River Thames Scheme

Supplementary Consultation
3 September to 7 October 2024

Ferris Meadow Lake Options Appraisal Report

Appendix D - Environmental Appraisal

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1. Introduction

This appendix sets out the environmental appraisal of the options being considered for the scheme alignment of the RTS in and around Ferris Meadow Lake.

2. Appraisal Methodology

The Environmental Appraisal is undertaken at a level proportionate to decision-making. It uses both readily accessible and existing baseline data from the ongoing RTS EIA process.

The assessment is qualitative, but where possible effects are quantified.

A Red Amber Green (RAG) scoring methodology has been used to aid project decision-making, this is based on the data collection referred to above, the current level of design information available on the options and professional judgement. Options are scored relative to the baseline environment.

It is assumed that mitigation is applied, similar to the Preliminary Environmental Information Report (PEIR), which presents an early stage of the Environmental Impact Assessment (EIA). Full details of this are not provided in this report. Any additional option-specific mitigation is identified.

Table 1: RAG Status applied to each topic

Status	Description
High	Option has potential for high environmental impact and difficulty in achieving acceptable mitigation.
Medium	Option has potential for a medium environmental impact and requires bespoke mitigation.
Low	Option has potential for a minor or positive environmental impact and mitigation is likely to be achieved through standard practice.

3. Environmental Appraisal

3.1 Introduction

For each environmental topic, the environmental baseline is presented, followed by a summary of the potential effects identified, any mitigation that may be required, areas of additional work required and a summary of the RAG status for each option.

3.2 Air Quality

Baseline

Ferris Meadow Lake and the proposed options fall within the Spelthorne Air Quality Management Area (AQMA). There are isolated hotspots in the vicinity of road junctions within this AQMA where the annual mean nitrogen dioxide (NO_2) Air Quality Objective (AQO) is within 10% of the objective. The closest readings to Ferris Meadow Lake within 10% of the AQO are approximately 2km to the south and north east. The closest local authority monitoring locations to Ferris Meadow Lake have monitored annual mean NO_2 concentrations below the AQO for all available years of monitoring data. The area is therefore expected to comply with the AQO.

Residential properties off Desborough Close and Chertsey Road back on to the left bank of the Chap, and commercial and industrial businesses are located along Ferry Lane and Towpath. The site also falls within the Ferris Meadows Site of Nature Conservation Interest (SNCI), and within 200m of Desborough Island SNCI, the adjacent River Thames is a designated Local Wildlife Site (LWS).

Assessment of potential effects

All options are likely to result in broadly similar effects on the Spelthorne AQMA.

Options 2 to 5, 7 and 8 are likely to generate higher volumes of excavated material and waste leading to a higher number of HGV movements on the local road network than other options. Options 2 to 5 and 8 also bring construction works to within 50m of residential, commercial and industrial properties, resulting in a higher risk of air quality effects on these receptors.

As the works are within the Ferris Meadows SNCI and adjacent to the River Thames LWS, construction activities have the potential to result in air quality effects on sensitive ecological receptors. Further study would be required to confirm this potential however, it is not a differentiating factor between options.

Mitigation

Tertiary mitigation measures are likely to mitigate effects on air quality. This would likely include an Air Quality Management Plan, Materials and Waste, Handling, Treatment and Placement Strategy, Construction Traffic Management Plan and standard construction practices such as dust barriers and suppression during earthworks.

Table 2: Air quality appraisal

Option	RAG Status	Justification
Option 1	Medium	Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.
Option 2	Medium	This option involves construction within 50m of residential properties off Desborough Close and Chertsey Road, and higher volumes of HGV movements on the local road network than Options 1, 6a and 6b. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.
Option 3	Medium	This option involves construction within 50m of commercial and industrial businesses along Ferry Lane and higher volumes of HGV movements on the local road network than Options 1, 6a and 6b. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.
Option 4	Medium	This option involves construction within 50m of residential properties off Desborough Close and Chertsey Road, and within 50m of commercial and industrial businesses along Ferry Lane. It would also result in higher volumes of HGV movements on the local road network than Options 1, 6a and 6b. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.

Option	RAG Status	Justification
Option 5	Medium	This option involves construction within 100m of residential properties off Desborough Close and Chertsey Road, and higher volumes of HGV movements on the local road network than Options 1, 6a and 6b. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.
Option 6a	Medium	This option involves construction works within 50m of residential properties however, there are fewer HGV movements on the local road network than Options 2 to 5. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.
Option 6b	Medium	This option involves construction works within 50m of residential properties however, there are fewer HGV movements on the local road network than Options 2 to 5. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.
Option 7	Medium	This option involves construction within 150m of residential properties located along Ferry Lane and may result in higher HGV movements on the local road network than Options 1, 6a and 6b. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.

Option	RAG Status	Justification
Option 8	Medium	This option involves construction within 50m of residential properties located along Ferry Lane and may result in higher HGV movements on the local road network than Options 1, 6a and 6b. Air quality effects are likely to be mitigated by tertiary mitigation measures. Possible effects on sensitive ecological sites, however, the risk is generally the same across all options.

3.3 Biodiversity

Baseline

Designated sites

Ferris Meadow Lake is not within 500m of any statutory designated sites; however, it is a supporting waterbody for the South West London Waterbodies Special Protection Area (SPA) and Ramsar Site designated for wintering gadwall *Mareca* (formerly *Anas*) *strepera* and shoveler *Anas clypeata*. The site has been surveyed for wintering gadwall and shoveler since winter 2012/3 for the RTS. Ferris Meadow Lake has a 5-year peak mean (based on data from winter 2012/3 to winter 2022/23) of 15.2 birds representing 1.8% of the SPA population and 3.8% of the Ramsar population. The gadwall 5-year peak mean (based on data from winter 2012/3 to winter 2022/23) is 6.8 birds representing 1.0% of the SPA population and 1.4% of the Ramsar population. The results of these surveys conclude that the lake is functionally linked land for the SPA and Ramsar Site.

The lake is within and near to several non-statutory designated sites. The lake is designated as Ferris Meadows Site of Nature Conservation Interest (SNCI) (Annex 1, Designations ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00133) and within approximately 60m of the River Thames – Elmbridge SNCI to the east and south. Desborough Island SNCI is approximately 100m to the east of Ferris Meadow Lake. The River Thames (and Towpath) Spelthorne Local Wildlife Site (LWS) is approximately 30m to the east and south of Ferris Meadow Lake.

Ferris Meadows SNCI is designated for grassland surrounding the lake (including remnants of Thames alluvial grassland), wetland communities fringing the River Thames, wintering wildfowl and summer breeding birds.

Desborough Island SNCI is designated for neutral species-rich grassland. Bulbous meadow-grass *Poa bulbosa*, which is nationally scarce, and Alexanders *Smyrnium olusatrum*, which is scarce in Surrey, were recorded in 1996 and the site was also recommended for its dragonfly interest in 1996.

The River Thames – Elmbridge SNCI is designated for the river margin habitat and the birds it supports.

The River Thames (and Towpath) Spelthorne LWS is designated for the habitats present, including intertidal vegetation, and the wildfowl and wading birds it supports.

Habitats

The habitats recorded during the 2022 UKHab surveys for the Preliminary Ecological Appraisal (PEA) include broadleaved woodland, mixed scrub, bramble scrub, neutral grassland, modified grassland, ponds and lake (WBi, 2023a) as shown in Annex 1, Biodiversity (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00137). Further baseline information for Ferris Meadow Lake and three lakes to the west are provided in Section 3.14.

Biodiversity net gain (BNG) is the subject of ongoing work at a scheme wide level, and as such an assessment of BNG achievement has not been considered specifically for each option.

Species

Badger: Evidence of badger use has been recorded to the east and south of Ferris Meadow Lake, within the footprint of all options (WBi, 2023c).

Otter: The lake is suitable for use by otter *Lutra* and otter presence has been recorded on the banks of the lake and River Thames in the form of potential holts and spraints (WBi, 2022). Camera traps were deployed at various locations surrounding Ferris Meadow Lake and the Chap in 2022 and 2023. Otter footage was recorded at one location to the south-east of Ferris Meadow Lake in 2022. Otter surveys are ongoing in 2024.

Water vole: The lake and surrounding waterbodies are suitable for use by water vole *Arvicola amphibius*, however, no evidence of water vole has been recorded within the RTS project area.

Amphibians:

- No great crested newts (GCN) *Triturus cristatus* have been recorded within the project area (WBi, 2023b).
- In 2023, Ferry Lane West 1 was surveyed for GCN eDNA, the results of which were negative. Ferry Lane West 2 was considered ‘poor’ for GCN using the habitat suitability index (HSI) so was not subject to eDNA survey. Ferry Lane West 3 was inaccessible for GCN survey in 2023 but was negative for eDNA in 2021.

The habitat within the footprint of all of the options is suitable for use by amphibians.

Bats:

- Bat roosts have been identified within trees on the south and east of Ferris Meadow Lake in 2017 and 2021, including within the footprint of the options (BL Ecology, 2019; 2022). The roosts identified are soprano pipistrelle *Pipistrellus pygmaeus* day, transitional or night roosts.

- The area to the south of Ferris Meadow Lake was classified as an optimal foraging area (OFA) for bats during 2017 bat scoping surveys (BL Ecology, 2019). Following further survey, it has been given a conservation value of 'regional' due to 'larger numbers of common bats and some recordings of locally rarer bats'.

The footprint of Options 2-8 has not been surveyed for bats as surveys followed the footprint of Option 1 only. Notable gaps in tree suitability data cover the area surrounding the Chap and localised areas to the west and south-west of Ferris Meadow Lake where there are trees present likely to support roosting bats.

