	N
Cassington Meadows SSSI	Negligible	N
Pixey and Yarnton Meads SSSI	Negligible	N
Wolvercote Meadows SSSI	Negligible	N
Port Meadow with Wolvercote Common and Green SSSI	Negligible	N
Iffley Meadows SSSI	Negligible	N
Non-Statutory Designated Sites and NERC Habitats		
Thames Island (Skinner's Weir Island) SNCI	Negligible	N
Swinford Toll Brook Meadow SNCI	Negligible	N
Pasture by A34 Thames Bridge SNCI	Negligible	N

¹⁸ GB non-native species secretariat - Biosecurity in the field. Accessed 2nd March 2022.
<http://www.nonnativespecies.org/index.cfm?pageid=174>.

Reach	Reach 1	
Binsey Green SNCI	Negligible	N
Bypass Swamp SNCI	Minor	N
Fiddler's Elbow Marsh SNCI	Minor	N
Thames Cut SNCI	Negligible	N
Heyford Hill Lane Pasture SNCI	Negligible	N
Thames Island near Streatley SNCI	Minor	N
Floodplain and grazing marshes	Negligible	N
Lowland fen	Negligible	N
Reedbed	Negligible	N
NERC and Notable Species Receptors		
Depressed River mussel	Minor	N
Fine-lined pea mussel	Minor	N
Brown / sea trout	Moderate	Y
European eel	Minor	N
Brook lamprey	Minor	N
Bullhead	Minor	N
Barbel	Minor	N
Ranunculus sp.	Minor	N
WFD Status Receptors		
Macroinvertebrates	Minor	N
Fish	Moderate	Y
Macrophytes	Minor	N
Diatoms	Minor	N
INNS		
Macroinvertebrates	Negligible	N

B4.2 REACH 2

B4.2.1 Statutory designated sites

B4.2.1.1 Wytham Ditches and Flushes SSSI

The Wytham Ditches themselves are small, slow-flowing ditches located north of the village of Wytham (Oxfordshire) which drain into Seacourt Stream (whose flow is controlled by the King's Weir) which forms part of the Thames distributaries. The site supports a species-rich eutrophic aquatic and fen flora. The physical environment assessment has identified that there is a minor risk of a reduction in level and velocity due to lower velocities from the River Thames into the Oxford watercourse distributaries. These reductions may, at most, cause a slight decrease in level at the downstream end of the Wytham Ditches network.

The species identified as present within the ditch system are typically slow-flowing species *Nuphar lutea*, fat duckweed (*Lemna gibba*) and shining pondweed (*Potamogeton lucens*), which suggest that flow through the ditch system under normal conditions is slow.

The risk of water quality deterioration in the impacted reach is high (associated with SRP) due to potential reduced flushing rates in Reach 1 as a result of a reduction in flow. However, the impacts will not extend to Wytham Ditches and flushes as the network is not fed by the distributaries. Overall, the water quality impacts

on Wytham Ditches and Flushes SSSI are anticipated to be of low magnitude due to the time of year the scheme is implemented and the fact that the network is not directly fed from the distributaries. The overall confidence in the data and subsequent assessment on Wytham Ditches and Flushes SSSI has been classed as medium due to the availability of data on the species and habitat that make up the site.

Three SSSI conservation objectives were considered to be potential vulnerable to impacts resulting from the drought permit implementation:

- Aquatic vegetation composition
- Indicators of local distinctiveness
- Indicators of negative change

The objectives and the potential impact to these have been set out in **Table B4-25**

The overall confidence in the data and subsequent assessment on Wytham Ditches and Flushes SSSI has been classed as **medium** due to the availability of data on the species and habitat that make up the site.

Table B4-25 Summary of Impacts on features/receptors of Wytham Ditches and Flushes SSSI, Reach 2 (Thames Distributaries)

Receptor	Sensitivity	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Aquatic vegetation composition	A total of 39 aquatic macrophyte species were found during the baseline surveys. The river macrophyte community reflects a species-rich, naturally eutrophic aquatic flora following drainage by pollution and fertiliser enrichment.	National	Low	Moderate
Indicators of local distinctiveness	At least one species which has its sole Oxfordshire locality on the site.	National	Low	Moderate
Indicators of negative change	Wytham Ditches and Flushes SSSI support a species-rich eutrophic aquatic and fen flora, examples of which are rare in the county following widespread drainage, pollution and fertiliser enrichment. They contain flowering plants which are now uncommon in central southern England.	National	Low	Moderate

B4.2.2 Non-Statutory designated sites and NERC Habitats

B4.2.2.1 Kennington Pool SNCI

The physical environment assessment has identified that the distributaries including the Hinksey Stream adjacent to the Kennington Pools SNCI, will be subject to a reduction in flow due to change in flows from the River Thames into the distributaries. It is understood that the Kennington Pool is not linked directly to Hinksey Stream and is separated by an embankment from a side-channel which has minimal flow for much of the year, only connected under flood events. Under a baseline drought scenario, Kennington Pool SNCI would not be receiving winter flooding from the distributaries and therefore the implementation of the permit will do nothing to reduce the volume of water entering the SNCI.

The risk of water quality deterioration in the impacted reach is high (associated with SRP) due to potential reduced flushing rates in Reach 1 as a result of a reduction in flow. However, the impacts will not extend to the SNCI as there is no pathway for hydrological connectivity during a drought scenario.

The overall confidence in the data and subsequent assessment on Kennington Pool SNCI has been classed as high. A summary of the impacts is provided in **Table B4-26**.

Table B4-26 Summary of Impacts on Kennington Pool SNCI, Reach 2 (Thames Tributaries)

Receptor	Sensitivity	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Kennington Pool SNCI	None identified	County	Negligible	Negligible

B4.2.3 NERC and other protected species/Notable Species

B4.2.3.1 Macroinvertebrates – Depressed River mussel and Fine-lined pea mussel

Consultation during the production of the previous Farmoor EARs identified the likely two NERC Section 41 priority species within the Farmoor drought permit zone of hydrological influence: depressed river mussel (*Pseudanodonta complanata*), and fine-lined pea mussel (*Pisidium tenuilineatum*).

Depressed River mussel

The 2006 drought permit report¹⁹ identified the widespread presence of depressed river mussel between Farmoor and Teddington. The report did not identify any in the tributaries, however their presence has been considered likely on a precautionary approach.

No depressed river mussel were recorded within reach 2 during the EA baseline monitoring between 2013 and 2024. The SESRO monitoring program recorded 9 individual depressed river mussels within the Thames at 5 locations downstream of reach 2, showing that they are present within the river system. No records of depressed river mussel were recorded within reach 2 itself during the SESRO monitoring scheme.

Fine-lined pea mussel

The 2006 drought permit report²⁰ identified the widespread presence of fine-lined pea mussel within reach 1. No fine-lined pea mussels were recorded by the EA monitoring program between 2013 and 2024.

Assessment

A reduction in velocity, or level and velocity, in the tributaries has the potential to significantly impact on the macroinvertebrate community present. However, the flow requirements for each of the NERC Act Section 41 macroinvertebrate species, identified in research by Extence *et al*²¹, suggest that, despite the scale of the hydrological impact, the NERC species present are unlikely to be significantly affected.

However, a reduction in the extent of in-stream and marginal habitats in the tributaries where there is no level control could impact on these species, in particular the depressed river mussel and fine-lined pea mussel. The fine-lined pea mussel is likely to be susceptible to reductions in river level, with the majority of the population present likely to inhabit marginal habitats susceptible to exposure with mortality possible.

Impacts associated with increased sedimentation are in line with that discussed for the macroinvertebrate community in reach 1. The impact of sedimentation due to reduced flow velocities is likely to result in short-term, temporary and reversible impacts. However, depressed river mussels occupy habitats where sediment accumulates and thus impacts on this species are not anticipated.

The risk of water quality deterioration in the reach is considered high risk in regards to SRP, low risk in regard to dissolved oxygen and no general risk from ammonia. The deterioration in water quality associated with these pressures will result in a reduction in the abundance and distribution of pollution sensitive species. Fine-lined pea mussel has a BMWP score of 3 so is relatively tolerant of pollution and reduced dissolved oxygen levels.

¹⁹ Scott Wilson (2006) Farmoor Drought Permit - Environmental Report .

²¹ Extence, C. A., Balbi, D. M. and Chadd, R. P. (1999) River Flow Indexing Using British Benthic Macroinvertebrates: A Framework for Setting Hydroecological Objectives. *Regulated Rivers: Research and Management* 15, pp 543 - 574.

It should be noted that the pollution tolerance is based on family level tolerances and the water quality tolerances may differ at species level.

Depressed river mussel has a BMWP score of 6 so is considered to be moderately sensitive to pollution and reduced dissolved oxygen levels. However, the impacts associated with consented discharges will be spatially linked to the source of the pressure, with the population of the species in the reach as a whole unlikely to significantly alter.

Summary

The impacts of the drought permit on fine-lined pea mussel and depressed river mussel in the Thames distributaries are considered to be at most of medium magnitude, temporary and reversible. Overall, the significance of impact in Reaches 1 on fine-lined pea mussel and depressed river mussel is considered to be **minor**.

A summary of the impacts is provided in **Table B4-27**.

Table B4-27 Summary of Impacts on NERC Act 41 fine-lined pea mussel and depressed river mussel, Reach 2 (Thames Distributaries)

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Fine-lined pea mussel	Reduction in habitat quality or species diversity as a result of sedimentation	County	Low	Minor
Depressed river mussel	- Reduction in extent and quality of in-stream and marginal habitats in some distributaries - Reduction in abundance or distribution as a result of reduced water quality.	County	Medium	Minor

B4.2.3.2 Fish

Four Brown trout individuals were recorded at sites on the Thames distributaries. The impacts of reductions in water level and velocity in the watercourses may be significant during the brown trout spawning period if they limit habitat availability within the distributaries during the hydrological winter period. Reductions in flow during egg incubation periods may also adversely influence recruitment as a result of reduced flushing of gravel. Within the distributaries, there is likely to be some available spawning habitat for brown trout, noting constraints such as low flows and suitable substrate. However, Osney Stream in particular is noted as providing suitable spawning habitat for brown trout. Whilst it is likely that natural drought (i.e. without drought permit implementation) would limit spawning habitat availability in advance of any drought permit impacts, there may be additional impacts or additional loss to habitat depending on the timing of the permit implementation. With this in mind it should be noted that flow routing will provide minimum flows into the distributaries, namely a minimum flow of 120 l/sec from the River Thames into the Seacourt Stream and an ecological minimum flow from the Seacourt Stream into each of the Bulstake Stream and Osney Stream. The ecological minimum flow for the Bulstake Stream and Osney Stream are each identified as likely in the order of 25-50 l/sec.

Any delay in the recovery of flows and water level may extend the period in which fish species are contained within certain refuges (e.g. areas of deeper water and higher dissolved oxygen concentrations). Despite the potential delay, it is noted that any loss of habitat and increased density of fish species in refuges is an impact attributable to a natural drought. An extension of this period could impact on the community and as a result of density dependent mortality, with increased competition and increased predator efficiency.

No eels were recorded at any of the sites located on the Thames distributaries however their presence can't be discounted due to known presence in the River Thames. Reduced flow velocity is unlikely to impact adult eel. A reduction in flow velocity may effect elver ability to migrate upstream however this commonly occurs in late spring or early summer, outside of the likely drought permit implementation period.

Bullhead (an Annex II species) were identified in the distributary channels in significant numbers, with 99 individuals recorded at 2 sites. They have been considered due to their sensitivity towards changes in habitat, notably low dissolved oxygen levels and sediment deposition²². Bullhead typically spawn around March and April with egg incubation taking place until the end of June. The potential for hydrological impacts to extend into this spawning period is unlikely however the species will be susceptible to the impacts of reduced water quality, levels and velocities in the Autumn and Winter periods.

Brook lamprey, an Annex II species, were not recorded in the distributary channels. As a precaution, it is assessed that brook lamprey are present in low abundances within all the impacted reaches. Brook lamprey ammocoetes are sedentary filter feeders living in marginal silts. As such they will be particularly susceptible to the reduction in flows and wetted width. The drought permit may also result in a greater loss, or extended drying, of wetted perimeter than might otherwise be expected under the current hydrological regime. Therefore, the reduction in flow due to the drought permit will reduce habitat availability and suitability for brook lamprey. This may result in increased rates of predation due to increased concentration in remaining suitable habitat. A winter permit implementation may also extend into the early part of the brook lamprey spawning season. Post drought permit monitoring will be undertaken to understand potential impacts associated with the permit implementation on lamprey populations, however flow routing of 25-50 l/sec should provide a minimum flow to facilitate lamprey spawning in the catchment and prevent the drying out of the distributaries.

Barbel are listed in Annex V of the Habitats Directive as a species of community interest. Barbel were recorded in the distributaries. Barbel typically require stretches of fast flowing watercourses with clean gravel and extensive macrophyte beds. Any reduction in flow velocities due to the drought permit could be significantly detrimental to the species, however, the flow routing should provide a minimum level of mitigation to support suitable habitat. Barbel typically spawn late spring to early summer, Barbel are known to use the Thames distributaries for spawning, notably Osney Stream. A winter drought permit wouldn't normally affect barbel spawning as this will occur outside the spawning season.

The fish communities present may be affected by water quality deterioration. The water quality assessment has identified a high risk of water quality deterioration in regards to SRP, associated to low flushing rates, in Reach 2 which may impact the fish community.

The overall confidence in the fisheries data and subsequent assessment has been classed as **moderate** due to the age of the most recent surveys completed, with only one of the sites being surveyed post 2014. A summary of the impacts is provided in **Table B4-28**.

²² Conserving Natura 2000 Rivers Ecology Series No.: 4 Ecology of the Bullhead

Table B4-28 Summary of Impacts on NERC Act 41 Notable Fish Species, Reach 2 (Thames Tributaries)

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Brown / sea trout	Migratory species (sea trout) may be impacted by flows (in terms of velocity), where the drought permit is in place within the main migration periods. However, proportion flow routing into Seacourt Stream at river flows will maintain a minimum flow in this reach. The risk to siltation of spawning gravels is considered minor, temporary and reversible. For brown trout, the risks are mainly related to reduced levels and flows, and reduced water quality.	Regional	Medium	Moderate
European eel	With regards to eels, no individuals have been identified in the tributaries. However, it may be that they are present in small numbers. Where present, and where flows are impacted within the main migratory periods, there may be an impact to eel migration however this is likely to be limited in nature. The implementation of the permit in Autumn will be outside the migratory period for eels.	County	Low	Minor
Brook lamprey	Juvenile lamprey are known to be poor swimmers and require flows for downstream movements to find suitable habitat for burrowing and feeding. Reduced flow velocity (minor risk) could impact the movement on individuals to spawning and nursery grounds in the upstream sections of the impacted reach. In addition, the drought permit may also result in a greater loss, or extended drying, of wetted perimeter than might otherwise be expected under the current hydrological regime. This may reduce availability of juvenile lamprey habitat and spawning habitat in the early part of the spawning season.	County	Medium	Minor
Bullhead	Bullhead have been found in high numbers. It is noted that depth of water is not critical to bullhead ²³ and the species is also widespread within the catchment. However, the species is noted for its sensitivity towards changes in habitat, notably increased sediment deposition which may occur in the tributaries (minor risk).	County	Low	Minor
Barbel	Barbel typically require stretches of fast flowing watercourses with clean gravel and extensive macrophyte beds. Any reduction in flow velocities due to the drought permit could be significantly detrimental to the species.	County	Medium	Minor

B4.2.3.3 Macrophytes- *Ranunculus* sp.

Impacts on *Ranunculus* sp during implementation may occur in relation to a reduction in the flushing of dead plant matter which may inhibit growth the following year. However, this would also be the case in a natural drought scenario. The drought permit implementation is unlikely to extend into late spring or early summer the following year during the key growing period, whereby water quality impacts including increased concentrations of SRP may impact the species.

Impacts on the *Ranunculus* species within Reach 2 are therefore considered to be low in during the growing period, and negligible throughout the rest of the year.

²³ Tomlinson, M. L. and Perrow, M. R. (2003) Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

The impacts likely to arise from the changes to the physical environment as a result of a the Farmoor drought permit are summarised in **Table B4-29**.

Table B4-29 Summary of impacts on *Ranunculus* species (Thames Distributaries)

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
<i>Ranunculus</i> sp.	Reduction in growth as a result of impacts on water levels and flows Changes in growth due to higher levels of SRP	County	Low (April and May only) Negligible (rest of the year)	Minor

B4.2.4 WFD receptors

B4.2.4.1 Macroinvertebrates

The assessment of impacts on the macroinvertebrate community should be considered in the context of the watercourses under baseline conditions. The Thames distributaries that make up Reach 2 receive hydrological input from the main Thames channel. The Seacourt stream will receive a constant rate of flow through the offtake structure through modifications to the existing structure. However, subsequent distributary channels, Bulstake Stream, Osney Stream, Hinskey Stream are not specifically controlled. Hinksey Stream and Bulstake Stream are fed directly by the Seacourt Stream, whilst Osney Stream is fed from the River Thames via an undershot sluice.

Reductions in flow within the distributaries may impact macroinvertebrate communities either through physical habitat loss (e.g. changes to wetted width) or changes to habitat parameters (e.g. flow, sediment dynamics, water quality). These changes can result in reductions in populations or regime shifts in community structure (e.g. from a predominance of species adapted to fast flowing environments, to a predominance of those species adapted to slower flowing environments). In lotic environments macroinvertebrates can quickly recolonise once suitable flow conditions are restored by immigration from upstream habitats and local refugia (e.g. pools, subsurface habitats).

The reduction in flow due to the drought permit could have an impact on recruitment of the macroinvertebrate community present in the watercourse, however this needs to be considered against the baseline conditions likely to be present. In the autumn period, flow, water level and marginal habitat reductions may have an impact on macroinvertebrate species with a spring emergence, as the majority of these species lay their eggs in autumn with the eggs overwintering in the watercourse and emerging the following spring. The impacts could limit the recruitment of the species in the watercourses. However, the recovery of the macroinvertebrate community is likely to be rapid following the cessation of drought permit.