Birds: Species including gadwall, shoveler, herring gull *Larus argentatus*, wigeon *Mareca* sp. and redwing *Turdus iliacus* have been recorded using Ferris Meadow Lake in winter 2022-2023 (APEM, 2023a). Breeding bird surveys recorded dunnock *Prunella modularis*, greenfinch *Chloris*, kingfisher *Alcedo atthis*, mistle thrush *Turdus viscivorus*, song thrush *Turdus philomelos*, starling *Sturnus vulgaris* and swift *Apus* in area surrounding Ferris Meadow Lake, however no breeding activity was recorded (Apem, 2023b).

Fish and eels:

- Surveys in 2016 recorded a number of species in Ferris Meadow Lake including: bullhead *Cottus gobio*, carp (anecdotal) *Cyprinus carpio*, European eel *Anguilla* and pike *Esox lucius*.
- The 2016 surveys also included the three waterbodies to the west of Ferris Meadow Lake. Species present in Ferry Lane West 1 (Annex 1 Water Environment (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00141)) include bullhead, carp (anecdotal), European eel and pike. Species present in Ferry Lane West 2 include perch and tench. Species present in Ferry Lane West 3 include carp, European eel and pike.
- In 2022 eDNA samples were undertaken of the River Thames and Ferry Lane West 1, 2 and 3 to identify which fish invasive non-native species (INNS) were present. No INNS were identified within these waterbodies.
- Fish species recorded within the River Thames (from Bell Weir Lock to the downstream of Teddington Weir) include Atlantic salmon *Salmo salar*, bream *Abramis brama*, brown/sea trout *Salmo trutta*, bullhead, carp, European eel, perch, pike, roach *Rutilus* and zander *Sander lucioperca*, an INNS.
- No fish data is available for the Chap, however it is a backwater section of the River Thames so will support a similar range of species as are known on the River Thames. This watercourse has suitability to be used by common species for shelter, and backwaters are a rarely occurring habitat on the River Thames.

Invertebrates (terrestrial): The PEA noted habitat suitable for invertebrates such as stag beetle *Lucanus cervus* in deadwood in the woodland to the north of the lake. Stag beetle habitat suitability surveys were undertaken within the margins of the lake,

including the trees and scrub present. These were found to be unsuitable for use (WBi, 2023d).

Invertebrates (aquatic): Surveys of the lake in 2022 recorded the nationally scarce water snail *Gyraulis laevis*. Also recorded were the INNS New Zealand mud snail *Potamopyrgus antipodarum;* zebra mussel *Dreissena polymorpha* and the demon shrimp *Dikerogammarus haemobaphes* (APEM, 2023b).

Reptiles: The lake and surrounding habitat is suitable for use by reptiles, and grass snake *Natrix helvetica* presence has been recorded in the field west of the lake and to the south-east on Desborough Island (WBi, 2023e).

Assessment of potential effects

Option 1: Flood relief channel via the lake (current design)

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect. Water quality deterioration in Ferris Meadows Lake is likely due to the Spelthorne Channel entering the lake. Nitrogen and phosphorous levels are expected to increase in dry periods but remain similar in wet periods. However, these effects will be mitigated against by the continuous augmented flow, reducing the residence times in the lake and reducing the risk of algal blooms and eutrophication. Refer to Appendix F for further details. Therefore, this impact is considered unlikely to cause a noticeable effect on the distribution of macrophytes, invertebrate, fish communities and marginal habitats of the lake and SPA birds.

The option would result in the removal of known bat roosts and bat foraging and commuting habitat. The provision of new roost sites and replanting will be required to mitigate impacts on bats but residually there will be a permanent loss of the bat OFA located to the south of Ferris Meadow Lake.

Fish pathogens and INNS from upstream sources on the Spelthorne Channel, which were not previously connected, will be able to enter the lake. Surveys are ongoing to understand where pathogens are present, once known mitigation measures to managed fish pathogens will be identified. An Outline INNS Management will be in place with measures to ensure the spread of INNS is controlled.

The reduction in size of Ferry Lane West 3 would permanently remove suitable amphibian and reptile habitat. A new pond or enhancement of the remaining sections of Ferry Lane West 3 will be required to mitigate these effects.

In addition, Option 1 increases connectivity for fish to Ferris Meadow Lake (already a floodplain feature) via the flow control structure to the south-east. Fish may enter Ferris Meadow Lake during flood flows, then they may become resident in the lake and no longer move upstream on the River Thames. This situation can already occur as the lake is within the floodplain of the River Thames but the frequency to which fish can enter the lake may increase. The impact can be mitigated through the fish pass proposed on this flow control structure and others within the Spelthorne channel so that fish can return to the River Thames.

Option 2: Flood relief channel via 'the Chap'

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect.

This option would not result in changes in the water quality/flows/residence time of Ferris Meadow Lake and there is no additional risk of introduction of INNS and pathogens to Ferris Meadows SNCI.

The Chap would receive the augmented flow resulting in mixing of river and lake water into the Chap from the upstream lakes on the Spelthorne channel, however water quality effects are considered to be limited (refer to Section 3.14). The flow and sediment transport processes in the Chap would alter and the residence time of the Chap would be reduced due to the introduction of the augmented flow. During flood flows when the Chap is being used as a flood relief channel it would no longer be considered a backwater habitat. Widening of the Chap will also result in the loss of riparian features within the Chap. Mitigation for the loss of the backwater will be required elsewhere on the River Thames, which will be difficult to achieve.

Potential effects on fish and eels in the Chap also include disturbance from construction as well as the introduction of INNS and fish pathogens into the Chap. Construction effects can be mitigated through restricting timing of in-channel works to be outside sensitive periods. An Outline INNS Management will be in place with measures to ensure the spread of INNS is controlled. Surveys are ongoing to understand where pathogens are present, and once known mitigation measures to managed fish pathogens will be identified.

Widening of the Chap would result in the loss of broadleaved trees. These have not been assessed for bat roost suitability, but it is likely that suitable trees are present. The provision of new roost sites and replanting will be required to mitigate impacts on bats.

There is the potential for otter habitats such as holts to be present within the Chap however, to date these have not been confirmed. Mitigation in the form of replacement holts will be required if otters are found to be present in the future.

Ferry Lane West 2 will be reduced in size, removing suitable amphibian and reptile habitat. A new pond or enhancement of existing ponds will be required to mitigate this effect.

Option 3: Flood relief channel west of the lake

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect.

This option would not result in changes in the water quality/flows/residence time of Ferris Meadow Lake and there is no risk of introduction of INNS and pathogens to Ferris Meadows SNCI.

This option increases the risk of introduction of INNS and pathogens from upstream lakes on the Spelthorne Channel entering the River Thames. An Outline INNS Management Plan will be in prepared with measures to ensure the spread of INNS is controlled.

The reduction in the size of Ferry Lane West 3 will affect amphibians and reptiles. A new pond or enhancement of the remaining sections of Ferry Lane West will be required to mitigate these effects.

The construction of a new flood channel to the west of the lake would involve the greatest amount of permanent terrestrial habitat loss including woodland, hedgerow, scrub and grassland within and outside of the SNCI. Compensatory planting will be required to mitigate the effect but there will be a permanent loss of terrestrial habitat residually in the SNCI.

Potential effects on fish and eels within Ferris Meadow Lake include disturbance from construction due to the lake edge works. Construction effects can be mitigated through restricting timing of in-channel works to be outside sensitive periods.

This option would result in the removal of known bat roosts. The lake edge engineering for the flood channel for Option 3 would require the removal of trees to the south-west of the Ferris Meadow Lake, this includes surveyed trees with bat roost suitability. Not all areas which would require removal for Option 3 have been surveyed for bat roost suitability, however there are mature trees present which are likely to offer suitability. This tree removal and the creation of the flood channel may also affect known foraging and commuting routes to the south of the lake; however, the creation of the flood channel would also provide suitable foraging habitat. The provision of new roost sites and replanting will be required to mitigate impacts on bats.

Option 4: Flood relief via both the Chap and west of the lake

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect.

This option would not result in changes in the water quality/flows/residence time of Ferris Meadow Lake and there is no risk of introduction of INNS and pathogens to Ferris Meadows SNCI.

The option will result in the introduction of the augmented flow and flood flows into the Chap, resulting in mixing of rivers and lake water. This option is unlikely to change the water quality of the Creek as it will continue to receive water from the River Thames as per the baseline and it will remain a backwater to the Thames for the majority of the time as it will not receive all of the flood flows (Refer to Section 3.14 for further details).

Potential effects on fish and eels include disturbance from construction as well as the introduction of INNS and pathogens via the Spelthorne Channel into the Chap. Construction effects can be mitigated through restricting timing of in-channel works to be outside sensitive periods. An Outline INNS Management will be in place with measures to ensure the spread of INNS is controlled. Surveys are ongoing to

understand where pathogens are present, and once known mitigation measures to manage spread of fish pathogens will be identified.

Ferry Lane West 2 will be reduced in size, removing suitable amphibian and reptile habitat. A new pond or enhancement of existing ponds will be required to mitigate this effect.

Broadleaved woodland, hedgerow, scrub, neutral grassland and modified grassland would be lost in order to connect the split flow flood channel to the Chap and the River Thames. The flood channel avoids Ferris Meadow Lake, therefore losing more grassland habitat than other options but less than Option 3; the majority of the grassland loss still falls within Ferris Meadows SNCI. Compensatory planting will be required to mitigate the effect but there will be a permanent loss of terrestrial habitat residually in the SNCI.

Option 4 is unlikely to require as much lake edge engineering or widening of the Chap than Options 2 and 3, therefore losing less broadleaved trees, potential bat roosts and riparian features. Tree removal and the creation of the flood channel may also affect known bat roosts and foraging and commuting routes to the south of the lake. There are also areas which would be affected by Option 4 which have not been surveyed for bats but contain mature trees which are likely to offer suitability. The provision of new roost sites and replanting will be required to mitigate impacts on bats.

Option 5: Underground engineered solution

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect.

This option would not result in changes in the water quality/flows/residence time of Ferris Meadow Lake and there is no risk of introduction of INNS and pathogens to Ferris Meadows SNCI as there will be no hydraulic connection.

Option 5 would impact Ferry Lane West 1 and 2, the Chap and the River Thames. Potential effects on these receptors include disturbance from construction to species utilising these habitats and the spread of INNS and pathogens via the Spelthorne Channel. An Outline INNS Management will be in place with measures to ensure the spread of INNS is controlled. Surveys are ongoing to understand where pathogens are present, and once known mitigation measures to manage spread of fish pathogens will be identified.

Ferry Lane West 1 and 2 may be reduced in size, removing suitable amphibian and reptile habitat. The area of loss will be slight, therefore losses can be mitigated for via enhancement of the retained areas of the ponds.

Option 5 results in the smallest loss of terrestrial habitat of all the options due to the flood channel being an underground tunnel. This reduces the loss of woodland, modified grassland and vegetated gardens overall and within Ferris Meadows SNCI. However, the tunnel outfall and new maintenance access road are at Desborough

Island SNCI and would result in the loss of neutral grassland, scrub and broadleaved woodland.

Option 5 does not appear to directly affect any known bat roosts; it is the only option which does not include loss of woodland to the north-west of Ferris Meadow Lake.

However, removal of woodland on Desborough Island is required to accommodate the flood channel and allow it to join the River Thames. The trees present have not been subject to assessment for bat roost suitability but are likely to offer suitable habitat. The removal of a section of the woodland present would create a break in suitable foraging and commuting habitat, however the flood channel would also provide suitable foraging habitat.

Option 5 includes the introduction of the augmented flow reducing the residence time of water in the Chap. Although there is currently no water quality monitoring data or modelling outputs for the Creek, it is anticipated that conditions are similar to the River Thames at Desborough. This option is unlikely to change the water quality of the Creek, as it will receive the augmented flow. It will continue to receive water from the River Thames and remain a backwater to the Thames for the majority of the time (Refer to Appendix F).

The tunnel may require the installation of 'fish friendly' pumps to rescue fish or other measures, if screens are not appropriate in order to reduce risk to fish washed in from upstream. The severity of the effect of fish passing through the tunnel and pumps is currently unknown.

Option 6a: Flood relief channel via the Lake with augmented flow to the Chap

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect.

Water quality deterioration in Ferris Meadow Lake is likely due to flood flows entering the lake (see Section 3.14 for further details). Additional nutrients, microbes or pollutants, could enter Ferris Meadow Lake during dry times due to the potential mixing of flow between augmented flow and Ferris Meadow Lake. As the augmented flow will predominately flow through the Chap, circulation through Ferris Meadow Lake will be low, increasing the residence time of the lake, allowing sediments and nutrients to settle in the lake, between flood events. There is therefore a risk that the increased residence time and continual input of nutrients, will increase the risk of eutrophication in the lake. Monitoring and mitigation for if oxygen levels do decline in the lake will be required to reduce the severity of this effect to a level where there is no impact on the Ferris Meadow Lake's aquatic ecology.

Option 6a includes the introduction of the augmented flow to the Chap, mixing river and lake water from upstream waterbodies via the Spelthorne Channel The flow and sediment transport processes in the Chap would alter and the residence time of the Chap would be reduced due to the introduction of the augmented flow. However, since the Chap is already directly connected to the river Thames as a backwater, water quality impacts resulting from mixing with the augmented flow would be likely to be

minimal. The Chap will remain a backwater to the Thames for the majority of the time as it will not be subject to flood flows (Refer to Appendix F).

There is a likelihood of spread of fish pathogens and aquatic INNS into Ferris Meadow SNCI due to the connection of the flows to the lake. The lack of flow control structure to the north-west of Ferris Meadow Lake (as is present in Option 6b) would allow potential mixing of flow between the augmented flow and Ferris Meadow Lake. An Outline INNS Management will be in place with measures to ensure the spread of INNS is controlled. Surveys are ongoing to understand where pathogens are present, and once known mitigation measures to managed fish pathogens will be identified.

This option, when compared to the others being appraised (apart from Options 1 and 6b), is likely to result in comparatively less habitat loss. Ferry Lane West 1 and 2 may be reduced in size, losing pond habitat to create the flood channel. The area of loss will be slight; therefore, losses can be mitigated for via enhancement of the retained areas of the ponds. Broadleaved woodland, hedgerow, scrub, neutral grassland and modified grassland would also be lost in order to connect the flood channel to Ferris Meadow Lake at the north-west and from the lake to the River Thames at the south, this includes loss within Ferris Meadows SNCI.

A reduction in size of the Ferry Lane West 3 would affect amphibians and reptiles. A new pond or enhancement of the remaining sections of Ferry Lane West will be required to mitigate these effects.

Potential effects on fish and eels could result from disturbance from construction. Construction effects can be mitigated through restricting timing of in-channel works to be outside sensitive periods.

In addition, Option 6a increases connectivity for fish to Ferris Meadow Lake (a flood plain feature) via the flow control structure to the south-east. Fish may enter Ferris Meadow Lake during flood flows, then they may become resident in the lake and no longer move upstream on the River Thames. There is a fish pass proposed on this flow control structure so that fish can return to the River Thames, so this impact is considered minor.

Option 6b: Flood relief channel via the Lake with augmented flow to the Chap and additional control structure

The effects are similar to Option 6a, apart from water quality deterioration in Ferris Meadow Lake is unlikely during non-flood conditions as mixing of the augmented flow and the lake is prevented under Option 6b. However, flood flows would still enter the lake, so the risk of INNS/pathogen spread remains.

Option 7: Division of Ferris Meadow Lake

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect.

Option 7 includes similar habitat loss and impacts to Option 1, with the addition of direct loss of lake habitat due to the sheet piled separation structure.

The separation structure would divide the lake into two separate waterbodies, the western side of which would include the addition of augmented flow and flood flows from the RTS flood channel. This western waterbody would be subject to an altered flow regime and the mixing of river water with lake water is anticipated to increase nutrient conditions and other contaminants in the lake (refer to Appendix F). These effects will be mitigated for by the continuous augmented flow, reducing the residence times in the lake and reducing the risk of algal blooms and eutrophication.

The separation of the lake into two smaller waterbodies is likely to reduce the sites viability for SPA and Ramsar birds. This is because larger open waterbodies generally provide greater areas to forage, particularly for dabbling ducks such a gadwall and shoveler and therefore the splitting of the lake into two smaller waterbodies is likely to reduce the foraging areas available. Also the larger the waterbody is, the less likely it is that birds will be susceptible to disturbance due to greater potential for birds to see predators/potential threats earlier, the probability that the predator/potential threat will be at a greater distance in a larger waterbody and the ability to seek refuge within the waterbody by keeping the predator/potential threat at a greater distance rather than moving to an alternative/safer waterbody. Therefore, as the lake will become two smaller waterbodies, the birds using it will become more susceptible to disturbance. In summary, the division of the lakes into two sections is considered likely to result in a reduction in the lake's ability to be a functional habitat of the SPA and Ramsar site which may result in the option leading to the RTS having an adverse effect on the site integrity of the SPA. Evidence to show that there are no satisfactory alternatives to the option is likely to be required (which will be difficult to achieve given the other options being considered).

In addition, Option 7 increases connectivity for River Thames fish to the western section of Ferris Meadow Lake (a flood plain feature). Fish may enter the western waterbody during flood flows, then they may become resident in the lake and no longer move upstream on the River Thames. There is a fish pass proposed on this flow control structure and others within the Spelthorne channel so that fish can return to the River Thames.

Option 8: Permanent connection of Ferris Meadow Lake to the River Thames.

Construction activities within the wintering period will lead to disturbance to SPA and Ramsar birds present within Ferris Meadow Lake. Timing noisy works outside of the wintering period will mitigate for this effect.

Option 8 includes similar loss of habitat to Option 1, with the addition of greater loss of neutral grassland in the field north-west of Ferris Meadow Lake due to the creation of a level retention structure.

Option 8 allows free movement of water between the River Thames and Ferris Meadow Lake, as well as the movement of fish. Due to the open connection with the River Thames, the risk of water quality deterioration of Ferris Meadows SNCI is high (see Section 4.14 for further details).

Fish entering the lake will have free movement so it could become a backwater for sheltering fish however, this is currently unknown. There is a fish pass proposed on the flow control structure to the north-west of Ferris Meadow Lake and others within the Spelthorne channel so that fish can return to the River Thames via the channel as well as the open connection to the south-east.

Option 8 could result in operational disturbance to the interest features of the South West London Waterbodies SPA and Ramsar Site due to the new access being created and more craft entering the lake. In addition, Ferris Meadow Lake would be directly connected to the River Thames at the outfall and the water quality of the lake would likely deteriorate from this and also potentially from boats entering the lake (see Appendix F). The reduction in water quality is likely to affect macrophyte, invertebrate, fish communities and marginal habitat. This may lead to the reduction in the lake's ability to be a supporting habitat of the SPA and Ramsar site which may result in the option leading to the RTS having an adverse effect on the site integrity of the SPA. Evidence to show that there are no satisfactory alternatives to the option is likely to be required, which will be difficult to achieve given the other options being considered.