Macroinvertebrate adults can emerge as early as March (e.g. Large Dark Olive Mayflies *Baetis rhodani* and March Brown Mayfly *Rhithrogena germanica*) and as late as September (e.g. *Trichoptera Hydropsyche* sp. and Autumn Dun *Ecdyonurus dispar*), although the majority of macroinvertebrates will emerge between May and July. The drought permit could potentially impact on those macroinvertebrate species with characteristic early emergence stages found in the distributaries, thus potentially limiting recruitment of these species in the watercourse the following year. Impacts resulting from the drought permit on spring emerging species is likely to be of low magnitude in Reach 2.

The Thames distributaries are more likely to be affected by reductions in flow than the main Thames. There are minor risks of changes in flow velocity for those distributaries where water levels are not controlled, and additionally there may be extended reductions to the wetted perimeter.

The baseline information shows a community that is generally unaffected by stress linked to low flow conditions. All sites had life EQR scores above 0.94 in 2022 and 2023 which is considered the threshold for stress due to low flow conditions. This indicates that the invertebrates within the Thames distributaries are largely unaffected by the drought conditions in 2022.

The water quality assessment has determined there is a high risk of changes to water quality in regards to SRP in Reach 2, with a low risk to dissolved oxygen and no general risk to ammonia.

WHPT_{ASPT} scores provide a measure of the existing water quality of the environment of the distributaries based on the tolerances of the macroinvertebrate species present. The higher WHPT_{ASPT} scores identify a community that is representative of good water quality and lower_{ASPT} scores are representative of poor water quality. WHPT_{ASPT} scores across the sites are varied, with EQR scores ranging from 'good' to 'poor'. The macroinvertebrate communities present may be affected by water quality deterioration.

In summary, the impacts comprise a potential increase in SRP and a potential reduction in wetted widths and flows. Considering the length of the impacts and the temporary and reversible nature of them, the magnitude of impact has been assessed as medium. Considering the ecological importance of the feature the overall impact is considered to be **Minor**. An impact summary is provided in **Table B4-30**.

The overall confidence in the invertebrate data and subsequent assessment has been classed as **moderate** due to the age of the most recent surveys completed, with only one of the two of the ten sites having surveys conducted after 2016.

Table B4-30 Summary of impacts on macroinvertebrate community, Reach 2 (Thames Distributaries)

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Macro-invertebrates	- Loss of spring/autumn emerging species - Loss of suitable egg laying habitat for spring emergence species - Reduction in species diversity and abundance as a result of reduced recruitment - Potential reduction in water quality and wetted perimeter	County	Medium	Minor

B4.2.4.2 Fish

The assessment of impacts on the fish community should be considered in the context of the watercourse under baseline conditions. The distributaries comprise a system of slow flowing waterbodies hydrologically connected to the River Thames which will be impacted by low flows prior to drought permit implementation. Fish are likely to move into areas of deeper water as the watercourse levels drop. The reduction in flows and water level could lead to increased stress in fish species. It is noted that if fish stranding occurs due to natural drought related impacts, it is likely that fish rescues by the Environment Agency will be undertaken to remove fish from isolated pool habitats.

Implementation during Autumn may coincide with the spawning period for brown trout, depending on the length of implementation (brown trout typically spawn in winter, with egg incubation taking place up until March). Flow routing of 120 l/sec into Seacourt Stream will maintain a minimum flow in this watercourse, specifically which may help maintain areas of suitable spawning habitat within this section of the reach. Ecological minimum flows will also be maintained within Bulstake Stream and Osney Stream, identified as likely in the order of 25-50 l/sec, however, this may still result in lower flows than the baseline scenario under certain circumstances. With the mitigation in place the drought permit is considered to have a medium magnitude of impact on brown trout, related to the potential reductions in flow and the subsequent impact on the availability of localised spawning habitat throughout the winter period.

Most other species present, such as barbel, will spawn in spring; following the principle above, hydrological impacts as a result of the permit implementation on the spawning of fish species present in spring are unlikely to occur and are summarised as low magnitude respectively.

Delay to the upstream passage of migratory European eel (elver) into and through the distributaries will only be affected if the implementation extends into spring (April), with the possibility of individuals congregating at the downstream end of obstacles being at an increased predation risk.

The fish communities present may be affected by water quality deterioration. The water quality assessment has identified a high risk water quality deterioration in regards to SRP, associated with low flushing rates in Reach 1 of the Thames. This may temporarily impact the fish community as a whole within this reach.

Considering the baseline status of fish species and the likely resilience of species present as a result of the intermittent nature of flow in the reaches, the impacts of water quality deterioration and flow impacts on fish is considered likely to be, at most, of medium magnitude in Reach 2. The overall ecological value of the community in Reach 2 is considered to be at the Regional level in line with Reach 1.

The overall confidence in the fisheries data and subsequent assessment has been classed as **moderate** due to the age of the most recent surveys completed, with only one of the sites being surveyed post 2014.

Table B4-31 Summary of impacts on fish community, Reach 2 (Thames Tributaries)

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Fish	- Potential loss of or reduction in extent of spawning habitat for brown trout - Increased stress and predation on species in refuges as a result of delay in recovery of flows - High risk of water quality deterioration in regards to SRP, associated to low flushing rates, in Reach 1 which may impact the fish community.	County	Medium	Moderate

B4.2.4.3 Macrophytes

The assessment of impacts on the macrophyte community should be considered in the context of the watercourse under baseline conditions. The Thames tributaries that make up reach 2 may dry out in certain areas during low flows, although as they are still fed directly by the Thames it is considered unlikely for widespread desiccation to occur. It should be noted that desiccation would be a result of natural drought conditions rather than implementation of the permit. This is because flow routing implemented with the permit will provide minimum flows into the tributaries, namely a minimum flow of 120 l/sec from the River Thames into the Seacourt Stream and an ecological minimum flow from the Seacourt Stream into each of the Bulstake Stream and Osney Stream. The ecological minimum flow for the Bulstake Stream and Osney Stream are each identified as likely in the order of 25-50 l/sec.

Implementation of the drought permit in the Autumn period may result in water quality impacts through increases in SRP concentrations however direct impacts on the macrophyte community will be reduced due to this being outside the main growing period. Impacts on flow velocity may reduce flushing of dead plant matter however this is unlikely to impact the macrophyte community beyond that of natural drought. The overall impact on the macrophyte community in Reach 2 is considered to be low in April and September, and negligible throughout the rest of the year.

The overall confidence in the macrophyte data and subsequent assessment has been classed as **high** due to the macrophyte surveys that were conducted in 2022.

A summary of the impacts is provided in **Table B4-32**.

Table B4-32 Summary of impacts on the macrophyte community, Reach 2 (Thames Tributaries)

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Macrophytes	- Reduction in growth as a result of impacts on water levels and flows - Changes in growth due to higher levels of SRP	County	Low (April and May only) Negligible (rest of the year)	Minor

B4.2.4.4 Diatoms

Due to an absence of data on the diatom community within the reach, the following assessment has been completed with a precautionary approach which considers more general impacts to diatom communities under the changes to the water quality and hydrological conditions.

Species composition of the diatom community is most dependent on nutrient levels (notably SRP), whilst flow and grazing pressure (e.g. by invertebrates) governs the 'thickness' of the diatom biofilm. Slowing of flows can shift the community away from sessile towards more motile taxa (i.e. that are able to live in a thicker biofilm) and those that grow on stalks.

The water quality assessment suggests there is high risk of increased concentration of SRP. Higher levels of SRP within the reach can cause increased growth rates of diatoms, which can alter the community present.

The risk to river habitats is assessed as uncertain. The reduction in flow and velocity could impact the diatom community through an increase in standing or slow water in the impacted reaches potentially resulting in an alteration to the community present, increasing the thickness of the biofilm (as a result of reduced scour) and skewing the community to more motile taxa.

These factors may result in moderate impacts, but which are temporary and reversible alteration to the diatom community. The overall value of the diatom community is considered to be of local-only value.

The overall confidence in the diatom data and subsequent assessment has been classed as **low** due to the absence of diatom surveys within the reach.

A summary of the impacts is provided in **Table B4-33**.

Table B4-33 Summary of Impacts on diatom community, Reach 2 (Thames Tributaries)

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Diatoms	- Alteration to community composition as a result of delayed recovery of flows in the watercourse - Increased SRP leading to changes in community composition	Local	Moderate	Minor

B4.2.5 Invasive Species

The drought permit would lead to a reduction in flows that would manifest as a reduction in levels, velocities and wetted widths. The changes to aquatic habitat may cause localised minor changes to the abundance of INNS that are already present. There is no pathway for new INNS to enter the River Thames as a result of the drought permit implementation. There is a general risk of INNS introduction associated with the monitoring and mitigation strategies, however this is not related to the abstraction. Surveyors and operators implementing the monitoring and mitigation activities will follow best practice protocols and biosecurity guidance as referenced in the EMP²⁴.

Overall, the risk of increasing the proliferation of INNS is considered to be **Negligible**.

The overall confidence in the INNS data and subsequent assessment has been classed as **medium** due to the availability of data.

B4.2.6 Summary of Impacts

Table B4-24 summarises the outcomes of the Environmental receptors assessment and includes deterioration to fish and macroinvertebrate receptors within WFD water bodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

²⁴ GB non-native species secretariat - Biosecurity in the field. Accessed 2nd March 2022. <http://www.nonnativespecies.org/index.cfm?pageid=174>.

Table B4-34 Summary of Impacts identified in Reach 1's environmental receptors assessment.

Reach	Reach 2	
	Significance of Impact/ Risk of Deterioration	Mitigation Required (Y/N)
Statutory Designated Sites		
Wytham Ditches and Flushes SSSI	Moderate	Y
Non-Statutory Designated Sites		
Kennington Pool SNCI	Negligible	N
NERC and Notable Species Receptors		
Depressed River mussel	Minor	N
Fine-lined pea mussel	Minor	N
Brown / sea trout	Moderate	Y
European eel	Minor	N
Brook lamprey	Minor	N
Bullhead	Minor	N
Barbel	Minor	N
Ranunculus sp.	Negligible	N
WFD Status Receptors		
Macroinvertebrates	Minor	N
Fish	Moderate	Y
Macrophytes	Minor	N
Diatoms	Minor	N
INNS		
Macroinvertebrates	Negligible	N

B4.3 REACH 3

B4.3.1 Statutory designated sites

B4.3.1.1 Hartslock SSSI

The riverine fen is the only habitat identified in the citation that is water dependent, and therefore the additional habitats will not be impacted upon by the drought permit.

The physical environment assessment has identified the risk to river habitats in Reach 3 to be minor. Impacts on the main channel of the River Thames will be similar to that in Reach 1, with reductions in flow velocity only as the watercourse is level controlled. The physical environment assessment has identified that the main channel of the River Thames in the impacted reaches will only be subject to reductions in velocity and therefore this site will not be impacted given it's location on the main stem of the River Thames.

The wetland habitat is unlikely to be impacted by a reduction in flow velocity, as it is likely to comprise a slow-flowing habitat. The water level is the critical factor for the site, and therefore as this is not affected by the drought permit, impacts are not anticipated. Impacts of water quality in the main River Thames are anticipated to have negligible impact on the site.

The impacts on the designated site as a result of the flow pressure on the main stem of the River Thames are considered to be of negligible magnitude, temporary and reversible. Overall, the significance of impact is considered to be **Negligible**. A summary of the impacts is provided below.

Table B4-35 Summary of Impacts on Hartstock SSSI, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Hartslock SSSI	Habitat degradation as a result of decreased river velocity in the River Thames	National	Negligible	Negligible

B4.3.2 Non-statutory designated sites and NERC habitats

B4.3.2.1 South Stoke Marsh (south) SNCI and South Stoke Marsh (north) SNCI

Although the physical environment assessment has identified the risk to river habitats in Reach 3 to be minor. Impacts on the main channel of the River Thames will be similar to that in Reach 1, with reductions in flow velocity only as the watercourse is level controlled. Consequently, the drought permit will not impact on the water level of the swamp habitat. The species likely to be present in the swamp habitat, such as reed sweet-grass, are likely to favour slow-flowing water, which suggests that flow through the designated site under normal conditions is slow and therefore impacts due to reduced velocity in the River Thames are unlikely to occur.

The physical environment assessment has identified that the main channel of the River Thames in the impacted reaches will only be subject to reductions in velocity and therefore this site will not be impacted given it's location on the main stem of the River Thames. The impacts on the designated site as a result of the flow pressure and water quality in the main stem of the River Thames are considered to be of negligible magnitude, temporary and reversible. Overall, the significance of impact is considered to be **Negligible**.

A summary of the impacts is provided below.

Table B4-36 Summary of Impacts on South Stoke Marsh (south) SNCI and South Stoke Marsh (north) SNCI, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
South Stoke Marsh (south) SNCI	Habitat degradation as a result of decreased river velocity in the River Thames	County	Negligible	Negligible
South Stoke Marsh (north) SNCI			Low	

B4.3.2.2 Monastic Fish Ponds, South Stoke SNCI

The physical environment assessment has identified that the main channel of the River Thames in Reach 3 will only be subject to reductions in velocity. Impacts on the main channel of the River Thames will be similar to that in Reach 1, with reductions in flow velocity only as the watercourse is level controlled. Consequently, the drought permit will not impact on the water level of the ditches or channels. The species identified as present in the ditch system are typically slow-flowing species, which suggests that flow through the designated site under normal conditions is slow and therefore impacts due to reduced velocity in the River Thames are unlikely to occur.

The impacts on the designated site as a result of the flow pressure on the main stem of the River Thames are considered to be of negligible magnitude, temporary and reversible. Impacts associated with water quality are anticipated to be of low magnitude. Overall, the significance of impact is considered to be **low**.

The designated sites are not considered to support water dependent features and therefore will not be impacted upon by the drought permit.

A summary of the impacts is provided below.

Table B4-37 Summary of Impacts on Monastic Fish Ponds, South Stoke SNCI, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Monastic Fish Ponds, South Stoke SNCI	Habitat degradation as a result of decreased river velocity in the River Thames	County	Low	Minor

B4.3.2.3 Whitchurch on Thames Wet Meadow SNCI

Although the physical environment assessment has identified the risk to river habitats in Reach 2 to be uncertain. Impacts on the main channel of the River Thames will be similar to that in Reach 1, with reductions in flow velocity only as the watercourse is level controlled.

The Oxfordshire Biodiversity Action Plan identifies that the lowland meadows are sensitive to changes in hydrology and nutrient status, with grassland of this type significantly reliant on winter flooding. The physical environment assessment has identified that the main channel of the River Thames in the impacted reaches will only be subject to reductions in velocity and therefore this site will not be impacted given it's location on the main stem of the River Thames.

The impacts on the designated site as a result of the flow pressure and water quality in the main stem of the River Thames are considered to be of negligible magnitude, temporary and reversible. Overall, the significance of impact is considered to be **negligible**.

A summary of the impacts is provided below.

Table B4-38 Summary of Impacts on Whitchurch on Thames Wet Meadow SNCI, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Whitchurch on Thames Wet Meadow SNCI	Habitat degradation as a result of decreased river velocity in the River Thames	County	Negligible	Negligible

B4.3.2.4 Coastal and Floodplain Grazing Marsh

Floodplain grazing marsh is defined as periodically inundated pasture, or meadow with ditches which maintain the water levels, containing standing brackish or fresh water. As these habitats are periodically inundated, they are sensitive to drought and flood events. Coastal and floodplain grazing marsh is not a specific habitat but a landscape type which supports a variety of habitats. The ditches within these habitats are usually rich in plants and invertebrates. Sites may contain seasonal water-filled hollows and permanent ponds with emergent swamp communities, but not extensive areas of tall fen species like reeds. The principal environmental variables influencing vegetation include: salinity, water depth, substrate and successional stage.

Low flows and water levels could therefore reduce aquatic habitat availability. This could impact on the fauna and flora assemblages associated with these ditches. Freshwater ditches often include various snail and mollusc species although the beetles *Graptodytes pictus*, *Gyrinus substriatus*, *Haliphus lineatocollis*, *Hydrophilus piceus*, *Laccobius colon*, *Laccobius minutus*, *Limnoxenus niger* and *Peltodytes caesus*, the bugs *Ilyocoris cimicoides*, *Plea minutissima* and *Sigara dorsalis*, the mayflies *Caenis robusta* and *Cloeon dipterum*,

the swimming caddis *Trietodes bicolor* are also known to occur in these habitats²⁵. These species are generally adapted to slow flowing water and are not sensitive to water quality changes.

B4.3.2.5 Lowland fens

Lowland fens are peatlands which receive water and nutrients from the soil, rock and ground water as well as from rainfall: they are minerotrophic. Two types of fen can broadly be distinguished: topogenous and soligenous. Topogenous fens are those where water movements in the peat or soil are generally vertical. They include basin fens and floodplain fen. Soligenous fens, where water movements are predominantly lateral, include mires associated with springs, rills and flushes in the uplands, valley mires, springs and flushes in the lowlands, trackways and ladder fens in blanket bogs and lags of raised bogs.

Lowland fen habitats are associated with Reach 3 of this drought permit. These fens appear to be floodplain fen, but are limited in extent within the impacted reaches. During low flow periods it is possible that these fen habitats are linked to groundwater levels in the underlying gravels. The water level is the critical factor for the site, and therefore as this is not affected by the drought permit, impacts are not anticipated. Impacts of water quality in the main River Thames are anticipated to have negligible impact on the site.

B4.3.2.6 Reedbeds

Reedbeds are wetlands dominated by stands of the common reed *Phragmites australis*, wherein the water table is at or above ground level for most of the year. They tend to incorporate areas of open water and ditches, and small areas of wet grassland and carr woodland may be associated with them.. Reedbeds are amongst the most important habitats for birds in the UK. They support a distinctive breeding bird assemblage including six nationally rare Red Data Birds, provide roosting and feeding sites for migratory species (including the globally threatened aquatic warbler (*Acrocephalus paludicola*), and are used as roost sites for several raptor species in winter. Five GB Red Data Book invertebrates are also closely associated with reedbeds²⁶.

Reedbeds are associated with Reach 3 of this drought permit. They form within marginal areas of the Thames, with water level being a critical factor. The water level is the critical factor for this receptor, and therefore as this is not affected by the drought permit, impacts are not anticipated. Impacts of water quality in the main River Thames are anticipated to have negligible impact on the reedbeds.

Summary

The impacts of the drought permit on the floodplain and grazing marsh, lowland fen, and reedbed habitats associated with the River Thames are considered to be of low magnitude in Reach 3, and temporary and reversible in both reaches. Overall, the significance of impact in Reach 3 are considered to be **minor**.