Mitigation

Tertiary mitigation would be followed as per the PEIR for known protected and notable habitats and species.

For all options appraised the construction works will need to be timed outside the over-wintering period to ensure no effects on SPA / Ramsar birds using Ferris Meadow Lake and that all in-channel works will avoid sensitive migration / spawning period for fish. Surveys are ongoing to understand where pathogens are present, and once known mitigation measures to managed fish pathogens will be identified as required.

New areas of habitat and the enhancement of habitats such as Ferry Lane Lakes 1,2 and 3 will be required to mitigate effects from any option.

For Options 1,2,3, 4 and 5 the provision of new roost sites and replanting is likely to be required to mitigate impacts on bats.

Of the options appraised, Options 7 and 8 present the greatest operational mitigation requirements to reduce effects on the SPA and Ramsar sites. For Option 7, this is primarily due to the splitting of Ferris Meadow Lake into two waterbodies and for Option 8, this is due to the increased disturbance from boats. Suitable operational mitigation may not be possible for these options.

Table 3: Biodiversity appraisal

Option	RAG Status	Justification
Option 1	Medium	Reduction in water quality within Ferris Meadow Lake is expected but this this impact is considered unlikely to cause an observable change on the distribution of macrophytes, invertebrate, fish communities and marginal habitats of the lake and SPA birds.
Option 2	High	This option will lead to a loss of a backwater habitat in the Chap during flood flows and the removal of riparian features due to the requirement to widen the channel. Acceptable mitigation to compensate for the loss of this habitat will be difficult to achieve.
Option 3	High	The option results in the greatest loss of Ferris Meadows SNCI habitat including grassland and woodland. Compensatory planting will be required to mitigate the effect but there will be a large permanent loss of terrestrial habitat in the SNCI residually.
Option 4	High	There will be a loss of Ferris Meadows SNCI habitats including neutral grassland and woodland. Compensatory planting will be required to mitigate the effect but there will be a permanent loss of terrestrial habitat in the SNCI overall.
Option 5	Medium	Avoids all loss of Ferris Meadows SNCI habitat and changes in water quality to the lake. Will require some removal of Desborough Island SNCI habitat (including grassland, scrub and woodland) so compensatory planting/enhancement measures will be required to ensure that the integrity of the site is not compromised. Limited habitat loss due to tunnel being underground.

Option	RAG Status	Justification
Option 6a	Medium	Option is likely to lead to adverse effect to the water quality of Ferris Meadow Lake as flood flows would enter the lake inputting additional nutrients. As the augmented flow will be predominately through the Chap circulation through Ferris Meadow Lake will be low and there is therefore a risk that the increased residence time and continual input of nutrients, will increase the risk of eutrophication in the lake. Monitoring and mitigation for if oxygen levels do decline in the lake will be required to reduce the severity of this effect to a level where there is no impact on the Ferris Meadow Lake's aquatic ecology.
Option 6b	Medium	The option is of lower risk to water quality deterioration in Ferris Meadows Lake compared to Option 6a due to presence of the flow control structure however, the risk of eutrophication remains due to the absence of the augmented flow within the lake. As for Option 6a, monitoring and mitigation for if oxygen levels do decline in the lake will be required to reduce the severity of this effect to a level where there is no impact on the Ferris Meadow Lake's aquatic ecology.
Option 7	High	The splitting of the waterbody into two smaller waterbodies is likely to reduce the lake's function as a supporting waterbody to the SPA and Ramsar site and therefore potentially causing Adverse Effects to Integrity to the SPA. There would be a need to demonstrate that there are no satisfactory alternatives to the option.
Option 8	High	High risk of reduction in water quality of Ferris Meadow SNCI due to its open connection with the River Thames. Creating a new access to the River Thames into the lakes could increase public disturbance which will affect SPA birds.

3.4 Climate Change Mitigation and Adaptation

Baseline

Climate change mitigation considers the identification, management and minimisation of greenhouse gas (GHG) emissions associated with construction and operation of the

project. Baseline GHG emissions are assumed to be zero as a conservative assessment.

Climate change resilience and adaptation considers the risks and resilience to the construction and operation of the project from future climate change. The project is located in the Met Office climate profile of Southern England, which is characterised as having a climate influenced by continental Europe, which can be subject to continental weather influences that bring cold spells in winter and hot, humid weather in summer. Most of Southern England is less than 100 metres (m) Above Ordnance Datum (AOD), however, it contains hills and downland landscapes over 100 mAOD. The River Thames drains the northern half of Southern England and flows eastward. Mean annual temperatures vary from about 11.5°C in central London and along the south coast to about 9.5°C over higher ground inland.

Using a future assessment timeframe of 2081-2100 (the latest that projections currently extend to), over land there would be a move towards warmer, wetter winters and hotter, drier summers. However, natural variations mean that some cold winters, some dry winters, some cool summers and some wet summers would still occur (UK Climate Projections, 2018 (UKCP18)).

Assessment of potential effects

All options would result in GHG emissions however, Options 2 to 5, 7 and 8 are expected to involve more extensive construction works, including the use of large amounts of concrete, steel and higher numbers of HGV movements, and therefore resulting in higher GHG emissions. All options would also require maintenance once operational which would result in ongoing GHG emissions. Full quantification of construction and operational GHG emissions is not currently available.

Section 7.1.9 of the Ferris Meadow Lake Options Appraisal Report includes a high-level carbon assessment which considers the amount of carbon of the different options, with the volumes of concrete and steel used having the greatest effect on the outcome of the assessment.

The options are proposed to help alleviate flood risk, which in itself is a consequence of climate change. For this reason, there is no differentiation between options when considering against climate change resilience and adaptation.

Mitigation

Primary and tertiary mitigation would manage risks associated with GHG emissions, and climate change mitigation and resilience for all options. These would include measures identified in the EIA process such as the installation of Sustainable Drainage Systems (SuDS) to ensure no increase in surface water flooding; an Outline Climate Adaptation Plan would be developed to include monitoring and adaptive management measures; and Climate Resilient Design for structures and a Carbon Management Plan, in line with the requirements of PAS2080.

Table 4: Climate appraisal

Option	RAG Status	Justification
Option 1	Low	Less extensive construction works, and therefore lower GHG emissions, than Options 2 to 5 inclusive. Effects are likely to be mitigated through primary and tertiary mitigation measures.
Option 2	Low	More extensive construction works, resulting in higher GHG emissions than Options 1, 6a and 6b. Effects are likely to be mitigated through primary and tertiary mitigation measures.
Option 3	Low	More extensive construction works, resulting in higher GHG emissions than Options 1, 6a and 6b. Effects are likely to be mitigated through primary and tertiary mitigation measures.
Option 4	Low	More extensive construction works, resulting in higher GHG emissions than Options 1, 6a and 6b. Effects are likely to be mitigated through primary and tertiary mitigation measures.
Option 5	Low	More extensive construction works, resulting in higher GHG emissions than Options 1, 6a and 6b. Effects are likely to be mitigated through primary and tertiary mitigation measures.
Option 6a	Low	Less extensive construction works, and therefore lower GHG emissions, than Options 2 to 5 inclusive. Effects are likely to be mitigated through primary and tertiary mitigation measures.
Option 6b	Low	Less extensive construction works, and therefore lower GHG emissions, than Options 2 to 5 inclusive. Effects are likely to be mitigated through primary and tertiary mitigation measures.

Option	RAG Status	Justification
Option 7	Low	More extensive construction works, resulting in higher GHG emissions than Options 1, 6a and 6b. Effects are likely to be mitigated through primary and tertiary mitigation measures.
Option 8	Low	More extensive construction works, resulting in higher GHG emissions than Options 1, 6a and 6b. Effects are likely to be mitigated through primary and tertiary mitigation measures.

3.5 Cultural Heritage

Baseline

There are no World Heritage Sites, Scheduled Monuments or Registered Parks and Gardens in proximity to Ferris Meadow Lake. There is an Area of High Archaeological Potential (AHAP), which is the site of a Romano-British or Early Medieval Fish Weir on the northern bank of the River Thames, adjacent to Ferris Meadow Lake. Otherwise, the area has been assessed to be of medium or low archaeological potential.

Eyot House is a Grade II Listed Building on D'Oyly Carte Island in the Thames, immediately south of Ferris Meadow Lake. Mill Eyot situated on the northern bank of the Chap is also Grade II listed. Shepperton Conservation Area lies to the north of the Chap and includes a number of Listed Buildings (Annex 1, Designations (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00133)).

Assessment of potential effects

Options 1, 3, 4, 6a, 6b, 7 and 8 are likely to affect the Roman or early medieval fish weir due to the location of the outfall flow control structure, however, a large proportion of this feature has potentially already been lost due to prior mineral extraction. The setting of Eyot House Grade II Listed Building would be affected by the flow control structure, although existing trees and vegetation on D'Oyly Carte Island are likely to provide some screening. The ground to the west of Ferris Meadow Lake, where Options 3 and 8 would be located, has been included in previous archaeological investigations and the archaeological potential is better understood, with low potential for unknown archaeology. The additional inlet structures required for Options 6a and 6b are located in an area of low archaeological potential to the west of Ferry Lane and no further investigations would be required.

For Option 2, the widening of the Chap is not anticipated to result in a substantial change to land-use (as it will remain undeveloped and free of built structures) which

would affect the character of the setting of Mill Eyot Grade II listed building. Existing vegetation is also likely to provide some screening. The area between Ferris Meadow Lake and the Chap has medium archaeological potential and has not been included in previous investigations, so may affect unknown archaeology. This would also apply to Option 4 which has a short section of channel widening of the Chap and a channel section through the ground north of Ferris Meadow Lake.