A summary of the impacts is provided in the table below.

Table B4-39 Summary of Impacts on NERC Act Section 41 Priority Habitats, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Floodplain and grazing marshes	- Reduction in species abundance and distribution as a result of sedimentation - Changes to species composition as a result of reduced water quality.	Regional	Negligible	Negligible
Lowland fen	- Reduction in species abundance and distribution as a result of sedimentation - Changes to species composition as a result of reduced water quality.	Regional	Negligible	Negligible

²⁵ Drake, C.M, Stewart, N.F., Palmer, M.A. & Kindemba, V. L. (2010) The ecological status of ditch systems: an investigation into the current status of the aquatic invertebrate and plant communities of grazing marsh ditch systems in England and Wales. Technical Report. Buglife – The Invertebrate Conservation Trust, Peterborough.

²⁶ UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Reedbed	Reduction in quality of reedbed habitat, with knock on effects on invertebrate communities	Regional	Negligible	Negligible

B4.3.3 NERC and other protected species/Notable Species

B4.3.3.1 Macroinvertebrates – Depressed River mussel and Fine-lined pea mussel

Consultation during the production of the previous Farmoor EARs identified the likely two NERC Section 41 priority species within the Farmoor drought permit zone of hydrological influence: depressed river mussel (*Pseudanodonta complanata*), and fine-lined pea mussel (*Pisidium tenuilineatum*).

Depressed River mussel

Baseline macroinvertebrate monitoring information for the impacted reach received from the Environment Agency identified the presence of depressed river mussel in the River Thames but only pre-2009. The abundance of species present was very low, with only one or two individuals present, and it is not considered likely to represent the distribution and abundance of these species accurately.

The 2006 drought permit report²⁷ identified the widespread presence of depressed river mussel between Farmoor and Teddington.

Surveys by Ricardo as part of the SESRO baseline monitoring program identified 1 individual depressed river mussel at site Ses_Eco_6a_S2 via airlift sampling in spring 2024, confirming the presence of the species within the reach 2. The SESRO monitoring program recorded 8 individual depressed river mussels within the Thames at 4 locations downstream of reach 2, showing the further presence within the river system.

Fine-lined pea mussel

The 2006 drought permit report²⁸ identified the widespread presence of fine-lined pea mussel within the reach. However no fine-lined pea mussels were recorded by the EA monitoring program between 2013 and 2024.

Assessment

The main impact on the species will be associated with a loss of habitat rather than flow reduction in the watercourse and the ingress of fine sediments, notably as a result of urban and agricultural run-off. In many lowland rivers and canals where flow velocity is naturally reduced, the fine-lined pea mussel is a characteristic species. The Farmoor drought permit will have little additional impact on the species against a baseline of drought conditions. It is highly unlikely that levels in the Thames would drop low enough even in drought conditions to cause widespread reduction in habitat associated with these two bivalve species.

The water quality assessment has identified no risk of deterioration to the dissolved oxygen saturation or ammonia levels within Reach 3, but there is a high risk to water quality in regards to SRP. The fine-lined pea mussel has fairly high tolerance to water quality deterioration (i.e. organic pollution and dissolved oxygen) as identified by its low BMWP score of 3 (where 1 is very pollution tolerant and 10 is pollution sensitive) and also evidenced by its colonisation of canal habitats and fine, muddy sediments. Depressed river mussels have a BMWP score of 6 showing some tolerance of water quality deterioration, although larger magnitudes of deterioration to water quality will likely have an impact on depressed river mussel populations.

Summary

The impacts of the drought permit on fine-lined pea mussel and depressed river mussel in the River Thames and distributaries are considered to be of medium magnitude, temporary and reversible. Overall, the

²⁷ Scott Wilson (2006) Farmoor Drought Permit - Environmental Report .

significance of impact in Reaches 3 on fine-lined pea mussel and depressed river mussel is considered to be **minor**. A summary of the impacts is provided in the table below.

The overall confidence in the notable macroinvertebrate data and subsequent assessment has been classed as **low** due to the small number of surveys completed where the species were observed.

Table B4-40 Summary of impacts on NERC macroinvertebrate species, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Fine-lined pea mussel	Reduction in habitat quality or species diversity as a result of sedimentation	County	Low	Minor
Depressed river mussel	- Reduction in extent and quality of in-stream and marginal habitats in some distributaries - Reduction in abundance or distribution as a result of reduced water quality.	County	Medium	Minor

B4.3.3.2 Fish

Drought permit implementation in Reach 3 will result in a minor risk of changes in flow velocity in the level controlled mainstem River Thames at times when drought permit in use; noting the effects are at times of very low velocity.

Brown trout were recorded at two sites on the Thames within Reach 3 and 15 individual European eels were recorded across all sites within Reach 3. The impacts of reductions in flows may be significant during the spawning period for brown trout if they limit habitat availability. However, whilst it is possible that some limited sub-optimal brown trout spawning habitat exists in shallow, faster-flow marginal zones, there is no high-quality spawning habitat in the main stem due to the low gradient, laminar flow in this reach. In any sub-optimal habitat that does exist, it is likely that natural drought (i.e. without drought permit implementation) would limit spawning habitat availability in advance of any drought permit impacts.

Bullhead (*Cottus gobio*) (an Annex II species) were identified in this reach of the Thames in low numbers, with 19 individuals recorded. They have been considered due to their sensitivity towards changes in habitat, notably low dissolved oxygen levels and sediment deposition²⁹. Bullhead typically spawn around March and April with egg incubation taking place until the end of June. The potential for hydrological impacts to extend into this spawning period is unlikely, but ultimately dependant on rainfall during the hydrological winter.

Brook lamprey (*Lampetra planeri*), an Annex II species, were not recorded in the main Thames channel. As a precaution, it is assessed that brook lamprey are present in low abundances within all the impacted reaches. Brook lamprey ammocoetes are sedentary filter feeders living in marginal silts. The reduction in flow due to the drought permit is related to velocity only in this reach, and therefore the abundance of marginal habitats should not be impacted.

Barbel are listed in Annex V of the Habitats Directive as a species of community interest. Barbel typically require stretches of fast flowing watercourses with clean gravel and extensive macrophyte beds. Any reduction in flow velocities due to the drought permit could be significantly detrimental to the species. Barbel are listed in Annex V of the Habitats Directive as a species of community interest. Barbel are resident in the main stem of the Thames in reaches 1, 2 and 3 and typically move to the distributaries to spawn, with the juveniles preferring to live in these smaller watercourses.

The risk of water quality deterioration has been identified as negligible in Reach 3 in regard to dissolved oxygen and ammonia, with a high risk in regard to SRP.

Overall, considering the baseline conditions and the hydrological impacts of the drought permit, impacts on NERC Act Section 41 fish species are considered to be of low impact magnitude and **minor** in significance.

²⁹ Conserving Natura 2000 Rivers Ecology Series No.: 4 Ecology of the Bullhead

The overall confidence in the fisheries data and subsequent assessment has been classed as **high** due to the number of surveys and the age of the most recent surveys completed.

Table B4-41 Impacts on NERC and notable fish species, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Brown / sea trout	Migratory species may be impacted by minor changes to velocity during the main migration periods for sea trout and European eel, if the drought permit implementation extends into these periods. However, it should be noted that the permit will only be implemented at times of low velocity whereby migratory cues may already be impacted.	Regional	Low	Minor
European eel	- There is a minor, temporary and reversible increase in sediment dynamics. Therefore the risk to siltation of spawning gravels is considered minor in this reach. - Stranding of individuals is considered unlikely as longitudinal connectivity will not be impacted in the main channel of the River Thames.	Regional	Low	Minor
Brook lamprey	- Juvenile lamprey are known to be poor swimmers and require flows for downstream movements to find suitable habitat for burrowing and feeding. Reduced flow velocity could impact the movement of individuals to spawning and nursery grounds in the upstream sections of the impacted reach. - It is noted that depth of water is not critical to bullhead³⁰ and that the species is also widespread within the wider catchment. However, the species are susceptible to siltation particularly over spawning gravels (considered a minor risk in this reach).	Regional	Low	Minor
Bullhead	- The habitat within this reach of the River Thames is not considered to be significant for Barbel, and it is unlikely that the individuals the main stem watercourse are resident. Barbel requires fast moving, well oxygenated water and therefore it is likely that any associated impacts do not extend beyond those of natural drought. Barbel will make use of existing weir pool habitats along the main stem of the Thames. - Physical environment assessment deems the risk of a reduction in dissolved oxygen to be non existent. There is no risk of fish mortality due to oxygen stress.	County	Low	Minor
Barbel	High risk in regards to SRP.	County	Low	Minor

³⁰ Tomlinson, M. L. and Perrow, M. R. (2003) Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

B4.3.4 WFD receptors

B4.3.4.1 Macroinvertebrates

The assessment of impacts on the macroinvertebrate community should be considered in the context of the watercourses under baseline conditions. The River Thames which comprises the entirety of Reach 3 is a large lowland river which will remain in line with baseline levels during drought permit implementation.

Minor reductions in flow velocity can impact macroinvertebrate communities either through physical habitat loss though changes to habitat parameters (e.g. flow, sediment dynamics, water quality). These changes can result in reductions in populations or regime shifts in community structure (e.g. from a predominance of species adapted to fast flowing environments, to a predominance of those species adapted to slower flowing environments). In lotic environments macroinvertebrates can quickly recolonise once suitable flow conditions are restored by immigration from upstream habitats and local refugia (e.g. pools, subsurface habitats).

In the autumn period, flow reductions may have an impact on macroinvertebrate species with a spring emergence, as the majority of these species lay their eggs in autumn with the eggs overwintering in the watercourse and emerging the following spring. The impacts could limit the recruitment of the species in the watercourses. Given the size and nature of the Thames, there will always be aquatic habitat available for invertebrate species. There will be no changes to the wetted widths in the main channel of the River Thames and therefore the availability and quality of marginal habitat which invertebrates use should not be impacted. The recovery of the macroinvertebrate community within marginal habitats is likely to be rapid following the cessation of drought permit.

Macroinvertebrate adults can emerge as early as March (e.g. Large Dark Olive Mayflies *Baetis rhodani* and March Brown Mayfly *Rhithrogena germanica*) and as late as September (e.g. *Trichoptera Hydropsyche* sp. and Autumn Dun *Ecdyonurus dispar*), although the majority of macroinvertebrates will emerge between May and July. The drought permit could potentially impact on those macroinvertebrate species with characteristic emergence stages in Autumn, thus potentially limiting recruitment of these species in the watercourse the following year. However this is likely to be of low magnitude in Reach 3.

The baseline information shows a community that is generally unaffected by stress linked to low flow conditions. Most sites had life EQR scores above 0.94 which is considered the threshold for stress due to low flow conditions. Species present in the Thames include several native bivalve species which are particularly prone to desiccation if levels drop low enough to expose areas of river bed. But it is unlikely that hydraulic conditions in the main Thames channel would be low enough even under drought conditions to expose the deeper sections of the channel in which bivalve species primarily inhabit.

WHPT_{ASPT} scores provide a measure of the existing water quality of the environment of the River Thames based on the tolerances of the macroinvertebrate species present. The higher WHPT_{ASPT} scores identify a community that is representative of good water quality and lower_{ASPT} scores are representative of poor water quality. WHPT_{ASPT} scores across the sites varied, with sites surveyed more recently having WHPT_{ASPT} EQR scores classified as 'moderate'. The macroinvertebrate communities present may be affected by water quality deterioration. The water quality assessment has identified no risk of deterioration of dissolved oxygen or ammonia in Reach 3, but a high risk in regards to SRP.

Considering the length of the impact, the medium magnitude, and the temporary nature and reversibility in Reach 3, the overall significance of impacts has been assessed as **Minor**. An impact summary is provided in the table below.

The overall confidence in the invertebrate data and subsequent assessment has been classed as **moderate** due to the high quantity of sites sampled, and the addition of the SESRO sampling sites provides a more up to date data set.

Table B4-42 Summary of impacts on macroinvertebrate community, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Macro-invertebrates	High risk in regards to SRP.	County	Medium	Minor

B4.3.4.2 Fish

The assessment of impacts on the fish community should be considered in the context of the watercourse under baseline conditions. Brown trout typically spawn in November, with egg incubation taking place up until March. The drought permit is considered to have a minor impact on flow velocity in this reach, however there will be no changes to river levels.

The impacts of reductions in flows may be significant during the spawning period for brown trout if they limit habitat availability. However, whilst it is possible that some limited sub-optimal brown trout spawning habitat exists in shallow, faster-flowing marginal zones, there is no high-quality spawning habitat in the main stem due to the low gradient, laminar flow in this reach. For any sub-optimal habitat that does exist, it is likely that natural drought (i.e. without drought permit implementation) would limit spawning habitat availability in advance of any drought permit impacts. The magnitude of impact considers the likelihood of desiccation, which in this reach is negligible, the likelihood of changes in spawning in habitat, which is low, and the resilience of the population to recover from this, which is high.

Most other species present will spawn in spring. Hydrological impacts on the spawning of fish species throughout spring are unlikely to occur as the potential for hydrological impacts to extend into this period is unlikely.

Delay to the upstream passage of migratory European eel (elver) into reaches may be affected if the delay to flow recovery extends into spring (April), with the possibility of individuals congregating at the downstream end of obstacles being at an increased predation risk, however again the likelihood of drought permit implementation at this time is low, and the actual impact beyond what would be experienced under baseline conditions is not likely to be significant as impacts to velocity are considered to be minor.

The water quality assessment has identified no risk of deterioration of dissolved oxygen saturation, but a high risk of increased SRP concentrations in Reach 3.

Considering the baseline status of fish species and the likely resilience of species present as a result of the intermittent nature of flow in the reaches, the impacts of water quality deterioration and flow impacts on fish is considered likely to be of low magnitude in Reach 3. The ecological importance of the receptor is considered regional and therefore the impact significance is minor. The overall confidence in the fisheries data and subsequent assessment has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4-43 Summary of impacts on fish community, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Fish	High risk in regards to increasing SRP concentrations.	Regional	Low	Minor

B4.3.4.3 Macrophytes

The assessment of impacts on the macrophyte community should be considered in the context of the watercourse under baseline conditions. The River Thames in Reach 3 is perennial and is highly unlikely to dry under drought conditions.

There is a high risk to water quality deterioration as a result of SRP, and negligible risk identified in regards to ammonia. Increased levels of SRP within the reach can lead to changes in community composition of macrophytes, with potential for certain species to dominate under the high nutrient conditions.

The main macrophyte growing season typically starts between April and extends until September. Therefore, potential water quality impacts on macrophytes in Reach 3 are identified in April and September.

Reduced velocities may limit the flushing of dead plant matter, however this risk is only considered to be minor in Reach 3, and therefore unlikely to be significant against a baseline of reduced flows during drought conditions.

Permit implementation impacts on the macrophyte community of Reach 3 are considered to be low in April and September, and negligible throughout the rest of the year.

The overall confidence in the macrophyte data and subsequent assessment has been classed as **low** due to the macrophyte surveys only being conducted at two sites within the reach.

A summary of the impacts is provided in the table below.

Table B4-44 Summary of impacts on macrophyte community, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Macrophytes	Changes in growth due to higher levels of SRP	County	Low (April and May only) Negligible (rest of the year)	Minor

B4.3.4.4 Diatoms

Due to an absence of data on the diatom community within the reach, the following assessment has been completed with a precautionary approach which considers more general impacts to diatom communities under the changes to the water quality and hydrological conditions.

Species composition of the diatom community is most dependent on nutrient levels (notably SRP), whilst flow and grazing pressure (e.g. by invertebrates) governs the 'thickness' of the diatom biofilm. Slowing of flows can shift the community away from sessile towards more motile taxa (i.e. that are able to live in a thicker biofilm) and those that grow on stalks.

The principal concern regarding impacts on the diatom community is the potential for increased SRP due to reduced dilution. Nutrient enrichment can stimulate growth in some diatom species potentially altering the community structure.

The overall value of the diatom community is considered to be of local-only value. The impact magnitude is deemed to be low and therefore the significance of impact is deemed to be Negligible. The overall confidence in the data and subsequent assessment has been classed as low due to the absence of available data on diatoms.

A summary of the impacts is provided in the table below.

Table B4-45 Summary of impacts on diatom community, Reach 3

Receptor	Impact	Ecological Importance of Receptor	Impact Magnitude	Significance of Impact
Diatoms	Increased SRP leading to changes in community composition	Local	Moderate	Minor

B4.3.5 Invasive Species

The drought permit would lead to a reduction in flows that would manifest as a reduction in velocity. The changes to aquatic habitat may cause localised minor changes to the abundance of INNS that are already present. There is no pathway for new INNS to enter the River Thames as a result of the drought permit implementation.

Overall, the risk of increasing the proliferation of INNS is considered to be **Negligible**.

The overall confidence in the data and subsequent assessment has been classed as **medium** due to the availability of data on INNS within the reach.

B4.3.6 Summary of Impacts

Table B4-46 summarises the outcomes of the Environmental receptors assessment and includes deterioration to fish and macroinvertebrate receptors within WFD water bodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4-46 Summary of Impacts identified in Reach 3's environmental receptors assessment.

Reach	Reach 3	
	Significance of Impact/ Risk of Deterioration	Mitigation Required (Y/N)
Statutory Designated Sites		
Hartslock SSSI and SAC	Negligible	N
Non-Statutory Designated Sites		
South Stoke Marsh (south) SNCI and South Stoke Marsh (north) SNCI	Negligible	N
Monastic Fish Ponds, South Stoke SNCI	Negligible	N
Whitchurch on Thames Wet Meadow SNCI	Negligible	N
NERC and Notable Species Receptors		
Floodplain and grazing marshes	Minor	N
Lowland fen	Negligible	N
Reedbed	Negligible	N
Depressed River mussel	Minor	N
Fine-lined pea mussel	Minor	N
Brown / sea trout	Minor	N
European eel	Minor	N
Brook lamprey	Minor	N
Bullhead	Minor	N
Barbel	Minor	N
Ranunculus sp.	Minor	N
WFD Status Receptors		
Macroinvertebrates	Minor	N
Fish	Minor	N
Macrophytes	Minor	N
Diatoms	Minor	N
INNS		
Macroinvertebrates	Negligible	N

B4.4 LANDSCAPE, NAVIGATION, RECREATION, HERITAGE AND INDUSTRY (ALL REACHES)

B4.4.1 Navigation

The River Thames is highly valued for its navigational and recreational uses, which have their own flow and level requirements³¹. The River Thames is navigable for powered craft from the estuary as far upstream as Lechlade in Gloucestershire. Small craft are able to navigate the river further upstream to Cricklade. The greatest movement of boat traffic generally takes place between Easter and September. The Thames is by far the most significant river for competitive rowing in the UK, and several locations hold nationally important events³². However, given the period of implementation (October to April), this will coincide with quietest period for boat movement in the calendar year. The River Thames provides a facility for novices, training, casual and competitive canoeing. The River Thames can be an important stage for national and international events.