All options may have a slight and temporary impact on Shepperton Conservation Area during construction, but this can be largely mitigated through screening to reduce noise and visual impact.

Option 5 may affect paleochannels due to the depth of tunnelling and result in loss of organic remains and artifacts. As the area to the north of Ferris Meadow Lake has not been investigated the depth of archaeological deposits is unknown. This area has medium potential and further information would be required before the impact of this option can be assessed.

All options may affect unknown archaeology in areas of undisturbed ground.

Mitigation

Additional investigations in the form of borehole survey would be recommended in the first instance to assess the stratigraphic sequence of deposits in the area of medium archaeological potential between the Chap and Ferris Meadow Lake. This would apply to Options 2, 4 and 5. This could confirm if greater harm would be caused by widening of the Chap along its entire length (Option 2) or restricting the additional works to the north-west of Ferris Meadow Lake (Option 4). More extensive mitigation may be required for palaeochannels and deep archaeological deposits if there is extensive loss from tunnelling (Option 5).

Screening of Listed Buildings through the integrated landscape design process and development of an Historic Environment Management Plan (HEMP) are as set out in the PEIR would mitigate effects from Options 1, 2, 3, 6a, 6b, 7 and 8. Mitigation during construction would also involve screening for potential noise and visual impacts, including on Shepperton Conservation Area.

While the options considered, generate different environmental risks, all options have been assessed as having the same level of risk (medium) and while these risks are important considerations, they are not determining factors in the environmental appraisal of the options.

Table 5: Cultural heritage appraisal

Option	RAG Status	Justification
Option 1	Medium	Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological Written Scheme of Investigation (WSI), including fish weir AHAP.
Option 2	Medium	Investigation recommended for land between the Chap and Ferris Meadow Lake as this has not been included in prior archaeological works. Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological WSI.
Option 3	Medium	Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological WSI, including fish weir AHAP.
Option 4	Medium	Investigation recommended for land between the Chap and Ferris Meadow Lake as this has not been included in prior archaeological works. Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological WSI, including fish weir AHAP.
Option 5	Medium	Investigation recommended for land between the Chap and Ferris Meadow Lake as this has not been included in prior archaeological works. Impact would depend on extent of loss caused by tunnelling. While archaeological WSI can address effects on paleoenvironmental remains, these may be extensive.
Option 6a	Medium	Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological WSI, including fish weir AHAP.
Option 6b	Medium	Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological WSI, including fish weir AHAP.
Option 7	Medium	Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological WSI, including fish weir AHAP.

Option	RAG Status	Justification
Option 8	Medium	Any impact on setting of Listed Buildings and any archaeology is likely to be mitigated through screening and archaeological WSI, including fish weir AHAP.

3.6 Flood Risk

Baseline

This area of the floodplain is majority fluvial Flood Zone 3b (functional floodplain / 1 in 30-year flood extent), including Ferris Meadow Lake, with patches of Flood Zone 3a and 3b as shown in the EA website mapping and in the baseline flood modelling for the RTS (without the channels in place) (WBi, 2023f).

The EA main watercourses in this area include the channel known as the Chap and the River Thames (see Annex 1, Water Environment (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00141)).

There are also some ordinary watercourses / drainage ditches within the vicinity of the existing alignment and the options being considered. There is a land drain located to the west of Ferry Lane, which appears to be connected with Ferry Lane West 1. There are a number of infilled / abandoned ditch channels and existing structures in this area noted in the engineering design drawings.

The site is in an area of patchy surface water flooding but there are no major surface water flood pathways based on existing EA surface water data.

The area is not recorded as being a “wetspot” based on Surrey County Council’s wet spot data. The nearest wetspot is located on Church Road c. 280m north of Ferris Meadow Lake.

Assessment of potential effects

Given the existing floodplain designation for the whole area, there are no differences between the options in this respect.

The options have been deliberately designed to meet the performance required of the RTS in this location, and designed with the same constraints, such as the water control structure needed to prevent the local groundwater level being drained down in non-flood conditions. Hence there is no tangible difference in the flood risk reduction provided by the different options, and there is no downstream detriment as a result of the different options. The evidence of this is provided in Appendix C.

The design options have also been designed with the same constraints, such as the water control structure needed to prevent the groundwater level being drained down through the flood channel in non-flood conditions. There is no difference in the flood performance as a result of the options.

There is no downstream detriment as a result of the different options, based on the fluvial modelling undertaken for testing the options.

It is assumed that the land drain design requirements of all options would be incorporated as part of the final option design to ensure there is no increase in flood risk from these sources.

Option 1 includes where necessary the compensatory land drain design requirements e.g. alternative drainage ditches, new outfalls to the channel itself, culverting sections where required and non-return valves; it is assumed these would be replicated where necessary for the other options being considered.

There are no surface water pathways that would be truncated based on the existing surface water data available.

None of the other options introduce different additional structures such as raised embankments that could be considered an additional risk to fluvial flooding in the area. However:

- Option 5 includes a tunnel and this is a potential future maintenance and management risk to ensuring the flood risk performance is maintained, hence it is not as resilient an option as others.
- Option 6b requires an additional control structure which would require maintenance and management, and could fail, hence it is not as resilient an option as others.

Mitigation

There is no need for any specific additional mitigation for any of the options in terms of the fluvial flood risk as this is incorporated into design.

Options 5 and 6b have additional structures that have the requirement for additional maintenance, management and therefore not as resilient as other options.

Table 6: Flood risk appraisal

Option	RAG Status	Justification
Option 1	Low	This option meets the performance required of the RTS in this location.
Option 2	Low	This option meets the performance required of the RTS in this location.

Option	RAG Status	Justification
Option 3	Low	This option meets the performance required of the RTS in this location.
Option 4	Low	This option meets the performance required of the RTS in this location.
Option 5	Medium	This option meets the performance required of the RTS in this location. This option has a major structure with future maintenance and management risk, which makes it less resilient than other options in ensuring the flood risk performance of the RTS is achieved.
Option 6a	Low	This option meets the performance required of the RTS in this location.
Option 6b	Medium	This option meets the performance required of the RTS in this location. This option has an additional flow control structure, which makes it less resilient than other options in ensuring the flood risk performance of the RTS is achieved
Option 7	Low	This option meets the performance required of the RTS in this location.
Option 8	Low	This option meets the performance required of the RTS in this location.

3.7 Health

Baseline

At this geographic scale, baseline health data is not sufficiently granular to characterise the local population. Potential receptors for health effects comprise:

- Local residents;
- Local businesses primarily Shepperton Open Water Swim, Desborough Sailing Club and Sunbury Skiff and Punting Club; and

- Leisure users, including swimmers using Ferris Meadow Lake and users of the Thames Path and Walton and Weybridge Public Right of Way (PRoW).

Ferris Meadow Lake is not a designated water for bathing, but if it was, it would be classified as 'Excellent' (the highest, cleanest water quality). Other classifications for bathing water comprise 'Good' (generally good water quality), 'Sufficient' (the water meets the minimum standard, 'Poor' (the water has not met the minimum standard, and work is needed to improve water quality).

Assessment of potential effects

The following effects were considered for the health assessment:

- Effects to residents and businesses from temporary increased emissions and dust due to the transportation of construction materials and waste;
- Effects to residents and businesses from temporary increased dust and particulate matter generated by construction activities;
- Effects to users of footpaths due to permanent diversion;
- Effects to swimmers and businesses using the lakes from changes at lakes in water quality and flow; and
- Effects from noise from construction activities causing temporary disturbance to residential receptors near construction areas.

All options have potential for effects on health during construction from reduced air quality, either from vehicle emissions from transport of material or dust from excavation (higher for Options 2 - 5 and 8). This may particularly affect people with existing respiratory disease or conditions such as asthma and those living or working close to construction activities and the local road network as a result of increased HGV movements (see Section 4.2 Air Quality).

Option 5 (underground engineered solution) would require the permanent diversion of the Walton & Weybridge PRoW (27a) around Desborough Island, which, due to the presence of the tunnel outlet, would result in a reduced length of footpath. This effect is considered negligible in terms of reduced physical activity.

Water quality can affect the health of users of Ferris Meadow Lake, through water-borne illness or reduced physical activity (and related mental health benefits) if swimmers are prevented from using the lake for periods of time due to poor water quality. At present, during large fluvial flooding events, water from the River Thames overtops the lake embankment and enters Ferris Meadow Lake; these events are more likely to occur during winter when the lake is less likely to be used for swimming.

Options 1, 3, 6a, 6b, 7 and 8 are likely to restrict use during construction as works are required within Ferris Meadow Lake. While the duration of construction is not known, this is likely to be greatest for Option 3 and 7, due to the extent of ground works required over the summer months and works required within the lake itself. This has the potential to affect the physical and mental health of regular users.

Option 1 will lead to mixing of river water with the lake water (see Water Environment, Section 4.14) via the new channel. This would likely result in ingress of additional nutrients, microbes and pollutants reducing water quality within Ferris Meadow Lake, and also reducing bathing water quality from the equivalent classification of 'Excellent' to 'Good' as most microbial organisms will have decayed before reaching the Lake (Appendix F). The continuous augmented flow would also decrease risk of algal blooms in the Lake and usually most microbial organisms will have decayed before reaching the Lake to achieve 'Good' status. Occasionally in flood conditions, residence times would be shorter, reducing the amount of decay. However without RTS in place, flood water from the River Thames would inundate the Lake and water quality would be similar. Notwithstanding the conclusions of the water quality modelling, the perceived risk to health, may still discourage some swimmers from using the Lake for exercise thus causing negative health effects.