The Environment Agency is the Navigation Authority of the non-tidal River Thames and River Medway. The Environment Agency has a statutory duty to maintain public navigation on the River Thames (between Cricklade and Teddington) and maintain prescribed sections of the river channel to specific depths³³.

There are businesses operating on or near the freshwater River Thames, houseboat communities and several marinas that are sensitive to lower water levels. The Environment Agency manages and maintains water levels to prescribed targets through a system of locks and weirs (see **Figure 4.1**). The West Thames Area Waterways team of the Environment Agency holds and maintains the River Thames waterways DP, which outlines planned activities to maintain navigation and river levels during a drought.

Baseline

The depth available for navigation varies along the freshwater River Thames due to natural differences in channel depth and differing lock designs. The maximum drafts of vessels that will normally be able to navigate the study area are 0.9m between Inglesham Round House near Lechlade to Oxford and 1.2m between Oxford and Reading. In order to meet its statutory duty, the Environment Agency manages and maintains water levels to exceed these depths to enable passage, carrying out monitoring of water levels upstream and downstream of each weir to facilitate this. The water levels at the upstream (head) and downstream (tail) gates are monitored by telemetry and visually five times a day at many locks across the Thames Region.

Environment Agency lock keepers are required to operate the weirs to manage head water levels (HWL) between specified high and low targets relative to a set standard for each lock, the Standard Head Water Level (SHWL). The SHWL at one lock provides sufficient water for navigation up to and into the tail of the next lock upstream. The navigable depth through a lock is constrained by an underwater sill at its tail³⁴. There are a number of houseboat communities along the River Thames that are particularly sensitive to reduced head water levels at the locks. Many of the craft at risk are moored with little under keel clearance and are very susceptible to minor drops in river level. Of concern is the fact that when they ground, they heel and this can strain their fixed service connections, which may include water, sewage, electricity and gas. The critical low HWL levels, relevant to the Farmoor drought permit, are detailed in **Table B4-47** below.

Table B4-47 Critical Minimum Head Water Levels

Lock	Critical low HWL (m)	Consequences of further HWL reduction
Eynsham	-0.100	Oxford Cruisers/Anglo Welsh unable to operate
Kings	-0.025	Seacourt Stream starved of water
Osney	-0.075	Boats ground in Osney Marina
Iffley	-0.125	Boats ground in Osney Marina/Hinksey Stream Disruption to Salters Bros at Folly and Donnington

³¹ Environment Agency (2008 update) Thames Corridor CAMS, 2004

³² Environment Agency (2006) River Thames Alliance: Thames Waterway Plan 2006-2011

³³ Environment Agency (2012) South East Region Drought Plan

³⁴ Environment Agency (2005) Drought Plan for the Thames Waterway (Internal)

Lock	Critical low HWL (m)	Consequences of further HWL reduction
Sandford	-0.100	Groundings at Hinksey Stream, Heyford Hill and Rose Island
Culham	-0.050	Groundings in Abingdon Marina Disruption to Harwell discharge
Days	-0.150	Groundings in reach due to sandstone outcrop Vessels unable to reach the Plough at Long Wittenham
Benson	-0.125	Disruption to Benson Waterfront
Caversham	0.050	Disruption to Salters, Tim Deaton Groundings just off the Warren

Of the impacted reaches houseboat communities on the stretch of the River Thames downstream of the Farmoor abstraction between Pinkhill and Eynsham Locks are most at risk from reductions in levels as there is no supporting tributary flow to this reach. The King's reach and downstream are supported by the inflow from the River Evenlode.

All distributaries of the River Thames carry a right of navigation, other than a stretch of backwater downstream of Folly Bridge. The 2006 EAR³⁵ reports that only limited reaches are actually used for navigation, with most boat activity limited to the use of Wolvercote Stream. The number of vessels using Wolvercote Stream increases during low flow periods when the Environment Agency's preference is to send navigation via the Wolvercote Stream and Dukes Cut to the Oxford Canal³⁶. At the time of the lowest recorded flows in this area (during summer of 1976), when navigation was restricted on the main River Thames, navigation was not restricted in the Wolvercote Stream and sufficient flow was available to support navigation at all times³⁷.

Both in the River Thames and the distributaries, average vessel movements are highest from April to September, then less in March and October and lowest in November to February. The timing of the increase in boat traffic in spring is closely linked to the timing of Easter school holidays. There are also a number of sailing and rowing clubs that use the River Thames that could be impacted by implementation of the Farmoor drought permit.

Assessment

The assessment of impacts on navigation is based on impacts identified in **Appendix A**, particularly changes in water level, as well as the in-depth study of impacts on navigation from the Farmoor drought permit undertaken in 2006³⁸.

Potential risks associated with the Farmoor drought permit include the potential for water levels in the impacted reaches of the River Thames and the distributaries, to drop below target levels, and that statutory levels are not maintained. However, the presumption must be that the statutory requirement to maintain water levels will be adhered to. It is also important to note that due to preceding dry conditions, it will be difficult to maintain SHWL at many of the locks downstream of the Farmoor abstraction regardless of whether the proposed drought permit is implemented and operating or not. This section considers the potential impacts the Farmoor drought permit may have on maintenance of water levels and subsequent impacts on navigation. Given the impacts are assessed between October to April, the winter period does not coincide with baseline drought conditions, therefore it is unlikely that levels will drop sufficiently enough.

The Environment Agency identifies a number of generic actions regarding navigation in times of drought (including the consideration of mandatory lock restrictions). It also refers to the River Thames Waterways DP³⁹ held and maintained by the Thames Area Waterways. The River Thames Waterways DP outlines planned activities to maintain navigation and river levels during a drought, it is noted that this document is currently due to be updated. The River Thames Waterways DP implies that even if SHWL is maintained appropriately, the implementation of a drought permit within a reach (lock group) triggers actions which include staunching of

³⁵ Scott Wilson (2006) Farmoor Drought Permit - Environmental Report .

³⁶ Scott Wilson (2006) Farmoor Drought Permit - Environmental Report .

³⁷ Scott Wilson (2006) Farmoor Drought Permit - Environmental Report .

³⁸ Scott Wilson (2006) Farmoor Drought Permit Environmental Report

³⁹ Environment Agency (2005) Drought Plan for the Thames Waterway (Internal)

weirs, switching off public power out of hours, restriction of lock cycles (e.g. restricted to once every half hour) and closure of locks out of hours.

Risk to the management of levels could require further management of navigation (lockage and navigation) out of hours. Direct pumping is proposed to provide sufficient water into the distributaries to maintain a minimum ecological flow to maintain the ecology. This would provide additional flow in the distributaries when flow would be at its lowest with the drought permit in place and would make it easier for sufficient headwaters to be maintained for navigation. Over-pumping would be initiated based on different triggers for each distributary, as agreed with the Environment Agency.

Considering the above, the physical environment impacts discussed in **Appendix A**, the businesses relating to a number of marinas, passenger boat/ hire boat operators and the effects on public use of the River Thames for navigation, the impacts of the Farmoor drought permit on navigation along the impacted reaches of the River Thames are considered to be **moderate** in all Reaches.

The duration of impacts would be limited to the implementation and operation of the drought permit which is anticipated to be in place for up to six consecutive months between October and April.

Other users who may potentially be impacted by the changes in the river environment as a result of the potential drought permit have been identified as recreational river users whose movement may be restricted by increase in floating plants.

Navigation restrictions are less of an issue with regard to rowers although the reduced manoeuvrability of larger boats may result in more difficult conditions. Rowers would only be impacted in the unlikely event that the proposed drought permit reduced level in the River Thames to a point that rowing, canoeing and sailing was no longer possible. Even complete cessation of flow would not prevent such activities occurring on the River Thames as the mobility of these activities allows them to use other stretches of the river that remain useable⁴⁰. Furthermore, no rowing, sailing or canoeing clubs are known to operate on the reach between the Farmoor abstraction and the confluence with the River Evenlode and river levels downstream of this point are expected to remain at a level suitable to support such activities.

B4.4.2 Angling

Baseline

The River Thames is highly valued and intensively used for angling with over 232,000 rod licences sold in 2008 in the Environment Agency Thames Region⁴¹. The environmental condition and the protection of the fish resource is of great importance, as demonstrated by the establishment of organisations such as the Thames Anglers Conservancy that aim to protect the River Thames from the many challenges the river faces and improve it.

The upper section of the River Thames is a good example of a popular coarse fishery. Both non-match and match angling take place along this stretch, mostly at weekends⁴². The River Thames is known to be an area holding large fish, which are nationally significant in terms of their size.

The most popular methods of fishing are swim feeder, pole, float and ledger with the highest volume of angling activity occurring in June, July and August. Different methods of fishing are utilised under different conditions, often affected by river level and flows. As such, the methods of fishing utilised will be affected by low flow conditions, and this may be exacerbated by the operation of the proposed drought permit at Farmoor⁴³.

Assessment

The assessment of impacts on angling is based on changes to water flow/levels, water quality and fish, which have been identified in **Appendix A** and **Section B4**. The risk to river habitats as a result of river flow effects are assessed as minor to moderate in Reach 1 and 2 and minor in Reach 3. However, it should be noted that limnophilic species, which largely dominate the community present, are unlikely to be adversely affected by the impacts associated with the drought permit as they are adapted to slow flowing or still water environments and are likely to thrive in the elevated riverine temperatures.

⁴⁰ Scott Wilson (2006) Farmoor Drought Permit Environmental Report

⁴¹ Environment Agency (2010), River Basin Management Plan, Thames River Basin District.

⁴² Scott Wilson (2006) Farmoor Drought Permit Environmental Report

⁴³ Scott Wilson (2006) Farmoor Drought Permit Environmental Report

As identified in **Section B4.1.4.2**, the most significant impacts to fish in both reaches has been identified as:

- Loss of or reduction in extent of spawning habitat for different species
- Increased stress and predation on species in refuges as a result of delay in recovery of flows
- High risk to water quality associated to SRP

As a result of the above, impacts to anglers will involve a required geographical shift in location to target specific areas or a change in the techniques used to fish during drought permit implementation. Despite the potential reduction in abundance and species diversity in the impacted reaches, angling would be able to continue during drought permit implementation. Therefore, impacts on angling are considered to be **minor** in all reaches.

B4.4.3 Designated bathing water sites

Baseline

There is one designated bathing water site in Reach 2, Wolvercote Mill Stream, and two designated bathing water sites in Reach 3, Wallingford Beach and Pangbourne Meadow.

The Wolvercote Mill Stream site is classified as Poor bathing water quality (2026) and for the 2026 bathing season has a “bathing not advised” notice in place⁴⁴.

Wallingford Beach is classified as Sufficient bathing water quality (2026)⁴⁵, while Pangbourne Meadow is not classified as the site was designated in 2026, therefore will be classified after the 2026 bathing season has ended⁴⁶.

Assessment

The drought permit may lead to reduced river velocities and levels, which could decrease dilution and flushing within the watercourses. This could increase the persistence of contaminants and therefore present a potential risk to bathing water quality.

Noting the Wolvercote Mill Stream bathing water already has a “bathing not advised” notice in place, there is no impact on this bathing water from a drought permit.

For the bathing waters in Reach 3, the **Appendix A** assessment includes a minor risk to flow velocities, which are important for flushing within the watercourse, and a medium risk from reduced dilution of three specific discharges (Oxford, Abingdon and Didcot STWs). These three STWs are upstream of the Reach 3 designated bathing water sites and the drought permit could increase risk to bathing water quality. It is noted that the bathing water season closes on 30 September annually and the timing of overlap with the drought permit is short.

The impacts on bathing water are considered to be **negligible** in Reach 2 and **moderate** in Reach 3. Water quality monitoring at Wolvercote Mill Stream, Wallingford Beach and Pangbourne Meadow has been proposed as part of the EMP in **Appendix C** in response to a request from the Environment Agency, in order to monitor potential impacts of the drought permit on bathing water quality.

⁴⁴ Environment Agency. 2026 Bathing Water Profile for Wolvercote Mill Stream. Available at: <https://environment.data.gov.uk/bwq/profiles/profile.html?site=ukj1402-11946> (Accessed: 25 August 2026).

⁴⁵ Environment Agency. 2026 Bathing Water Profile for Wallingford Beach, River Thames. Available at: <https://environment.data.gov.uk/bwq/profiles/profile.html?site=ukj1403-11947> (Accessed: 25 August 2026).

⁴⁶ Environment Agency. 2026 Bathing Water Profile for Pangbourne Meadow, River Thames. Available at: <https://environment.data.gov.uk/bwq/profiles/profile.html?site=ukj1102-11941> (Accessed: 25 August 2026).

B5 ENVIRONMENTAL RECEPTORS ASSESSMENT SUMMARY

Table B5-1 summarises the significance of impacts identified from the assessment of receptors within impacted reaches.

Table B5-1 Significance of impacts on environmental receptors

Receptor	Reach 1	Reach 2	Reach 3
Statutory Designated Sites			
Oxford Meadows SAC	Negligible	N/A	N/A
Cassington Meadows SSSI	Negligible	N/A	N/A
Pixey and Yarnton Meads SSSI	Negligible	N/A	N/A
Wolvercote Meadows SSSI	Negligible	N/A	N/A
Port Meadow with Wolvercote Common and Green SSSI	Negligible	N/A	N/A
Iffley Meadows SSSI	Negligible	N/A	N/A
Wytham Ditches and Flushes SSSI	N/A	Moderate	N/A
Hartslock SSSI	N/A	N/A	Negligible
Non-Statutory Designated Sites and NERC Habitats			
Thames Island (Skinner's Weir Island) SNCI	Minor	N/A	Negligible
Swinford Toll Brook Meadow SNCI	Negligible	N/A	N/A
Pasture by A34 Thames Bridge SNCI	Negligible	N/A	N/A
Binsey Green SNCI	Negligible	N/A	N/A
Kennington Pool SNCI	N/A	Negligible	N/A
Bypass Swamp SNCI	Minor	N/A	N/A
Fiddler's Elbow Marsh SNCI	Minor	N/A	N/A
Heyford Hill Lane Pasture SNCI	Negligible	N/A	N/A
South Stoke Marsh (south) SNCI and South Stoke Marsh (north) SNCI	N/A	N/A	Negligible
Monastic Fish Ponds, South Stoke SNCI	N/A	N/A	Negligible
Whitchurch on Thames Wet Meadow SNCI	N/A	N/A	Negligible
Floodplain and grazing marshes	Negligible	N/A	Negligible
Lowland fen	Negligible	N/A	Negligible
Reedbed	Negligible	N/A	Negligible
NERC and Notable Species Receptors			
Depressed River mussel	Minor	Minor	Minor
Fine-lined pea mussel	Minor	Minor	Minor
Brown / sea trout	Moderate	Moderate	Minor
European eel	Minor	Minor	Minor
Brook lamprey	Minor	Minor	Minor
Bullhead	Minor	Minor	Minor
Barbel	Minor	Minor	Minor
Ranunculus sp.	Minor	Minor	N/A
WFD Status Receptors			
Macroinvertebrates	Minor	Minor	Minor
Fish	Moderate	Moderate	Minor
Macrophytes	Minor	Minor	Minor
Diatoms	Minor	Minor	Minor

Receptor	Reach 1	Reach 2	Reach 3
INNS Receptors			
Macroinvertebrates	Negligible	Negligible	Negligible
Other receptors			
Navigation	Moderate	Moderate	Moderate
Angling	Minor	Minor	Minor
Designated bathing water sites	N/A	Negligible	Moderate

APPENDIX C: ENVIRONMENTAL MONITORING PLAN AND MITIGATION – FARMOOR DROUGHT PERMIT

C1 BACKGROUND AND BASIS OF THE ENVIRONMENTAL MONITORING PLAN

This document is Appendix C: Environmental Monitoring Plan and Mitigation of the Farmoor drought permit Environment Assessment Report (EAR). With reference to the approach to undertaking environmental assessments shown as a process diagram in Figure 3-1 of the EAR, this appendix includes a section:

- on mitigation requirements and the principal of measures to avoid, reduce or mitigate and an indication of potential mitigation options to consider for the drought permit.
- providing details regarding proposed monitoring including information on the principal of monitoring, baseline monitoring requirements, monitoring at the onset of drought, monitoring during drought permit/implementation, monitoring post drought permit implementation and details of the specific mitigation requirements for each drought permit/order.

The Environmental Monitoring Plan (EMP) has been prepared in support of Thames Water's Drought Plan 2022 and in compliance with the requirements of Section 6 (Environmental assessment, monitoring and mitigation) of the Environment Agency's DPG2025¹.

Guidance states that in a Drought Plan, a water company must describe the measures they may need to take to restrain the demand for water within their water supply system, obtain extra water from other sources, and how the effects of an environmental drought and those resulting from the application of a drought permit are to be monitored and/or mitigated.

This EMP includes the following sections:

- **Section C1** – Background and basis of the EMP
- **Section C2** – EMP guidance underpinning the programme
- **Section C3** – Biosecurity measures
- **Section C4** – Baseline Monitoring approach
- **Section C5** - On-set, in-drought and post drought monitoring and mitigation approach
- **Section C6** –The proposed monitoring and mitigation plan: **Table C6-1** identifies the specific monitoring items and mitigation (where applicable) for the Drought Permit. **Table C6-2** provides detail on monitoring frequency. **Table C6-3** provides a summary of the proposed walkover locations. **Figure C6-1** (separate document) provides a mapped overview of the recommended ecological monitoring sites.

Where **negligible** or **minor** adverse impacts from drought permit implementation are anticipated for identified receptors, no further mitigation has been recommended in line with the Ricardo Thames Water 'Drought Plan 2027 Environmental Assessment Methodology Report'² which has been agreed with the regulators. The environmental assessment has concluded that there are a number of features sensitive to the potential impacts of the drought permit, which are summarised in the relevant sections of this EAR including the drought impact.

Control sites are crucial in assessing the ecological impact of flow pressure resulting from water resource activities. They can help determine whether any ecological impact being observed is a result of the water resource activity being investigated, rather than wider environmental influences.

Good control sites for hydro-ecological assessment should be chosen where there are no significant water quality problems or pressures which could undermine relationships between ecology and flow. Ideally, they must not be affected by the water resource activity being investigated nor have additional water resource activity upstream that could affect the flow regime, however, where baseline abstraction occurs upstream of a control this is also acceptable. It is imperative that they are as similar in nature to the baseline conditions of the impact sites as possible, most importantly in relation to stream size and channel gradient.

¹ Environment Agency (2025) Water Company Drought Plan Guideline, March 2025.

² Thames Water Utilities Ltd (2025). Thames Water Drought Plan 2027: Environmental Assessment Methodology Report – Prepared by Ricardo (V7 May 2025).

Appropriate control sites are listed below:

- Farmoor - Located on the River Thames above the abstraction point and above the lock (SP4035801379).
- Control Walkover: US SP4012301449, DS SP4057301337

The final location of this control site will be confirmed dependant on consultation with the Environment Agency prior to the application for the Drought Permit.

The monitoring programme has taken consideration of:

- Any potential changes in the assessment of the hydrological, water quality and geomorphological impacts based on baseline conditions at the onset of drought.
- Any potential changes in the assessment of impacts on environmental features based on baseline conditions at the onset of drought.
- Any changes in assessment and/or monitoring methodologies and biological indices.

C2 ENVIRONMENTAL MONITORING PLAN GUIDANCE

Guidance on the objectives and content of the EMP is given in Section 4 and 5 of the Environment Agency's 'Environmental assessment for water company drought planning' supplementary guidance to the DPG2025. The issues specified are addressed in subsequent sections of this report.

The guidance states that an EMP should include details of the monitoring required and states this should include:

Baseline monitoring – collection and maintenance of baseline monitoring datasets help understand the nature of the environment under 'normal' circumstances, along with establishing the sensitivity of the environment to changes in flow and any especially sensitive features of interest. Baseline monitoring is also essential in enabling understanding of the actual environmental impact of supply side drought management actions. It allows comparison between the environment under 'normal' conditions against observed environmental datasets during and after a drought.

Onset and In-drought monitoring - to help assess the immediate environmental impacts of drought action during a drought along with informing choices and implementation of mitigation measures. This can be split between pre-permit application (Onset) and post-permit implementation (In-drought) stages.

Post-drought (recovery) monitoring - to help assess any longer-term environmental impacts of, or recovery from, the implementation of drought actions.

It may be possible to mitigate or reduce adverse effects on the environment. The guidance states a drought plan should, therefore, identify:

- pre-drought mitigation actions: actions you will implement before or whilst the drought is developing to reduce the likely environmental impact of your proposed actions
- in-drought mitigation actions: actions you will implement during a drought to minimise the environmental impact of your proposed actions
- post-drought mitigation actions: actions you will implement following a drought to reduce any environmental impacts that may occur as a result of the actions you implement

The DPG also indicates that a drought plan should provide evidence that the mitigation measures that are proposed will be effective for the features that could be at risk from a drought option. The EMP should show how this will be monitored. The drought plan should also include details of any additional permits or approvals needed to carry out the mitigation measures.

In some cases, mitigation actions may be necessary to prevent derogation of other abstractions (for example, by providing alternative supplies if feasible).

C3 BIOSECURITY

Biosecurity is a major issue across the UK to prevent disease and pathogen transfer and the spread of non-native invasive species; drought conditions can increase some of these risks but reduce others. It is important that prior to commencing any monitoring or implementing any mitigation measures, a biosecurity risk assessment is completed to highlight the risks relating to the proposed activities and ensure good working practice is followed. A biosecurity plan should be prepared to set out the risks and the prevention measures (or mitigation measures should adverse effects arise). This will be implemented by documenting this (alongside other environmental and health and safety risks) in the “Site Visit Risk Assessment and Methodology” form that will be completed by the field surveyors prior to undertaking any fieldwork.

During a drought, Thames Water will work with the Environment Agency, Natural England, and, if necessary, landowners (e.g. CLA) and the agriculture sector (e.g. NFU) as appropriate to promote the importance of biosecurity measures at times of low flows. This could include joint press releases and website messages. A joint message is likely to have the greatest impact, rather than one organisation working in isolation.

C4 BASELINE MONITORING

C4.1 ROUTINE BASELINE MONITORING

Baseline monitoring is required to assess the baseline sensitivity of the receiving environment outside of environmental drought conditions and to identify impacts of drought options over and above the effects of environmental drought. A comprehensive review of existing baseline information relating to Thames Water supply-side drought options has been carried out in preparation of the Thames Water Drought Plan. The adequacy of these data has been reviewed and consideration has been made as to whether there is a need for further baseline monitoring to reduce uncertainty regarding the presence or distribution of important features, which will be updated through the review of the assessment.

The use of existing monitoring sites (for Environment Agency and Thames Water monitoring programmes) and standard methodologies applied in data collection are recommended, where possible. It should be noted, however, that not all existing monitoring sites are necessarily required to feed into Drought Permit assessments. This baseline monitoring programme is customised to the individual sites associated with a particular drought option and the sensitive features known to be present within proximity to the site. Where an initial assessment of a receptor, such as a protected site deemed dependant on an impacted waterbody (following the Environment Agency DPG) indicates either a lack of confidence in existing data, or a lack of data, the sensitivity of the receptor will be classed as 'uncertain'. Uncertainty is based on our understanding of the presence, distribution and extent of the receptor and professional judgement. Further surveys may be recommended if the sensitivity is deemed uncertain in order to inform a detailed assessment (see section below).

To assist in the development of potential drought permit or order applications identified in its Drought Plan (DP), to further inform the environmental assessments and to reduce uncertainty, Thames Water has made a commitment to undertake additional baseline environmental surveys, where appropriate.

Baseline monitoring has been ongoing since 2012 following the preparation of the EARs and comprised a walkover using a bespoke methodology developed by Cascade, Cascade Hydro-Ecology Walkover (CHEW) approach. The initial walkover survey also identified key 'monitoring/surveillance' reaches, based on a selection of the most appropriate or significantly impacted reaches. Targeted macroinvertebrate and macrophyte surveys have been undertaken and the results are outlined in the individual drought permit baseline sections for each environmental feature.

A number of Baseline Environmental Monitoring Reports (BEMRs) have been produced which are of relevance to the Farmoor drought permit, these include:

- Farmoor: 2015³ (containing 2012-2015 data), 2017⁴ and 2019⁵, 2020, 2021 and 2022⁶.

On completion of the initial monitoring programme (2012 to 2015) and following review of the recommendations made in the EARs for DP 2017, it was recommended that monitoring should continue to be undertaken at appropriate intervals to ensure baseline information is robust to support any future application for drought powers. The baseline monitoring programme has been developed using best practice guidelines where appropriate, including JNCC Common Standards Monitoring Guidance⁷ and WFD classification requirements⁸. This monitoring programme complies with the ecological monitoring methods in the DPG2025. Future monitoring will be reasonable and practicable and will be subject to further discussion with the Environment Agency and Natural England.

³ Cascade Consulting (2016) Baseline Environmental Monitoring Report – Farmoor Drought Permit, August 2016. Report for Thames Water Utilities Limited.

⁴ Ricardo Energy & Environment (2019) Baseline Environmental Monitoring Report (2017) – Farmoor Drought Permit. Report for Thames Water Utilities Limited

⁵ Ricardo Energy & Environment (2020) Baseline Environmental Monitoring Report (2019) – Farmoor Drought Permit. Report for Thames Water Utilities Limited

⁶ Ricardo Energy & Environment (2023) Baseline Environmental Monitoring Report (2022) – Farmoor Drought Permit. Report for Thames Water Utilities Limited

⁷ JNCC (2014) Common Standards Monitoring Guidance for Rivers, ISSN 1743-8160

⁸ European Parliament (2000) Directive 2000/60 EC The Water Framework Directive: Annex V

The relevant monitoring approaches applied in the baseline monitoring programme have been set out in the sections below. It is noted that, where applicable, these methodologies will also be used for monitoring at the onset, in-drought and post drought to inform the impacts associated with the implementation of a drought permit/order.

C4.2 PHYSICAL ENVIRONMENT

C4.2.1 Environment Agency Surveys

The Environment Agency routinely monitor a number of sites within identified potentially impacted reaches as part of EU Water Framework Directive (WFD) monitoring programmes. These monitoring surveys can also be utilised for in-drought and post-drought assessments. Monitoring includes the following key elements:

- River flow monitoring at a series of gauging stations
- Physico-chemical water quality monitoring at sites on all the main rivers for parameters outlined in the 2010 Defra Directions (carried out for WFD and other purposes).

C4.2.2 Hydrology (River Flows and Water levels)

River flow data assist the baseline understanding of the river catchment, establish the zone of influence of the drought options and assist in the differentiation of drought-related impacts and drought options on hydrology and hydro-ecology.

To ascertain the hydrological impacts of the drought option, a variety of different hydrological/hydrometric datasets were obtained. These generally came from either the Environment Agency, Thames Water or the Centre of Ecology and Hydrology's (CEH) national river flow archive website.

Long-term flow records show the typical variation of flow within a watercourse over time. Statistics on flow can be obtained for long term datasets. Typical statistics include median flow and infrequent high and low flows. Of relevance for drought studies are the low flow statistics, such as Q95 which represents flow equalled or exceeded for 95% of days in the measured record.

River stage/level measured data (obtained from the Environment Agency) are generally long-term measurements of the depth of a watercourse at a fixed location. Stage refers to elevation above ordnance datum whilst level is relative to a nearby local datum (such as bed level). Stage/level measurements are a coarser approximation of the variability of a river over time in that higher levels are generally associated with higher discharges. In the absence of local flow data, stage/levels have been used in the assessment generally to show if the variability in stage/level experienced nearer to a potentially impacted reach is similar to that of flow gauge further upstream/downstream. If the local stage/level is similar to the more distant flow gauge, then the measured flow gauge data may be used to derive approximate flows (through catchment apportioning) in the vicinity of where the drought option, and any impact of it, is focussed.

A combination of continuous and ad-hoc river level and flow gauging monitoring should be undertaken to inform the assessments and provide in-situ data pre/during and post implementation, as outlined below.

Continuous (auto data logging) surveys include:

- River level and flow gauging – Data is collected by the Environment Agency as part of routine monitoring of the physical environment. This data can be requested from the Environment Agency's regional data centres for analysis and many are located in the vicinity of water infrastructure.
- Standing water level logging - Data is collected by Thames Water (in-reservoir), the Environment Agency or other responsible body (Wetland trusts, etc.) as part of routine monitoring of the physical environment. This data can be requested from the Environment Agency's regional data centres for analysis.

Ad hoc surveys include:

- Spot flow gauging – Safe and effective spot flow gauging is dependent on the size and current flow of the water body. Common methods include:
 - o In-channel measurements using Acoustic Doppler Current Profiler (ADCP). This can be undertaken with a hand held ADCP when the water is at a suitable flow and the user can

safely wade across the wetted width of the water body. This involves the submersion of the ADCP unit to record measurements at particular locations/intervals to create a flow profile.

- o In-channel measurements using an Electromagnetic (EM) gauge. Such a technique is employed when stream flow is extremely low and involves the submersion of the EM unit into the flow, to take a measurement.
- Cross-sectional profile (depth and wetted width), flow and velocity data should be collected within the impacted reaches at sites identified during walkovers.

C4.2.3 Hydrology (Groundwater Level Monitoring)

Where available, borehole and well assessments should consider the feasibility of installing automatic water level logging devices, alternatively manual dip readings should be taken. The datum level should be carefully determined and noted and referenced to ground level datum or other appropriate local datum.

Where automatic logging devices are installed, a manual calibration dip should be taken once every 6 months (as a minimum) and compared to the logger data. Any discrepancies and re-calibration should be clearly identified in the data record. The manual calibration dip reading should be carefully recorded and retained for future reference.

If the groundwater level is being obtained from a borehole used for potable supply purposes, great care must be taken not to cause any contamination of the groundwater during installation of automatic logging equipment or manual dip readings.

C4.2.4 River Habitats / Geomorphology

In order to understand the impacts of changes in flow on habitats and geomorphology, river habitat and geomorphological data is proposed to be collected. It is proposed that up to date characterisation of the river habitats of the reaches is informed by walkover surveys in the form of a River Conditions Assessment Form. It should be focussed on locations of bank poaching, surface water outfall input and also downstream of weirs where flows are likely to be particularly low in order to provide a suitable comparison to make a conclusion on deterioration or otherwise within the impacted reaches.

The survey should contain a range of ecological, hydrological, geomorphological data for the channel bed and banks, flow and surrounding land and incorporate elements of the RHS. The survey also collects information on the anthropogenic modifications present within and around the channel and the land-use around the channel. This data can be generally semi-quantitative with some quantitative data describing channel width and depth.

Aerial imagery data of the impacted reaches can be reviewed using Google Earth. The aerial images can be used to assess the impacted reaches by deriving counts of geomorphological features in the channel (e.g. sediment bars, riffles, pools, bank erosion etc.), the presence of anthropogenic structures in and around the channel, particularly weirs, bridges and reinforced or re-sectioned banks and the surrounding land use. In addition, the images can be used to acquire measurements of channel length and width and the width of weirs. Aerial imagery may be limited in some cases due to the presence of riparian vegetation obscuring the channel and water clarity at the time aerial images are taken, which means features and channel dimensions could not be directly assessed via this method.

C4.2.5 Water Quality

Water quality surveys will include:

- In-situ spot measurements using a multi-meter probe to measure pH, temperature, electrical conductivity and dissolved oxygen (% saturation and mg/l).
- Water quality samples will be taken in the field and sent to an accredited laboratory for alkalinity, unionised ammonia, ammonia, hardness, nitrate, phosphate, suspended solids, total oxidised nitrogen, orthophosphate, temperature, and pH analysis.

The number and location of samples will be determined by the length of the reach and specific water quality pressures identified within the reach, whilst accounting for the spatial distribution and results of all relevant Environment Agency historic water quality monitoring data. In general, samples will be taken in areas that are targeted for ecological monitoring (particularly macroinvertebrates).

C4.3 ECOLOGY

C4.3.1 Environment Agency Macroinvertebrate and Fish Monitoring Surveys

The Environment Agency routinely monitor a number of sites within impacted reaches as part of WFD and National Fisheries monitoring programmes. These monitoring surveys can also be utilised for in-drought and post-drought assessments. To ensure a sufficient dataset to inform the environmental baseline for environmental assessment Thames Water also carry out further macroinvertebrate and fish monitoring using the same methodologies. These datasets are used in the preparation of the EARs.

For all available macroinvertebrate data where environmental variables were available, EQRs should be calculated using RICT for WHPTNTAXA and WHPTASPT indices which directly relate the macroinvertebrate community to WFD status over the monitoring period. Baseline conditions for sites within the zone of influence of the drought option should also be established through existing data. These included graphing the hydrology, water quality, habitat and macroinvertebrate (LIFE scores and WHPT EQRs) variation temporally over the monitored period. This information is used to inform the assessment of any potential impacts on the macroinvertebrate community (as per the RBMP3 status assessments in each EAR). Consideration should also be given to drought-specific indices such as the Drought Effect of Habitat Loss on Invertebrates index (DEHLI).

As part of the WFD assessment of the fish element the Environment Agency undertakes a FCS2 assessment for most WFD waterbodies. The assessment within the EAR considers the scale and longevity of any fish status impacts and determined the severity and duration of impacts to the physical environment as a result of the drought permit and the specific requirements of the fish population present. These assessments were informed by the last FCS2 data available for sites within impacted reaches associated with each drought option.

C4.3.2 Ecology Records Search

Information obtained from the Environment Agency, National Biodiversity Network (NBN) and supplementary report and data from Thames Water has provided information on the distribution of NERC Act Section 41 Priority species.

C4.3.3 Targeted Baseline Monitoring

Where gaps in data have been identified, targeted surveys are recommended for specific reaches to gain sufficient data for baseline assessment.

C4.3.4 Local/Key Wildlife Site Monitoring

If impacts are concluded to be likely, consideration will need to be given as to what could be undertaken in the event of a drought permit being implemented for each LWS/KWS, i.e. what potential monitoring and / or mitigation would be deemed reasonable and / or practical. As discussed and agreed with the Environment Agency (at a meeting held on 12th July 2023), no baseline monitoring would be required for an impacted LWS/KWS.

C5 ON-SET, IN-DROUGHT AND POST DROUGHT MONITORING AND MITIGATION

C5.1 INTRODUCTION

The DPG supplementary guidance states monitoring data is required to inform an environmental assessment in advance of a drought, and any in-drought and post-drought data requirements. This section of this EMP details the monitoring measures that will be undertaken during each progressive stage of a drought: on-set; in-drought; and post-drought. The DPG supplementary guidance states that it may be possible to mitigate or reduce adverse effects that drought actions have on the environment and the drought plan must identify in-drought and post drought mitigation measures.

Quantitative and qualitative monitoring surveys are recommended for different stages of the drought process where a reliable data set is required in order to determine impacts to sensitive features and reduce uncertainty in environmental assessment. This monitoring will provide data necessary to satisfy the requirement of Section 4.3 of the DPG for water companies to review the environmental impacts of the drought by analysing baseline, in-drought and post-drought data (where post-drought monitoring has been required).

C5.2 MONITORING METHODOLOGIES AND LOCATIONS (GENERAL)

The monitoring programme will continue during the on-set, in-drought and post drought option implementation periods in order to provide robust data on environmental conditions during and after the implementation of drought options (locations are provided below in **Table C6-1** and **Table C6-3**).

In line with Environment Agency advice, no in stream monitoring will be undertaken during environmental drought, unless agreed otherwise, to prevent further harm to the aquatic communities through sampling. Data collected in the baseline, on-set and in drought this period can be compared to data collected in post-drought conditions to determine the rates of recovery and any further appropriate mitigation required.