Options 2, 3 and 4 would have reduced effects to users of Ferris Meadow Lake as there would be no direct input of water through the lake, although the existing periodic ingress of flood waters would continue.

Option 5 would remove direct effects to users of Ferris Meadow Lake as the option would avoid increasing hydraulic connectivity to the lake.

Options 6a and 6b would also result in the lake receiving river waters during a flood, this would be formalised and may be more frequent. With Option 6a, the Lake would also receive a small amount of the augmented flow. Both options potentially reduce bathing water quality as described above, although to a lesser extent than Option 1. The perceived risk of health effects is likely to reduce, due to the diversion of the augmented flow to the Chap.

For Option 7 the effect on water quality for open water swimmers using the north east side of Ferris Meadow Lake would be mitigated by installation of the separation bund.

Option 8 would result in a reduction of water quality due to the direct connection to the Thames. The use of the lake as a marina may also introduce additional pollutants from boats. Potential for equivalent bathing water quality of 'Poor', may result in illness from ingesting water, and would discourage swimmers from using the lake and impact the Shepperton Open Water Swim business.

Changes to water quality in the Chap (Section 4.14) are not considered to have an effect on the health of sailing and boating users for Options 2 and 4. However, the relocation of Desborough Sailing Club for Option 2 (also used by Sunbury Skiff and Punting Club) would mean that there is a potential impact on the well-being of workers and leisure users for a period during construction.

Noise effects from construction are covered in Section 4.10. Annoyance which can lead to health effects are more likely to affect local residents, particularly those that are at home during the day, such as the elderly, or young children and parents.

Mitigation

A range of standard practice measures are used to reduce construction effects relating to air quality and noise as outlined in Sections 4.2 and 4.10.

Additional engagement with users and Shepperton Open Water Swim is particularly important for Options 1 and 6a and 6b in relation to risks and perceived risk of reduced water quality.

Table 7: Health appraisal

Option	RAG Status	Justification
Option 1	Medium	There may be an effect of the perceived risk to health, discouraging swimmers from using the lake and consequential health impacts. This perceived risk may be difficult to mitigate as it is not necessarily linked to water quality, which is predicted to be of good for bathing.
Option 2	Low	This option avoids perceived health risks to users of Ferris Meadow Lake during operation. There would be a temporary impact to sailing and boating during construction, but it is assumed that alternative facilities can be found on the River Thames.
Option 3	Medium	There may be restrictions to use during construction on the bank of the lake, this may impact swimmers' health and well-being and as the duration of work and ability to use alternatives (e.g. Swim Heron >10 miles away) is unknown, a precautionary assessment is applied.
Option 4	Low	This option avoids perceived health risks to users of Ferris Meadow Lake during operation.
Option 5	Low	This option avoids perceived health risks to users of Ferris Meadow Lake during operation.
Option 6a	Medium	Impacts to Ferris Meadow Lake are reduced, however a small amount of augmented flow may lead to a perceived health risk, although potentially less than Option 1, can still lead to reduced use and impact on Shepperton Open Water Swim during operation.

Option	RAG Status	Justification
Option 6b	Low	Impacts to Ferris Meadow Lake reduced. the additional flow control structure to prevent augmented flow entering the Lake may help alleviate concerns regarding risks from water quality during operation.
Option 7	Low	This option avoids perceived health risks to users of Ferris Meadow Lake during operation, although construction effects will be greater.
Option 8	High	The direct connection with the River Thames is likely to substantially reduce equivalent bathing water standards, with potential effects on swimmers from ingested water, discouraging swimmers from using the Lake and impacting the Shepperton Open Water Swim business during operation.

3.8 Landscape and Visual Amenity

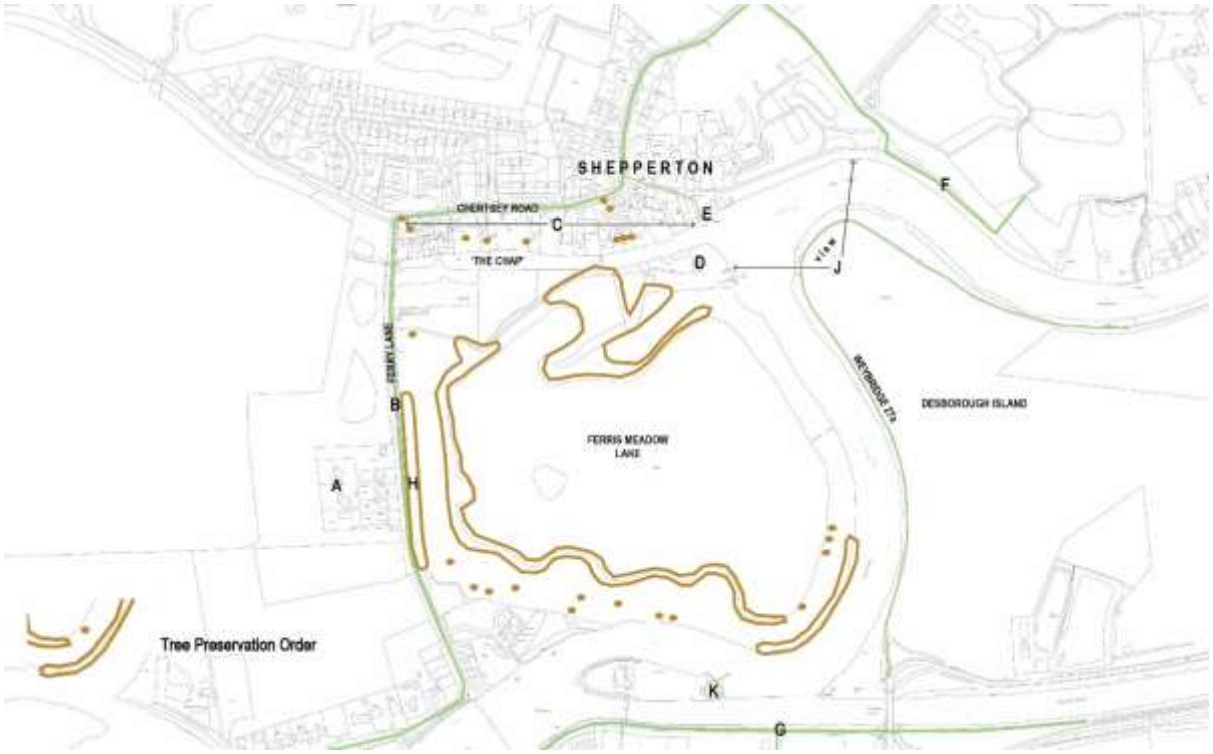
Baseline

There are no statutory landscape designations (i.e. National Parks or Areas of Outstanding Natural Beauty) in the area surrounding Ferris Meadow Lake but it is located within the Green Belt. Shepperton Conservation Area is located to the north of the River Thames and there are a large number of trees within Shepperton and around Ferris Meadow Lake which are the subject of a Tree Preservation Order (Annex 1 Designations (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00133)).

Ferris Meadow Lake and its surrounding green space has an enclosed naturalised character with wooded edges that filter views from Ferry Lane on its western boundary. The Thames Path National Trail (TPNT) follows the route of Ferry Lane as it leaves its Thameside location for a short stretch. The lake sits within the RTS Landscape Character Assessment (LCA) Area ‘3m’ (PEIR Figure 12.3)– Ferry Lane Lakeside Recreation where it is described as having *a semi enclosed character with moderate to low intervisibility*; *a relatively peaceful area valued for its range of recreational activities.* There are open views from Desborough Island to the east, including from the Walton & Weybridge 27a public footpath that runs around the island’s edge. Shepperton is located to the north of the River Thames with the public footpath Sunbury 62 ending at the water’s edge. From this location there is a pleasing panorama looking south towards the northern edge of Desborough Island, taking in the naturally vegetated eastern edge of Ferris Meadow Lake and the Sailing Club moorings at the north of the site, located within the Chap, the River Thames backwater.

Assessment of potential effects

Plate 1: Landscape and Visual Considerations



Option 1: Flood relief channel via the Lake

The break in the roadside vegetation to the east and west of Ferry Lane, to accommodate the proposed Ferry Lane Crossing under which the channel would flow, would create views west along the channel for a limited distance for users of the TPNT. The channel outlet structure with footbridge at the southern end of Ferris Meadow Lake would be visible to users of the TPNT, public footpath Walton & Weybridge 27 (*Plate 1 ref G)* and to visitors to D'Oyly Carte Island (*Fig ref K*). Whilst visible within the overall view looking northeast from the café at the eastern end of D'Oyly Carte Island, these introduced features would not be overbearing, nor would they seem incongruous amongst other existing features locally. The introduction of the proposed footbridge to Desborough Island would also be in character with other similar local features including bridges, masts and weirs. Any likely visual effects could be mitigated through consideration of design, material finish and riparian planting and embedded planting would assist in screening and settling project elements. There would be a small change to the key characteristics of RTS landscape character area 3m through the introduction of these features, but they would not detract from its existing character.

Trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree Preservation Order. Localised consideration of the location of this track would reduce the need for their removal.