C5.3 ON-SET OF ENVIRONMENTAL DROUGHT MONITORING

C5.3.1 On-set of environmental drought walkovers

The on-set drought monitoring locations are provided below in **Table C6-1** and **Table C6-3**. Walkover surveys during the onset of environmental drought will monitor the current hydrological, water quality and habitat conditions at the on-set of the drought permit implementation. This type of walkover survey incorporates elements of the RHS, and will identify conditions of ecological features such as key fish habitats and risks. Data will be collated via the 'River Conditions Assessment Form', the scope and content of which has been agreed with the Environment Agency and Natural England prior to a 2022 application of the drought permit. The monitoring will identify the 'monitoring/surveillance' reaches, based on selection of most significantly impacted reaches, which will remain consistent throughout the subsequent walkover surveys. Walkover surveys will be conducted by experienced field surveyors, with knowledge and understanding of walkover surveys, river habitats and ecological features associated with this environment.

Duration and Frequency

On-set drought monitoring will be undertaken on one occasion, prior to the implementation of the drought permit.

Local wildlife site monitoring

As discussed and agreed with the Environment Agency (at the meeting held on 12th July 2023), at drought on-set, a walkover survey of potentially impacted LWS will be undertaken to identify the condition of the LWS, focussing on the ecological features of interest / importance cited in the LWS record prior to drought permit implementation.

At drought on-set, a walkover survey of impacted LWS will be undertaken to identify the condition of the LWS, focussing on the ecological features of interest / importance cited in the LWS record.

C5.3.2 In Drought (During Drought Option Implementation) Monitoring

In-drought surveys will be undertaken to monitor changes to sensitive features during implementation of the drought option and to identify the need for mitigation measures at the same sites monitored during the on-set environmental drought walkovers. In drought monitoring should commence two days after the implementation of the drought option.

The in-drought monitoring locations are provided below in **Table C6-1** and **Table C6-3** and will be consistent with those undertaken during the on-set monitoring to allow for comparison to baseline drought conditions to provide an assessment of any changes in ecological features. Monitoring methodologies will adopt the same methodologies as applied during on-set monitoring. No in-stream monitoring will be undertaken during environmental drought, unless otherwise advised and agreed with the Environment Agency and Natural England, to prevent further harm to the invertebrate community through kick/ sweep sampling.

Walkover surveys will monitor features such as habitat availability, providing qualitative information on the effects of the drought measures, and allow decisions to be taken quickly regarding further monitoring and/or mitigation requirements. This type of walkover survey incorporates elements of the RHS and will identify conditions of ecological features such as key fish habitats and risks, data will be collated via the 'River Conditions Assessment Form'.

Mitigation measures are provided in **Table C6-1** based on the likely impacts to sensitive features. These measures should be updated where potential additional 'new' impacts are identified from walkover surveys.

Duration and Frequency

In-drought monitoring will be initiated immediately once the drought permit is implemented. The in-drought surveillance walkovers will take place two days after the drought option implementation until the drought permit / order expires or is revoked, unless otherwise agreed by the Environment Agency. The frequency of the in-drought monitoring is assumed to be monthly for a period of six months from implementation, however expert judgement will be used to identify the severity of impacts as a result of the walkovers and therefore frequency may be increased as a result.

Method

The visual monitoring of the potentially affected reaches to detect any potential change in habitat will be recorded via the 'River Condition Assessment Form'. Photographs should be taken at recorded locations to be repeated during subsequent surveys.

Changes in fish habitat can be discreet and subtle as discharge reduces. Baseline conditions and images will be available in each survey reach taken during the on-set monitoring such that changes can be detected and reported by the field team.

Environmental Impacts

Environmental impacts observed may include:

- Fish in distress, for example gasping at the surface or leaping out of the water
- Dead or dying fish
- Concentration of fish in restricted areas/pools which could increase susceptibility to predation
- Exposure of key functional habitat, particularly where there are reduced flows over or siltation of brown trout redds
- Stranding of fish in marginal areas
- Signs of pollution
- Changes to geomorphology e.g. changes in wetted width and exposure or normally submerged marginal features
- From general water quality spot surveys; low levels of dissolved oxygen below the boundary of WFD moderate and poor status may indicate drought impacts.

Parameters to be included in water quality spot sampling analysis are outlined below.

Water Quality Monitoring

In-stream water quality monitoring will be undertaken in the form of spot sample measurements using handheld meters to identify environmental problems on the affected waterbodies that may be caused by the reduction in flow. These will be taken during each of the walkover locations (detailed below in **Table C6-1**).

Water quality monitoring should be undertaken during each walkover survey until the drought permit expires or is revoked.

In situ probe readings and spot water quality samples should be taken in the centre of the channel at mid-depth where appropriate. The following parameters will be recorded:

- Dissolved oxygen concentration (mg/l) and saturation (%)
- Conductivity
- Water temperature
- pH
- Turbidity

Algal Monitoring will be undertaken at Farmoor reservoir and within the River Thames at Culham. The following parameters will be recorded:

- Soluble reactive phosphorus (ug/L)
- Total phosphorus (ug/L)
- Dissolved ammonium (NH₄) (mg/l)
- Dissolved silicon (mg Si/L)
- Chlorophyll - a (ug/L)
- Temperature
- Greenpico
- Diatoms
- Green Meso
- Crypto
- Cyano
- Green Diatoms
- Green Meso
- Green Pico
- Crypto
- Cyano

Local Wildlife Sites

As discussed and agreed with the Environment Agency (at the meeting held on 12th July 2023), no in-drought monitoring of KWS/LWS features (where relevant to the permit) will be undertaken and no specific mitigation is to be implemented. However, other in-drought monitoring will be undertaken to record the actual levels of groundwater and rivers, and their subsequent recovery.

Reporting

Data will be collated in the field using the 'River Conditions Assessment Form'. Thames Water will provide the Environment Agency a briefing note after the completion of surveys, detailing:

- Inventory of walkover surveys undertaken: dates, locations and findings
- Summary of water quality measurements, where taken
- Completed datasheets from the surveillance walkover surveys of habitat quality and ecological stress
- Recommendations for the implementation of any mitigation measures

- Recommendations for the frequency of subsequent monitoring in the “during drought permit” period.

C5.4 MITIGATION MEASURES

If, during the visual and water quality monitoring there are significant environmental impacts observed (e.g. fish in distress/ low dissolved oxygen / reduced habitat availability etc.), then a mitigation response may be required. Mitigation measures are provided in **Table C6-1** below based on the likely impacts to sensitive features.

The mitigation recommendations have been made in a hierarchy of approach which follows the general principle of 1) reducing the pressure at source; 2) pressure management in the river; and 3) ecological action. The implementation of mitigations during the in-drought and post-drought periods should follow this principle, with movement to mitigation measures in the next hierarchy dependent upon the success or failure of mitigation in the lower hierarchy.

Thames Water have commissioned a project to identify potential options to enhance the environmental resilience of rivers within their operational area to improve their robustness in times of drought. This project is reviewing all potentially impacted reaches identified in the EARs and assessing what river restoration options might improve the environmental resilience in the area, should there be a drought and / or a need to implement drought options. This work is ongoing at the moment, therefore, outcomes are not included in the EARs and will be incorporated at a later update. The extent, location and type of mitigation measures will also be informed by walkovers that are completed at the onset of drought.

C5.5 IN DROUGHT MITIGATION OPTIONS

The surveillance walkovers incorporate visual and water quality monitoring. This includes a number of suggested signs of environmental distress which may be observed during the visual observations and the water quality sampling. If the monitoring identifies signs of environmental distress Thames Water would notify the Environment Agency and review and assess a remedial course of action to address the signs of environmental distress, where possible. The frequency of the in-drought monitoring is assumed to be monthly for a period of six months from implementation, however expert judgement will be used to identify the severity of impacts as a result of the walkovers and therefore frequency may be increased as a result.

Where water level impacts have been identified; the creation of alternative refuges in deeper water where walkover surveys identify the loss of important deep water habitat or high densities of fauna in refuges (fish) may be considered. Placing stones or logs in a main river to enhance habitats is permitted under flood risk activity (FRA) exemption FRA18⁹ where installation of habitat structure made of natural materials (but not including weirs and berms) is permitted on a main river. Placing these items may assist in creating alternate refuges in the event that identified refuges are insufficient or not retained during the implementation of the drought permit. These structures should be permitted assuming:

- stones must be less than 400mm in any dimension and of a type that occurs naturally in the main river
- logs must be of less than 2m in length, less than 400mm in diameter and oriented to within 45° of the flow of water
- logs must be from a tree species that occurs naturally in the vicinity of the main river; and it must be securely pinned to the bed or bank of the main river to prevent wash out and congregation downstream
- the stones or logs are placed in the channel over no more than 20m of the length, and 20% of the width, of the main river
- no stones or logs are placed within 100m of a non-agricultural building in the floodplain, a natural channel habitat structure, an existing emplacement of stones or logs placed in the main river for habitat enhancement or a man-made structure on or in the main river
- material may remain in place post drought permit if allowed under exception.

Provision of in-stream structures and flow baffles to create functional refuges to support flow sensitive species where walkover surveys identify a projected loss of habitat inundation (macroinvertebrates, fish). It may be necessary to introduce in-stream structures at sites to create functional refuges to support displaced fish stocks.

⁹ <https://www.gov.uk/government/publications/environmental-permitting-regulations-exempt-flood-risk-activities/exempt-flood-risk-activities-environmental-permits>

Installing habitat structures made of natural materials (excluding weirs and berms) is permitted under exemption FRA15¹⁰ which allows installation of structures made of natural materials (but not including weirs and berms).

These structures should be ready to be installed at suitable sites and would be permitted as long as:

- the structure occupies no more than half the width of the cross-sectional area of the channel in the main river and no more than 20m of the length of the main river
- no part of the structure is higher than 0.3m above the level of the river bed or 25% of the height of the bank (excluding any wall or embankment), whichever is greater
- the structure is made from naturally occurring woody material and is securely fastened to the bed of the main river, the bank or both
- no works take place within 100m of a non-agricultural building in the floodplain, another natural channel habitat structure, stones or logs placed in the main river for habitat enhancement or a man-made structure on or in the main river
- all structures should be removed within one month of the expiry of the drought permit.

A combined approach should be used to capture any fish, either isolated from the main flow of the river or showing signs of distress from the DP implementation process. Standard methods should be used including electric fishing to capture fish from cover features and also manual searches (under cobbles etc.) using hand nets to manually capture fish. Any fish captured should be relocated to a suitable area of habitat less affected by the reduction in flow. All electric fishing should be undertaken by fully trained fisheries scientists following standard electric fishing practice for operators and equipment, as developed by the European Standards Committee and detailed in the Environment Agency Code of Practice and Electric Fishing Equipment Annex A and B, Issue II regulations. Prior to any fish removals, application should be made via an FR2 form to apply for S27A authorisation to use fishing instruments other than rod and line.

If fish continue to show signs of distress, they should be captured and held for a short period, allowing recovery of both the fish and the levels of instream dissolved oxygen. In the case that these levels fail to recover, the fish should be moved to a suitable release site downstream where appropriate conditions exist on the day. It may also be necessary to relocate fish across barriers where movement between two areas as a result of an instream barrier is restricted.

Any eel captured should be kept in a separate tank to all other fish species as they secrete mucus which can infest the gills of other fish. Dissolved oxygen concentration should be monitored and optimum concentrations maintained by continuous infusion, using an oxygenation unit.

The identification of appropriate mitigation to be implemented during a drought needs to take into account all of the species present in the reach, as the implementation of some mitigation measures for the benefit of one species could be at the detriment of another.

C5.6 POST DROUGHT MONITORING

In order to assess whether the implementation of the drought options has any long-term effects on any environmental features, monitoring after implementation of drought options will be necessary for certain features. This is specified in **Table C6-1**.

This monitoring will provide a quantitative dataset to assess whether the implementation of the drought permit has had any long-term effects on any sensitive environmental features within the extent of hydrological influence associated with the Farmoor drought permit and to demonstrate recovery where appropriate.

The frequency and duration of the post-drought monitoring will be agreed with the Environment Agency and Natural England.

C5.6.1 Data Analysis

Comparison of the post-drought monitoring results to monitoring data from (a) baseline monitoring locations, (b) monitoring of control sites and (c) in-drought monitoring locations (where available), will provide a quantitative

¹⁰ <https://www.gov.uk/government/publications/environmental-permitting-regulations-exempt-flood-risk-activities/exempt-flood-risk-activities-environmental-permits>

dataset to determine whether the implementation of drought options has had any long-term effects on any sensitive environmental features within the extent of hydrological influence associated with each of the drought options, demonstrate recovery where appropriate, and identify the need for further monitoring and mitigation.

Identifying any long-term effects on ecological features and an assessment of the efficacy of any in-drought and post drought mitigation measures should be initially informed by a direct comparison of the relevant biological metrics/indices.

For macroinvertebrate communities this includes a direct comparison of the EQRs calculated using RICT for WHPTNTAXA and WHPTASPT indices and a direct comparison of the total WHPT score, LIFE scores and PSI scores as obtained for a specific monitoring site (i.e. where monitoring has been completed pre-drought and post drought from the monitoring site.). A drought option is considered to have resulted in an impact on the macroinvertebrate community where EQRs have reduced by one biological band when comparing the results of a minimum of five-year baseline monitoring data against a control site. Comparison against a long-term data set is required to allow for natural variation in community structure. It is also advised that consideration is given to trends in the calculated DEHLI indices both pre and post drought.

For fish communities the assessment should consider a direct comparison of the species assemblage, density, biomass and standing crop density and biomass for a specific monitoring site (i.e. where monitoring has been completed pre-drought and post drought from the monitoring site.). The data analyses should also include a comparison of length-frequency distribution plots to identify any impacts on recruitment. A drought option is considered to have resulted in an impact on the fish community where EQRs have reduced when comparing the results of a minimum of five-year baseline monitoring data. Comparison against a long-term data set is required to allow for natural variation in community structure. It is noted that monitoring results could vary naturally as a result of changes in habitat availability following a severe natural event (e.g. drought or flood). As such, the assessment of any impacts on the ecological features, and the subsequent need for further post drought mitigation, should also consider the result of the baseline, in-drought and post drought monitoring results at control sites. For example, the overall biomass of the fish community with a river reach associated with a drought option may have reduced by 10%, however, a similar observation could be made at a control site. As such, the 10% reduction could be considered to be as a result of natural variations/drought impacts and not necessarily as a result of the implementation of a drought option. Should this not be possible, the assessment should rely on expert judgment of the relevant metrics and data.

Biological indices and metrics are mostly informative and basic representations of a biological community's condition and represents a summary of complex ecological data. To reduce any uncertainty in the assessments it is, therefore, recommended that the assessment is further supported by a statistical analysis of the macroinvertebrate and fish community data using an appropriate software package (e.g. Primer or R) to complete a similarity analysis. The statistical analyses should be used to identify which species typified survey sites pre- and post-drought option implementation and whether there has been a statistically significant difference in either the diversity and/or abundance of the ecological communities. The statistical analyses should include the comparison between sites and with control sites and should consider a minimum of five-year baseline monitoring data (where available) to allow for natural variation.

C5.7 POST DROUGHT MITIGATION OPTIONS

Some mitigation options are considered to be most effective when applied following removal of drought option measures (i.e. post drought) where adverse impacts, as a result of the drought permit, have been identified.

The recommended post-drought mitigation options could include any of the following suite of mitigation options:

- Enhancement of habitat within the impacted reach (macroinvertebrates, fish).
- Capture and relocate across barrier (taking migratory period into account) where significant numbers of migratory fish congregate at obstacle (fish).
- Relocation of juveniles where walkover surveys identify the likely desiccation of marginal habitats or loss of water depth at important habitats (fish)
- Restocking using offspring from broodstock from the catchment where monitoring indicates loss of fish abundance or recruitment (fish).
- Restocking of coarse fish from the catchment where monitoring indicates loss of fish abundance or recruitment (fish).

The requirement for the implementation of any potential post-drought mitigation options will be discussed with the Environment Agency and Natural England.

C5.8 MONITORING AND MITIGATION MEASURES: ENSURING ENVIRONMENTAL PROTECTION

The monitoring and mitigation measures set out in this EMP have been based on previous experience and evidence from droughts in other parts of the UK and/or from water management experiences more broadly from water companies and the Environment Agency (for example, aeration of waterbodies by United Utilities on the Manchester Ship Canal or by the Environment Agency and Thames Water on the lower River Thames). Some of the mitigation measures do carry a level of risk and for this reason full consultation with the Environment Agency and Natural England will take place to agree whether a particular mitigation action is the best option in the prevailing drought situation and that it will have the greatest chance of success. Whilst no mitigation measure can claim to provide a 100% success rate, there is good evidence from across the UK that the measures set out in this EMP will likely have a positive, beneficial effect for the environment.

C6 PROPOSED MONITORING AND MITIGATION

Table C6-1 identifies the specific monitoring and mitigation recommendations associated with the Farmoor drought option and its associated reaches for each impacted receptor. **Table C6-2** provides a proposed monitoring plan to be read alongside Table C6-1, which includes a breakdown of the proposed monitoring, the timings and the frequency. **Table C6-3** provides a list of the sample sites for quick reference. **Figure C6-1** provides a plan of the proposed spot monitoring including the proposed macroinvertebrate, macrophyte, water quality and hydrological monitoring sites. **Figure C6-2** provides a plan of the proposed walkover locations.

Table C6-1 Farmoor drought permit: Monitoring and Mitigation Recommendations

Survey Item	Potential Impact identified in EAR	Baseline / Pre-drought (not to be considered during implementation)	On-set of environmental drought (frequency: on one occasion, prior to drought permit implementation)	During Drought Permit Implementation Period		Post Drought Permit
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions	Monitoring and post-drought mitigation (where applicable)
River Condition Assessment Walkovers	N/A	Baseline walkovers are to be undertaken and details to be filled out in an appropriate 'River Condition Assessment form' Walkovers will be undertaken along the River Thames (Reach 1 and 3) and along the distributaries (Reach 2). Walkover locations are detailed in Table 3 and Figure 1 .	Walkovers are to be undertaken and details to be filled out in an appropriate 'River Condition Assessment form' Walkovers will be undertaken along the River Thames (Reach 1 and 3) and along the distributaries (Reach 2). Walkover locations are detailed in Table 3 and Figure 1 .	Walkovers are to be undertaken and details to be filled out in an appropriate 'River Condition Assessment form'. Walkovers should be repeated regularly. Surveys should be undertaken on the first, second and fifth day of implementation as a starting point, followed by an adaptive approach whereby the frequency and scope of the walkovers following the first week of implementation is dictated by the watercourse conditions, monitored flow gauge data and recent weather conditions. This will be confirmed with the EA. Walkovers will be undertaken along the River Thames (Reach 1 and 3) and along the distributaries (Reach 2). Walkover locations are detailed in Table 3 and Figure 1 .	N/A	Post drought baseline walkovers will be undertaken following cessation of the permit operation.
Macroinvertebrates	All reaches: Minor Potential changes to species composition as a result of reduced water quality and low flows.	Baseline monitoring will be undertaken in spring (March - May) summer (June - August) and autumn (September - November) at the following locations: Reach 1: Water intake Swinford EA ID: 35847 SP4454008704 Reach 2 (Thames Distributaries): Wytham Mill SP4767309466 Botley Stream SP4944006600 Bulstake SP4982606416 Osney SP4989606388 North Hinskey SP4945605594 South Hinksey SP5118404455 Reach 3: Days Lock (EA ID: 35891) SU5687393535	N/A- No in stream monitoring is to be undertaken during drought.	N/A- No in stream monitoring is to be undertaken during the implementation period	Mitigating impacts to the macroinvertebrate community is not feasible or necessary during drought permit implementation.	Post drought baseline monitoring will be undertaken in spring, summer, and autumn at the following locations to provide insight into community changes post implementation. Reach 1: Water intake Swinford EA ID: 35847 SP4454008704 Reach 2 (Thames Distributaries): Wytham Mill SP4767309466 Botley Stream SP4944006600 Bulstake SP4982606416 Osney SP4989606388 North Hinskey SP4945605594 South Hinksey SP5118404455 Reach 3: Days Lock (EA ID: 35891) SU5687393535
Macrophytes	All reaches: Minor Potential changes to species composition as a result of reduced water quality and low flows.	Baseline monitoring will be undertaken in summer (June - September) at the following locations: Reach 1: EA Site 184225: SP4479108759 Reach 2 (Thames Distributaries): Seacourt Stream at Wytham: SP4770008900 Bulstake Stream SP4982606416 Osney SP4989606388 Hinksey Stream at Manor Lane SP4984905346	In-drought monitoring to understand community prior to implementation of the permit. LEAFPACS2 macrophyte survey to be carried out if environmental drought occurs between June and September (through agreement with EA) Reach 1: EA Site 184225: SP4479108759 Reach 2 (Thames Distributaries): Seacourt Stream at Wytham: SP4770008900 Bulstake Stream SP4982606416 Osney SP4989606388	N/A- No in stream monitoring is to be undertaken during the implementation period. Walkovers of key areas known to be susceptible to low flows, to assess baseline macrophyte community at onset of the drought. Details to be filled out in an appropriate 'River Condition Assessment form'. Walkovers detailed in Table 3 and Figure 1 . Walkovers should be repeated regularly. Surveys should be undertaken on the first, second and fifth day of implementation as a starting point, followed by an adaptive approach	Mitigating impacts to the macrophyte community as a result of delayed recovery of flow is not feasible or necessary during drought permit implementation.	Baseline monitoring will be undertaken in summer (June - September) at the following locations: Reach 1: EA Site 184225: SP4479108759 Reach 2 (Thames Distributaries): Seacourt Stream at Wytham: SP4770008900 Bulstake Stream SP4982606416 Osney Ditch SP4989606388 Hinksey Stream at Manor Lane SP4984905346 Hinksey Stream at the Fishes SP5106904586 Kennington Pool SNCI: SP5185803406 Reach 3: EA Site 214018

Survey Item	Potential Impact identified in EAR	Baseline / Pre-drought (not to be considered during implementation)	On-set of environmental drought (frequency: on one occasion, prior to drought permit implementation)	During Drought Permit Implementation Period		Post Drought Permit
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions	Monitoring and post-drought mitigation (where applicable)
		Hinksey Stream at the Fishes SP5106904586 Kennington Pool SNCI: SP5185803406 Reach 3: EA Site 214018 SU5332397452	Hinksey Stream at Manor Lane SP4984905346 Hinksey Stream at the Fishes SP5106904586 Kennington Pool SNCI: SP5185803406 Reach 3: EA Site 214018 SU5332397452 If agreed with EA that full macrophyte survey not applicable for current conditions or time of year, macrophyte community will be assessed through walkovers of key areas known to be susceptible to low flows. Details to be filled out in an appropriate 'River Condition Assessment form'. Walkovers detailed in Table 3 and Figure 1 .	whereby the frequency and scope of the walkovers following the first week of implementation is dictated by the watercourse conditions, monitored flow gauge data and recent weather conditions. This will be confirmed with the EA.		SU5332397452 If existing macrophyte community has significantly deteriorated, consider reseeding/replanting where possible to promote recovery. Replanting of macrophyte community composition to be informed by pre-drought community.
Fish community - Brown/ Sea trout - Lamprey species - European eel - Barbel	Reach 1 and Reach 2 (Thames distributaries): Moderate Reach 3: Minor Reduction in extent or quality of spawning, nursery and cover habitats Fragmentation of habitats and increased significance of obstacles Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species.	Brown trout, lamprey and barbel spawning habitats are understood as a result of: - CHEW walkover undertaken in 2014 by Ricardo - Environment Agency Rare and Protected Species database - Data from 12 Environment Agency fish monitoring sites - Local knowledge from Environment Agency fisheries and ecology teams	No in stream monitoring is advised during onset of environmental drought to prevent further harm to the fish community through sampling. Walkovers are to be undertaken and details to be filled out in an appropriate 'River Condition Assessment form' Walkovers detailed in Table C6-3 Riverbed substrate composition, connectivity, fish barrier assessments and an assessment of habitat fragmentation will be undertaken during each walkover survey.	Repeat "on-set" monitoring walkovers. Walkovers should be repeated regularly. Surveys should be undertaken on the first, second and fifth day of implementation as a starting point, followed by an adaptive approach. whereby the frequency and scope of the walkovers following the first week of implementation is dictated by the watercourse conditions, monitored flow gauge data and recent weather conditions. This will be confirmed with the EA. Fragmentation of habitats: Fish passage assessment of barriers /obstructions to fish passage and any associated fish passes should be undertaken to ascertain if they pose an increased risk to the free movement of fish. These will be undertaken during each walkover survey with data collated in the 'River Condition Assessment form'.	The need for mitigation will be determined based on expert judgement from the results of the during drought monitoring walkovers. In-built mitigation will include flow routing implemented alongside the permit providing minimum flows into the distributaries, namely a minimum flow of 120 l/sec from the River Thames into the Seacourt Stream and an ecological minimum flow from the Seacourt Stream into each of the Bulstake Stream and Osney Stream. The ecological minimum flow for the Bulstake Stream and Osney Stream are each identified as likely in the order of 25-50 l/sec. Fragmentation of habitats: Consider modifying any impacted fish passes (where possible) to ensure passage is maintained during key migration periods (e.g. agree to provide an appropriate proportion of flow into the pass to enable passage). Consider 'Trap & Transport' of concentrated abundances of migrating fish accumulated below impassable barrier/s to spawning grounds upstream of the impacted reach (where environmental parameters such as dissolved oxygen and temperature allow). Alternatively, mitigation should seek to protect any populations 'trapped' as a result of the barrier/s until flows increase for example by using aeration (if dissolved oxygen levels are low) or preventing predation (see below). Deployment of aeration equipment in key reaches that have standing or slow flowing water with low oxygen levels. Increased predation: Targeted installation of woody debris features to provide submerged and overhead cover from predation where significant abundances of fish have been identified by walkover surveys. Consider provision of physical deterrents to deter piscivorous birds at significant locations (e.g. scare crows) in consultation with Environment Agency, Natural England. In extreme cases (where environmental parameters such as dissolved oxygen and temperature allow), consider removal of concentrated abundances of fish deemed to be stranded/at risk, relocating fish to suitable locations outside	Post-drought fish population surveys at Thames Water/Environment Agency monitoring sites (corresponding with a control and impact site/s) to determine any changes in population dynamics both temporally and spatially.

Survey Item	Potential Impact identified in EAR	Baseline / Pre-drought (not to be considered during implementation)	On-set of environmental drought (frequency: on one occasion, prior to drought permit implementation)	During Drought Permit Implementation Period		Post Drought Permit
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions	Monitoring and post-drought mitigation (where applicable)
					of the impacted reach within the watercourse (in accordance with local Environment Agency Fisheries guidance). Reduction in abundance of species: In extreme cases, following consultation with the Environment Agency restocking of flow sensitive fish species can be considered if recovery needs to be facilitated Reduction in water quality: Deployment of aeration equipment in key reaches that have standing or slow flowing water with low oxygen levels. Where point sources (STW) can affect water quality, consider improving treatment efficiency if possible and/or dosing with hydrogen peroxide in line with Environment Agency Guidance to (further) reduce biochemical oxygen demand.	
Invasive non-native species (INNS) - Signal crayfish (Pacifastacus leniusculus), - Zebra mussel (Dreissena polymorpha) - Chinese mitten crab (Eriocheir sinensis)	Increasing the distribution of invasive non-native species (INNS)	Baseline macroinvertebrate surveys can be used to develop an increased temporal understanding of the presence of the identified invertebrate INNS. Walkover surveys will provide record of any identified INNS	No in stream monitoring is advised during environmental drought to prevent further harm to the aquatic communities through sampling.	No in stream monitoring is advised during environmental drought to prevent further harm to the aquatic communities through sampling.	Mitigating the impact of the drought permit on macroinvertebrate species through direct intervention is not feasible or necessary. Mitigation for the spread of INNS should be centred around preventative measures by following best practice protocols and biosecurity guidance ¹¹ .	All INNS records to be provided to the Environment Agency. Monitoring should commence in following the drought and should continue for at least two years in order to assess the impact of drought permit implementation on the INNS species identified during monitoring. The results of these surveys should be used to inform the requirement for biosecurity protocols and monitoring during subsequent drought permit implementation period. Understanding of the population dynamics post drought to be developed through the macroinvertebrate baseline monitoring programme and is not INNS specific monitoring.
Fine-lined pea mussel Depressed river mussel	All reaches: Minor Reduction in abundance or distribution as a result of reduced water quality and flows.	Location of suitable pea mussel and depressed river mussel habitat and their susceptibility to drying is known as a result of: - CHEW walkover undertaken in 2014 by Ricardo Species presence is known as a result of: - Data from routine Environment Agency and TWUL monitoring sites for invertebrates. - Farmoor Drought Permit – Environmental Report ¹² Further understanding will be provided by the proposed macroinvertebrate baseline monitoring programme.	No in stream monitoring is advised during environmental drought to prevent further harm to the invertebrate community through kick/ sweep sampling. Walkover of key reaches known to be susceptible to lower flows will provide information on impact to key habitat. Walkovers detailed in Table 3 and Figure 1 . Details to be filled out in an appropriate 'River Condition Assessment form'.	No in stream monitoring is advised during drought permit implementation to prevent further harm to the invertebrate community through kick/ sweep sampling. Repeat onset walkovers. Walkovers should be repeated regularly. Surveys should be undertaken on the first, second and fifth day of implementation as a starting point, followed by an adaptive approach. whereby the frequency and scope of the walkovers following the first week of implementation is dictated by the watercourse conditions, monitored flow gauge data and recent weather conditions. This will be confirmed with the EA.	Mitigating the impact of the drought permit on macroinvertebrate species through direct intervention is not feasible or necessary.	Understanding of the population dynamics post drought to be developed through the macroinvertebrate baseline monitoring programme. Post drought baseline macroinvertebrate monitoring will be undertaken as part of the baseline monitoring programme to provide insight into community changes post implementation. Reach 1: Water intake Swinford EA ID: 35847 SP4454008704 Reach 2 (Thames Tributaries): Wytham Mill SP4767309466 Botley Stream SP4944006600 Bulstake SP4982606416 Osney SP4989606388 Reach 3: Days Lock (EA ID: 35891) SU5687393535
Water Quality Sampling	N/A	Baseline water quality sampling to be undertaken in spring, summer and autumn line with macroinvertebrate sites using an <i>in-situ</i> multi-meter probe to measure: pH, temperature, electrical conductivity and	At each walkover site (Table 3), <i>in-situ</i> water quality data is to be obtained: Dissolved Oxygen % Temperature C, Specific Conductivity, pH. The location of the water quality monitoring will be recorded for repeat visits. Water quality sampling	At each walkover site (Table 3), <i>in-situ</i> water quality data is to be obtained following the same adaptive frequency as the walkovers. Dissolved Oxygen % Temperature C, Specific Conductivity, pH. The location of the water quality monitoring will be recorded for repeat visits. Water quality	N/A	Baseline water quality sampling to be undertaken in spring, summer and autumn line with macroinvertebrate sites using an <i>in-situ</i> multi-meter probe to measure: pH, temperature, electrical conductivity and dissolved oxygen (% saturation and mg/l).: Reach 1: Thames at Water Intake, Farmoor SP4397906495

¹¹ GB non-native species secretariat - Biosecurity in the field. Accessed 2nd March 2022. <http://www.nonnativespecies.org/index.cfm?pageid=174>.

¹² Scott Wilson (2006) Farmoor Drought Permit - Environmental Report .

Survey Item	Potential Impact identified in EAR	Baseline / Pre-drought (not to be considered during implementation)	On-set of environmental drought (frequency: on one occasion, prior to drought permit implementation)	During Drought Permit Implementation Period		Post Drought Permit
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions	Monitoring and post-drought mitigation (where applicable)
		dissolved oxygen (% saturation and mg/l).: Reach 1: Thames at Water Intake, Farmoor SP4397906495 Reach 2 (Thames Distributaries): Wytham Mill SP4767309466 Botley Stream SP4944006600 Bulstake SP4982606416 Osney SP4989606388 North Hinskey SP4945605594 South Hinksey SP5118404455 Reach 3: Thames at Sutton Bridge, Culham SU5091094811 <i>In-situ</i> monitoring will also be undertaken at the walkover locations in River Thames (Reach 1 and 3) and along the distributaries (Reach 2). Walkover locations are detailed in Table 3 .	will be undertaken in line with Environment Agency Operational Instructions ¹³¹⁴ . Algal monitoring is to be undertaken at pre-established monitoring sites (as completed in the 2022 pre-implementation drought monitoring): Farmoor Reservoir north Farmoor Reservoir south Thames at Water Intake, Farmoor SP4397906495 Thames at Sutton Bridge, Culham SU5091094811	sampling will be undertaken in line with Environment Agency Operational Instructions ¹⁵¹⁶ . Monthly algal monitoring is to be undertaken at pre-established monitoring sites (as completed in the 2022 pre-implementation drought monitoring): Farmoor Reservoir north Farmoor Reservoir south Thames at Water Intake, Farmoor SP4397906495 Thames at Sutton Bridge, Culham SU5091094811		Reach 2 (Thames Distributaries): Wytham Mill SP4767309466 Botley Stream SP4944006600 Bulstake SP4982606416 Osney SP4989606388 North Hinskey SP4945605594 South Hinksey SP5118404455 Reach 3: Thames at Sutton Bridge, Culham SU5091094811 <i>In-situ</i> monitoring will also be undertaken at the walkover locations in River Thames (Reach 1 and 3) and along the distributaries (Reach 2). Walkover locations are detailed in Table 3 .
Water Quality Monitoring - Cassington STW			N/A	Measure and record the level of dissolved oxygen (DO) and if this drops below 6.9mg/l or 80% saturation, the following water quality monitoring will be undertaken: River Thames at Cassington Sewage Treatment Works - Upstream: In the reach between SP 458400 9808 and SP 46158 09918 - Downstream: In the reach between SP 52804 02415 and SP 52957 01856 Frequency of monitoring to be conducted alongside walkovers.	N/A	N/A
Storm Tank Monitoring	N/A	N/A	N/A	Throughout implementation period, measure the level monitor installed on the first storm tank at SP4614712170. Storm tank monitoring by means of the Storm Tank Level Monitor and the Event Duration Monitor relating to STW Storm Tank to prevent spilling from the storm tank at Cassington STW to the River Thames. For Cassington STW from the commencement of use of this permit and for the entire period of use of this permit. Triggers for mitigation at Cassington STW:	Abstraction under the drought permit to cease immediately and return to licensed conditions.	N/A

¹³ Environment Agency (2018). Taking a sample for chemical and microbiological analysis. Operational Instruction 019_09. Issued 17/02/2018.

¹⁴ Environment Agency (2018). Sampling bathing water for chemical and microbial parameters ES-005. Issued 23/01/2009.

¹⁵ Environment Agency (2018). Taking a sample for chemical and microbiological analysis. Operational Instruction 019_09. Issued 17/02/2018.

¹⁶ Environment Agency (2018). Sampling bathing water for chemical and microbial parameters ES-005. Issued 23/01/2009.