Option 2: Flood relief channel to 'the Chap'

The proposed route of the sheet pile edged flood channel across the north of Ferry Lane, would create a break in the roadside vegetation east and west to accommodate the proposed Ferry Lane Crossing under which the channel would flow. This would open up views west towards along the channel toward the level retention structure for users of the TPNT for a limited distance of their route. These features would also be clearly visible from the residential properties south of Chertsey Road (Plate 1 ref C) (some of which include trees that are the subject of a Tree Preservation Order), though would be less visible to the residents further south on Ferry Lane (Plate 1 ref A). The widening construction work of the Chap would potentially impact the characterful riparian rear gardens of these properties which include trees that are the subject of a Tree Preservation Order and there would be a marked change to their rear outlook with the relocation of the sailing club boat house and its associated elements (Plate 1 ref D). The broader channel would be visible from the users of public footpath Sunbury 62 at the water's edge in Shepperton (Plate 1 ref E) and the TPNT as it runs adjacent to the Thames to the east (Plate 1 ref F). From this location, visible elements such as the wrought iron waterside balcony of the Warren Lodge Hotel and the moored sailing boats, along with the quiet backwater nature of the Chap provide a pastoral and calm outlook with the historic context of Shepperton Conservation Area in the background. There would be a moderate change in the key characteristics and perceptual qualities of RTS landscape character area 3m from the loss of these features and the introduction of a broader, larger, more open channel and relocated sailing club and permanent changes in receptors' visual experience from the introduction of the widened Chap channel and the partial loss of the existing picturesque waterside setting.

Option 3: Flood relief channel west of the Lake

The proposed routing of the flood channel through the land west of Ferris Meadow Lake would create a break in the roadside vegetation to the east and west of Ferry Lane, to accommodate the Ferry Lane Crossing under which the channel would flow. This would introduce a partial change in outlook for a small number of residents in their homes in Ferry Lane (Plate 1 ref A) and in views east by users of the TPNT towards the realigned sheet pile edged channel section. The required channel width and widened access track proposed in this option would potentially reduce any area available between the channel and Ferry Lane for tree planting and screening and would alter the current filtered view at this location through the trees and scrub to the lake. There are groups of trees in this area that are the subject of a Tree Preservation Order, both adjacent to the road and along the lake edge, as well as other individual protected trees in the southern area of the lake environment. It is likely that many would be lost to allow for the channel construction in this location. The level retention structure adjacent to the west of the channel's intersection with Ferry Lane would be

clearly visible by users of the TPNT for a limited distance and there might be glimpsed views west of the wider channel section by residents in the properties south of Chertsey Road. The footbridge over the channel at the south of the lake would be visible from the TPNT and by visitors to D'Oyly Carte Island (Plate 1 ref K). Whilst project elements would be apparent in parts of the overall view looking northeast from the café at the eastern end of D'Oyly Carte Island, they would not be overbearing and would not seem incongruous amongst other existing features locally. There would be a small change to the key characteristics of RTS landscape character area 3m through the introduction of project features, but they would not detract from its existing character. Any likely landscape and visual effects could be mitigated through consideration of design, material finish and riparian planting and embedded planting would assist in screening and settling project elements. There would be a small change to the key characteristics of RTS landscape character area 3m through the introduction of project features, but they would not detract from its existing character. The proposed footbridge to Desborough Island would not be an unusual feature at this location and would be representative of other similar features including bridges, masts and weirs.

Option 4: Flood relief split between both the Chap and west side of the Lake

There would be views for residents in properties to the south of Chertsey Road toward the southern sheet pile edge of the channel section however the reduced width of the split channel in this location would provide potential opportunity for bank edge softening and marginal planting. Whilst the required channel width would be reduced contained within the existing dimensions of the Chap, the widened access track proposed in this option would potentially reduce any area available for tree planting as screening and would alter the current filtered view at this location through the trees and scrub to the lake. There are groups of trees in this area that are the subject of a Tree Preservation Order, both adjacent to the road and along the lake edge, as well as other individual protected trees in the southern area of the lake environment. Whilst the space required for this option to the west of the lake would likely be less than for Option 3, it is likely that many would still be lost to allow for the channel construction. The footbridge over the channel at the south of the would be visible from the TPNT, public footpath Walton & Weybridge 27 (Plate 1 ref G) and by visitors to D'Oyly Carte Island (Plate 1 ref K). Whilst project elements would be apparent in parts of the overall view looking northeast from the café at the eastern end of D'Oyly Carte Island, they would not be overbearing and would not seem incongruous amongst other existing features locally. There would be a small change to the key characteristics of RTS landscape character area 3m through the introduction of project features, but they would not detract from its existing character. Any likely effects could be mitigated through consideration of design, material finish and riparian planting and embedded planting would assist in screening and settling project elements and further reduce any non-significant effects. The proposed footbridge to Desborough Island would not be an unusual feature at this location and would be representative of other similar features including bridges, masts and weirs.

Option 5: Underground engineered solution

The constructed elements including the debris boom and tunnel entrance shaft located on the northwest edge of Desborough Island, and the maintenance access road on the western edge of Desborough Island required for this option, would be visible when viewed from the TPNT and NCR 4 north of the Thames, Desborough Island and Weybridge 27a and the waterside environs of Shepperton including public footpath Sunbury 62. They would bring about a change in the key characteristics at this location, described within the RTS LCA (PEIR Figure 12.3) as *a small-scale pastoral landscape characterised by a meandering river channel in a flat alluvial floodplain; with riparian strips of marginal planting and lines of riverside trees. A settled pastoral view is gained at the north of the island towards Old Shepperton*. The proposed realigned footpath is located at the most characterful area of the island with its views toward Shepperton and the Chap (Plate 1 ref J). There are clear views across the river from the TPNT to the existing naturalised and quiet northern edge to the Island. Further infrastructure including the debris boom, tunnel entrance shaft and raised access track required to the west of Ferry Lane would be visible to users of the TPNT on Ferry Lane for a limited stretch with likely effects upon landscape character and visual amenity. Consideration of design, material finish and planting to assist screening would provide some mitigation.

Option 6a: Flood relief channel via the Lake with augmented flow to the Chap

A proposed small culvert into the Chap would potentially be visible from the end residences to the south of Chertsey Road. A proposed raised access track adjacent to the proposed augmented flow channel would be glimpsed by users of the TPNT (Plate 1 B below or Annex 1 Socio-economic and recreation (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00140)) and there would be a break in the roadside vegetation to the east and west of Ferry Lane, to accommodate the proposed Ferry Lane Crossing under which the channel would flow. The outlet structure with footbridge would be visible to users of the TPNT, public footpath Walton & Weybridge 27 (Fig ref G and Annex 1) and by visitors to D'Oyly Carte Island (Fig ref K). Whilst these project elements would be apparent in parts of the overall view looking northeast from the café at the eastern end of D'Oyly Carte Island, they would not be overbearing and would not seem incongruous amongst other existing features locally. There would be a small change to the key characteristics of RTS landscape character area 3m through the introduction of project features, but they would not detract from its existing character. Any likely effects could be mitigated through consideration of design, material finish and riparian planting. Trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree Preservation Order. Localised consideration of the location of this track would reduce the need for their removal.

The proposed footbridge to Desborough Island would not be an unusual feature at this location and would be representative of other similar features including bridges, masts and weirs.

Option 6b: Flood relief channel via the Lake with augmented flow to the Chap with additional control structure

A new flow control structure and associated operational compounds and access track located adjacent to Ferry Lane, and a raised access track adjacent to the proposed augmented flow channel are closely located to Ferry Lane and would be clearly visible by users of the TPNT for a short, limited distance at the proposed footbridge crossing the channel section. There would be potential filtered views north for residents at The Uppings, the north end property on Ferry Lane through the existing woodland towards the structures however any effects could be mitigated through appropriate screening including tree and understory planting to the south of the channel structures. The outlet structure would be visible to users of the TPNT, public footpath Walton & Weybridge 27 (Plate 1 ref G or Annex 1) and by visitors to D'Oyly Carte Island (Plate 1 ref K). Whilst these project elements would be apparent in parts of the overall view looking northeast from the café at the eastern end of D'Oyly Carte Island, they would not be overbearing and would not seem incongruous amongst other existing features locally. There would be a small change to the key characteristics of RTS landscape character area 3m through the introduction of project features, but they would not detract from its existing character. Any likely non-significant effects could be further reduced through consideration of design, material finish and riparian planting and embedded planting would assist in screening and settling project elements and helping to reduce any effects. Trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree Preservation Order. Consideration of the location of this track would reduce the need for their removal. The proposed footbridge to Desborough Island would not be an unusual feature at this location and would be representative of other similar features including bridges, masts and weirs.

Option 7: Division of Ferris Meadow Lake

The break in the roadside vegetation to the east and west of Ferry Lane to accommodate the crossing and bridge under which the channel would flow would create views for users of the TPNT west. There would be filtered views of the lake bund from Ferry Lane and potential glimpsed views from the TPNT, public footpath Walton & Weybridge 27 (*Plate 1 ref G*) and by visitors to D'Oyly Carte Island (*Plate 1 ref K*), with the channel outlet structure at the southern end of Ferris Meadow Lake clearly visible to users of the TPNT, public footpath Walton & Weybridge 27 and to visitors to D'Oyly Carte Island. Whilst these project elements would be apparent in parts of the overall view looking northeast from the café at the eastern end of D'Oyly Carte Island, they would not be overbearing and would not seem incongruous amongst other existing features locally. The introduction of the bund through the lake would result in a small change in the key characteristics of RTS landscape character area 3m but would not detract from its overall existing character, with any non-significant landscape and visual effects further reduced by the considered design of the bund, its form and the material consideration of the integrated safety rail. Riparian and embedded mitigation planting would further assist in screening and settling project elements. The proposed footbridge to Desborough Island would not be an unusual feature at this location and would be representative of other similar features including

bridges, masts and weirs. Trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree Preservation Order. Localised consideration of the location of this track would reduce the need for their removal.