Survey Item	Potential Impact identified in EAR	Baseline / Pre-drought (not to be considered during implementation)	On-set of environmental drought (frequency: on one occasion, prior to drought permit implementation)	During Drought Permit Implementation Period		Post Drought Permit
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions	Monitoring and post-drought mitigation (where applicable)
				- At any time when the level monitor installed on the first storm tank shows the tank is 60% full. - At any time when the Event Duration Monitor installed between the storm tank and environment records any spilling from the storm tank to the River Thames.		
Spot flow gauging	N/A	Spot flow gauging to be undertaken in the distributaries at the previously established suite of sites in spring and autumn: Wytham Mill SP4767309466 Bulstake Stream SP4982606416 North Hinksey SP4945605594 Osney Stream SP4937006750 Castle Mill SP5014607254 Wolvercote SP4864309428 Flow gauging in the River Thames will be provided by EA gauges.	Spot flow gauging to be undertaken in the distributaries at the previously established suite of sites: Wytham Mill SP4767309466 Bulstake Stream SP4982606416 North Hinksey SP4945605594 Osney Stream SP4937006750 Castle Mill SP5014607254 Wolvercote SP4864309428 Flow gauging in the River Thames will be provided by EA gauges.	Spot flow gauging to be undertaken in the distributaries at the previously established suite of sites during walkovers: Wytham Mill SP4767309466 Bulstake Stream SP4982606416 North Hinksey SP4945605594 Osney Stream SP4937006750 Castle Mill SP5014607254 Wolvercote SP4598909673 Frequency of spot flow gauging will be in line with the walkovers - Surveys should be undertaken on the first, second and fifth day of implementation as a starting point, followed by an adaptive approach, whereby the frequency and scope of the walkovers following the first week of implementation is dictated by the watercourse conditions, monitored flow gauge data and recent weather conditions. This will be confirmed with the EA. Flow gauging in the River Thames will be provided by EA gauges.	The water company shall gather the results of flow monitoring to direct the appropriate variable rate of the pump at Seacourt Stream. The water company shall discuss and agree with the Agency any proposed changes to the pumping rate based on using the visual assessment of channel condition from walkovers and contemporary flow data gathered.	Spot flow gauging to be undertaken in the distributaries at the previously established suite of sites in spring and autumn: Wytham Mill SP4767309466 Bulstake Stream SP4982606416 North Hinksey SP4945605594 Osney Stream SP4937006750 Castle Mill SP5014607254 Wolvercote SP4864309428 Flow gauging in the River Thames will be provided by EA gauges.
Bathing Water Quality	N/A	N/A	N/A	Water quality monitoring using laboratory analysis of a water sample for E.coli and Intestinal Enterococci at: Wolvercote Mill Stream, Wallingford Beach and Pangbourne Meadow bathing water sites. Wolvercote Mill Stream at SP4866709359 Wallingford Beach at SU6102489389 Pangbourne Meadow at SU6370176828 Frequency of bathing water quality monitoring will be within the first three days of implementation and then repeated on a monthly basis (unless required more frequently as specified in writing by the EA).	N/A	N/A

Table C6-2 below provides a summary of the proposed monitoring, and monitoring frequency, highlighted in the table above.

Table C6-2 Farmoor drought permit: Monitoring Plan Summary

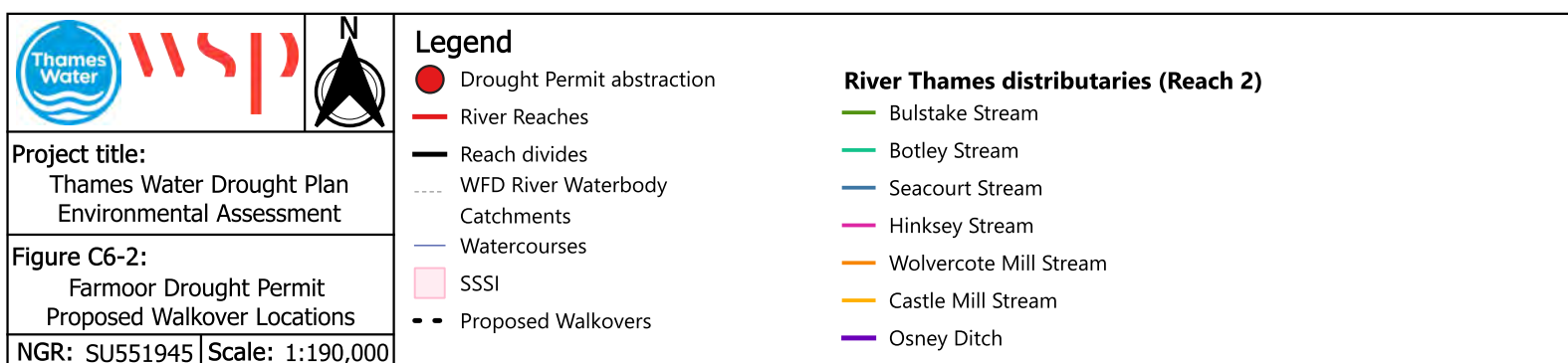
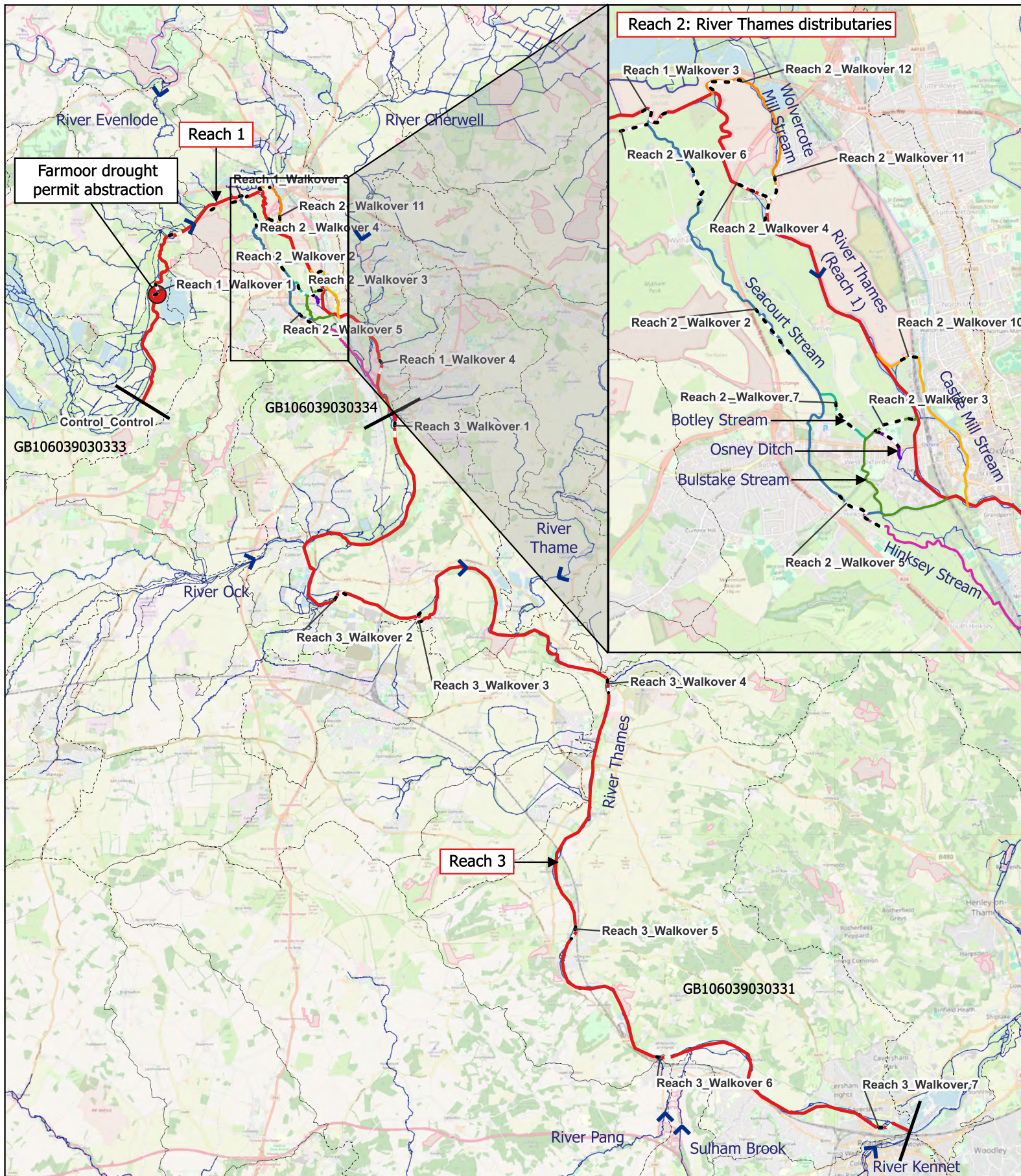
Proposed monitoring plan for Farmoor drought permit				Sampling type		Inclusion by drought stage (y/n)						Footnote references. For example, for frequency by drought stage.
						Baseline	Pre-permit application	During application	During implementing	Post-permit		
Item no.		Category / receptor										
1		Hydrology										
1.1		River flow (EA gauging stations)		Continuous - EA		Y	Y	Y	Y	Y		See *1
1.2		River flow (spot flow gauging)		In-situ		Y		Y	Y	Y		See *1
2		Physico-chemical										
2.1		Water quality		In-situ		Y		Y	Y			See *2
3		Ecological										
3.1		Macro-invertebrates		Survey		Y				Y		See *3
3.2		Macrophytes		Survey		Y		Y		Y		See *4
4		Targeted walkovers and /or drone										
4.1		River habitat and geomorphology (River Conditions Survey Form)		Walkover / drone		Y						See *5
4.2		River habitat, specific for fish and macrophyte drought stress (River Conditions Survey Form)						Y	Y	Y		See *6
Footnotes												
1		- Environment Agency monitoring stations can provide flow gauging along the River Thames. - Spot flow gauging proposed at sites within the distributaries during implementation will be on an adaptive basis. This approach assumes surveys to be undertaken on the first, second and fifth day of implementation as a starting point, followed by the adaptive approach.										
2		- Baseline sampling / survey requirement is seasonal (spring, summer autumn) every other year for six years, then once every three years. - In-situ WQ measurement of temperature, dissolved oxygen (as % saturation and concentration in mg/l), conductivity and pH taken using calibrated water quality meters at all sites. Laboratory samples for Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), ammoniacal nitrogen, alkalinity, orthophosphate, pH, turbidity and suspended solids. Samples to be obtained alongside macroinvertebrates. - During permit application and implementation <i>in-situ</i> monitoring is proposed at walkover sites and algal monitoring at four pre-determined sites on the same adaptive frequency as flow gauging and walkovers. - During permit implementation, bathing water quality monitoring using laboratory analysis of a water sample for E.coli and Intestinal Enterococci at Wolvercote Mill Stream bathing water.										
3		- Baseline sampling / survey requirement is seasonal (spring, summer and autumn), every year for three years, then once every three years. - If environmental drought occurs during June to September period carry out LEAFACS2 macrophyte survey at the baseline monitoring sites to understand community prior to implementation of the permit. - No sampling during drought permit implementation - Post-permit monitoring will be undertaken through the baseline programme										
4		- Baseline sampling / survey requirement is annual (summer) for three years, then once every three years. - If environmental drought occurs during June to September period, carry out LEAFACS2 macrophyte survey at the baseline monitoring sites to understand community prior to implementation of the permit. <i>[To be agreed with the EA depending on time of year and current conditions, if LEAFACS2 not deemed necessary, macrophytes will be recorded as part of walkover surveys]</i>. - No in-stream sampling during drought permit implementation. - Post-permit monitoring will be undertaken through the baseline programme										
5		- Baseline river habitat surveys undertaken using the previously agreed river conditions assessment form. - Baseline survey requirement is once only.										
6		River habitat surveys undertaken using the previously agreed river conditions assessment form, refined as needed and completed once pre-application/during application. During implementation these will be completed on an adaptive basis. This approach assumes surveys to be undertaken on the first, second and fifth day of implementation as a starting point, followed by the adaptive approach.										

Table C6-3 below provides a summary of the proposed monitoring walkover locations.

Table C6-3 Farmoor drought permit: Proposed Walkover Sites Summary

Survey Type	Reach	Site ID	NGR
Walkover surveys following the River Condition Assessment Form – Baseline, on-set and during drought monitoring	Control site	Control	US SP4012301449, DS SP4057301337
	Reach 1	Walkover 1	US SP4378306377, DS SP4384106786
		Walkover 2	US SP4435808678, DS SP4480508791
		Walkover 3	US SP4707810200, DS SP4739410213
		Walkover 4	US SP5253703841, DS SP5253003378
	Reach 2 (Distributaries)	Walkover 1	US SP4766909520, DS SP4774309052
		Walkover 2	US SP4842107858, DS SP4883207320
		Walkover 3	US SP5027206555, DS SP4983406415
		Walkover 4	US SP4852908905, DS SP4819709350
		Walkover 5	US SP4941505646, DS SP4992705281
		Walkover 6	US SP4681709967, DS SP4713310044
		Walkover 7	US SP4937006750, DS SP4958006448
		Walkover 8	US SP4598909673, DS SP4625009825
		Walkover 9	US SP5012606056, DS SP5023306216
		Walkover 10	US SP5014607254, DS SP5034307286
		Walkover 11	US SP4864809426, DS SP4861409164
		Walkover 12	US SP4791710454, DS SP4826810547
	Reach 3	Walkover 1	US SP5311901421, DS SP5311100922
		Walkover 2	US SU5078094557, DS SU5121494760
		Walkover 3	US SU5402093963, DS SU5421593743
		Walkover 4	US SU6136391462, DS SU6140490954
		Walkover 5	US SU6012681888, DS SU5995981410
		Walkover 6	US SU6326476836, DS SU6375076828
		Walkover 7	US SU7188174106, DS SU7233674180

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APPENDIX D – HABITATS REGULATIONS ASSESSMENT

D1 HABITAT REGULATION ASSESSMENT

The Environment Agency's DPG2025 specifies that a water company must ensure that its DP meets the requirements of The Conservation of Habitats and Species Regulations 2017. The DPG2025 refers to guidance relating to Habitats Regulations Assessment (HRA) that can be used which includes the UK Water Industry Research (UKWIR) report 'Strategic Environmental Assessment and Habitat Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans'¹. The UKWIR report recommends that all DPs should be subject to the first stage of HRA, i.e. screening for Likely Significant Effects (LSEs).

Under Regulations 63 and 105 of the Habitats Regulations 2017, any plan or project which is likely to have a significant effect on a Habitats site (SAC, SPA or Ramsar site), either alone or in-combination with other plans or projects, and is not directly connected with, or necessary for the management of the site, must be subject to a HRA to determine the implications for the site in view of its conservation objectives.

A HRA has been undertaken in accordance with currently available guidance^{2,3,4,5} and has been based on a precautionary approach as required under the Habitats Regulations. It has followed the staged HRA approach, commencing with the Stage 1 screening. Where a significant effect is likely a Stage 2 Appropriate Assessment is undertaken of the drought option to determine whether this would adversely affect the integrity of the Habitats sites, either alone or in-combination with other plans and projects, taking into account available mitigation measures.

This section summarises the outcomes of the Stage 1 Screening, Stage 2 Appropriate Assessment and any in-combination effects resulting from implementing the proposed drought permit with other plans and projects, as identified in the HRA.

D1.1 STAGE 1 – SCREENING

This screening stage has identified whether the drought option has the potential to cause LSE on the integrity of a Habitat site(s). A summary of the conclusions of the Stage 1 Screening is presented in **Table D0-1** below. At the time of writing the HRA a drought permit implementation period of October to April is assumed.

As there is no pathway for impacts from the proposed scheme to the qualifying features, no LSE's have been identified, and there is no potential for in-combination impacts with any other plan or project. Therefore, a Stage 2 Appropriate Assessment is not required.

¹ UKWIR (2021) Environmental Assessments for Water Resources Planning (21/WR/02/15).

² Court of Justice for the European Union's ruling on People Over Wind and Sweetman ('Sweetman II') vs Coillte Teoranta, Case C-323/17.

³ UK Government (2019). Guidance on the use of Habitats Regulations Assessment.

⁴ UK Government (2019). Conservation of Habitats and Species Regulations (Amendment) (EU Exit).

⁵ Natural England (2020). Guidance on how to use Natural England's Conservation Advice Packages in Environmental Assessments.

Table D0-1 Screening of Farmoor Drought Permit LSE on Habitats sites

Habitats site ⁶	Qualifying Feature(s)	Potential for effects on qualifying features?	LSE on Habitats site(s) alone?	Effect in-combination with existing consents?	Effect in-combination with other drought options?
Oxford Meadows SAC (5.3km)	H6510 Lowland hay meadows (<i>A. pratensis</i> , <i>S. officinalis</i>) S1614 Creeping marshwort, <i>Apium repens</i>	<u>Construction</u> Minor construction works may be required to bring the option online as a drought source. Works will include temporary electric submersible pumps. There will be no loss of qualifying habitat due to the scheme as the construction footprint will not impinge on any of the qualifying habitat. Transport of materials and equipment during construction on site will require minimal general construction traffic. Transport will utilise the existing road network. The temporary increase in vehicle numbers required for the construction of the scheme is considered to be negligible. Therefore, no LSEs from the construction phase are anticipated on the qualifying features of Oxford Meadows SAC. <u>Operation</u> Both lowland hay meadows and creeping marshwort <i>Apium repens</i> are the water dependent qualifying features of Oxford Meadows SAC. A hydrological assessment for the scheme has identified that the River Thames and its distributaries will be subject to reductions in velocity and water level, due to lower flows downstream from Farmoor reservoir. The lowland meadows are primarily linked to groundwater levels but are also linked to the River Thames via winter flooding. The proposed scheme will not impact groundwater levels or winter flood flows. Therefore, no LSEs are anticipated from the operation of the Farmoor drought option on the Oxford Meadows SAC.	No	No	No
Little Wittenham SAC (>10km however, adjacent to potentially impacted reach of River Thames)	S1166 Great crested newt, <i>Triturus cristatus</i>	<u>Construction</u> No impact. <u>Operation</u> Great crested newts are the water dependent qualifying feature of Little Wittenham SAC. The site is currently in favourable condition and hydrological changes have not been identified as a threat or pressure that could prevent Little Wittenham SAC achieving favourable conservation status. The 2025 Farmoor EAR identified that the Little Wittenham SAC is not fed by the River Thames. All the GCN ponds are perched above the Thames floodplain and fed by small spring-fed streams. Therefore, the drought permit is not considered to impact on the permanence of the ponds within the SAC. No LSEs are anticipated from the operation of the Farmoor drought option on the Little Wittenham SAC.	No	No	No
Hartslock Wood SAC (>10km however, adjacent to potentially impacted reach of River Thames)	H6211 Dry grasslands and scrubland facies: important orchid sites H91J0 <i>Taxus baccata</i> woods of the British Isles	<u>Construction</u> No impact. <u>Operation</u> Qualifying features of the SAC are not water dependent and therefore, no LSEs have been identified from the Farmoor drought option during operation.	No	No	No
Cothill Fen SAC (6km)	H7230 Alkaline fens H91E0 Alluvial woods with <i>A. glutinosa</i> , <i>F. excelsior</i>	<u>Construction</u> No impact. <u>Operation</u> The SAC is not in hydrological connectivity with the River Thames. Therefore, no LSEs are anticipated from the operation of the Farmoor drought option on the Cothill Fen SAC alone.	No	No	No

⁶ The distances given are to the nearest element of each scheme.
WSP | Issue 5 | 14/09/2026

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