Option 8: Permanent connection of Ferris Meadow Lake to the River Thames

The break in the roadside vegetation to the east and west of Ferry Lane to accommodate the proposed bridge under which the channel would flow, would create views west towards along the channel and flow control structure for users of the TPNT for a limited distance of their route and there might be glimpsed views looking south for people in their properties on Chertsey Road west of Ferry Lane toward the wider channel section. The footbridge at the southern end of Ferris Meadow Lake would be visible to users of the TPNT, public footpath Walton & Weybridge 27 (*Plate 1 ref G)* and to visitors to D'Oyly Carte Island (*Fig ref K*) but would not be overbearing and would not seem incongruous amongst other existing features locally. There would be a small change to the key characteristics of RTS landscape character area 3m through the introduction of project features, but they would not detract from its existing character. Any likely non-significant effects could be further reduced through consideration of design, material finish and riparian planting, and embedded planting would assist in screening and settling project elements. The proposed footbridge to Desborough Island would not be an unusual feature at this location and would be representative of other similar features including bridges, masts and weirs. Trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree Preservation Order. Localised consideration of the location of this track would reduce the need for their removal.

Mitigation

Where possible, softening of any sheet pile edges of new channel sections with the inclusion of a marginal shelf would assist in retaining the naturalised character and reducing visual and landscape effects. Consideration of the material finish of the proposed bridge, structures and safety railings would assist in settling elements into their location.

For all Options (apart from 5), design should consider minimising loss of trees (particularly those with Tree Preservation Orders), for example by routing of the access track, as well as mitigation for loss to be agreed with LPAs. Options 3 and 4 planting, (including potential replacement tree planting agreed with the LPA for any trees lost that were the subject of a Tree Preservation Order) to the east of Ferry Lane, would be required to screen views from the residential properties and to replace valued trees that will be lost. Consideration of the material finish of the proposed bridge would assist in settling it into its location.

In either location, west of Ferry Lane or south of Ferris Meadow Lake, the bridges and outlet structure are representative of other local riparian engineered features and would not detract from the overall character of a working and vibrant river and its

environs. Whilst they would add further elements of built form into the landscape and would be apparent in parts of overall views by visual receptors, they would form a small part of an overall visual experience. Consideration of the location of the tunnel entrance shaft for Option 5 would reduce the visual and landscape effects of this element. Retained planting wherever possible and consideration of the position and finish of the access road.

Options 2 and 5 have both been given a 'high' rating as both options have the potential to result in high impacts on visual amenity and landscape character and where it would be difficult to achieve an acceptable level of mitigation. Those assessed as moderate include options that have impacts on residential receptors and would require the likely loss of trees that are the subject of a Tree Preservation Orders, that would be difficult to avoid.

Table 8: Landscape and visual amenity appraisal

Option	RAG Status	Justification
Option 1	Low	Any potential effects could be mitigated by planting and marginal shelves to soften and filter views including the track widening east of Ferry Lane. .
Option 2	High	Potential significant effects upon visual amenity and to landscape character from the introduction of the new channel through the Chap and the loss of existing features and aesthetic and perceptual qualities. Likely effects loss of trees subject to a Tree Preservation Order that would require replacement tree planting.
Option 3	Medium	Potential effects upon visual amenity and to landscape character from the proposed routing of the channel to the west of Ferris Meadow Lake and likely loss of trees subject to a Tree Preservation Order that would require replacement tree planting.
Option 4	Medium	Potential effects upon visual amenity and to landscape character and likely loss of trees subject to a Tree Preservation Order that would require replacement tree planting. Other new planting and marginal shelves would soften and filter views.

Option	RAG Status	Justification
Option 5	High	Potential significant effects upon visual amenity and to landscape character from the introduction of the tunnel structures located in the Northwest corner of Desborough Island, and the loss of existing features and aesthetic and perceptual qualities. .
Option 6a	Low	Any potential effects could be mitigated by planting and positioning of project elements to reduce effects including the track widening east of Ferry Lane. .
Option 6b	Medium	Potential effects upon visual amenity and to landscape character through the introduction of engineered features located near residential receptors. Any potential effects could be mitigated by planting and positioning of project elements to reduce effects, including the track widening east of Ferry Lane.
Option 7	Low	Any potential effects could be mitigated by planting, design and material consideration of project elements to reduce effects including the track widening east of Ferry Lane.
Option 8	Low	Any potential effects could be mitigated by planting and marginal shelves to soften and filter views and reduce effects including the track widening east of Ferry Lane.

3.9 Materials and Waste

Baseline

While the Technical and Feasibility Appraisal in Appendix B, covers excavated volumes of material, this section also looks at other considerations such as landfill capacity and designations for mineral resources, similar to the EIA for RTS.

The River Thames floodplain has valuable reserves of aggregates and non-aggregates (such as silica sand and clay). Mineral extraction of sand and gravel is one of the primary industries in the study area, with several designated Mineral Safeguarding Areas (MSA) present. In the Ferris Meadow Lake area there is an MSA on Desborough Island. There are many voids created from the extraction of aggregates within the study area, some of which are now filled with water, and this includes Ferris Meadow Lake.

A recent broad scale review of landfill capacity, based on publicly available information, has found ample landfill capacity in the region for the estimated types and volumes of waste that could be generated by the RTS during construction. However, the future landfill capacity is currently unknown.

Assessment of potential effects

Option 1: Flood relief channel via the Lake

This option would result in some reduced capacity and availability of permitted inert and non-hazardous landfill sites in Surrey from disposal of waste arising from project activities associated with material and waste excavation. The option requires the flood channel to run through landfill. However, the effect of processing contaminated materials and waste is reduced by this option because the placement of the weirs fall outside of areas of landfill. It is anticipated that this option will result in approximately 55,200 m^3 of soil and waste excavated.

Option 2: Flood relief channel via the Chap; Option 3: Flood relief channel west of the Lake; Option 4: Flood relief via both the Chap and west of the Lake

These options require the placement of a larger water control structure and wider flood channel within an area of historic landfill. This reduces capacity and availability of treatment centres in Surrey due to processing the site-won waste from excavation in the landfill. Also, there would be a reduced capacity and availability of permitted inert and non-hazardous landfill sites in Surrey and materials management issues. This is from disposal of additional waste arising burden from this option associated with widening the Chap (Option 2 estimates 102,500 m^3 of soil and waste excavated) and creation of the flood channel (likely a substantial amount of waste generation) to the west of Ferris Meadow Lake, approximately 143,700 m^3 of soil and waste excavated in Option 3 and approximately 124,900 m^3 of soil and waste excavated in Option 4.).

Option 5: Underground engineered solution

This option requires the placement of a larger water control structure and wider flood channel and inlet structure within an area of historic landfill. This reduces capacity and availability of treatment centres in Surrey due to processing the site-won waste from excavation in the landfill. Also, there is reduced capacity and availability of permitted inert and non-hazardous landfill sites in Surrey and materials management issues from disposal of additional waste arisings from this option associated with tunnel excavation, tunnel outlet and outfall structure on Desborough Island. It is anticipated that this option will result in approximately 217,600 m^3 of soil and waste excavated. Works on Desborough Island sterilises part of a Mineral Safeguarding Area. A substantial amount of additional materials are likely to be imported to the site, notably concrete for this option.

Option 6a flood relief channel via the Lake with augmented flow to the Chap and Option 6b as above with additional control structure

These options would result in some reduced capacity and availability of permitted inert and non-hazardous landfill sites in Surrey from disposal of waste arising from project

activities associated with material and waste excavation. These options require an additional augmented flow and inlet structure within part of a historic landfill. These new features would generate additional waste, including potentially contaminated materials, approximately 59,400 m^3 of soil and waste for either option. The effect of processing waste and contaminated materials is reduced by this option because the placement of the weirs fall outside of areas of landfill.

Option 7: Division of Lake

This option requires the placement of a structure within Ferris Meadow Lake, necessitating importing a modest amount (10,500 m^3) of additional materials (the fill between the two sheet piled walls, assuming the worst-case scenario that scheme-won fill would not be suitable).

The reduced capacity and availability of permitted inert and non-hazardous landfill sites in Surrey from disposal of waste arising from project activities associated with material and waste excavation from this option would be similar to that of Option 1, approximately 55,200 m^3 of soil and waste.

Option 8: Permanent connection of Ferris Meadow Lake to the River Thames

This option requires the placement of a larger water control structure and wider flood channel within an area of historic landfill. This reduces capacity and availability of treatment centres in Surrey due to processing the site-won waste from excavation in the landfill. Also, reduced capacity and availability of permitted inert and non-hazardous landfill sites in Surrey and materials management issues from disposal of additional waste arisings from this option associated with the creation of the flood channel to the west of Ferris Meadow Lake. Soil arisings from breaching Ferris Meadow Lake is not anticipated to require much processing or waste generation. Approximately 113,000 m^3 of soil and waste is estimated to be excavated for this option.

Mitigation

A Materials and Waste, Handling, Treatment and Placement Strategy to detail waste and material recovery or disposal in accordance with standard construction practices would be required.

Application of standard construction practices in relation to handling of soils.

The project is applying the waste hierarchy. This includes, for example minimising the generation of waste, recovery of material arisings, and treatment of waste to make it suitable for recovery.

Table 9: Materials and waste appraisal

Option	RAG Status	Justification
Option 1	Low	Effects are likely to be mitigated through primary and tertiary mitigation measures and through development of a Materials and Waste, Handling, Treatment and Placement Strategy.
Option 2	Medium	This option requires the construction of a water control structure and wider flood channel within an area of historic landfill. Potential to generate more excavated waste and potentially contaminated materials, thereby reducing capacity at waste treatment centres in Surrey.
Option 3	Medium	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Potential to generate more excavated waste and potentially contaminated materials, thereby reducing capacity at waste treatment centres in Surrey.
Option 4	Medium	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Potential to generate more excavated waste and potentially contaminated materials, thereby reducing capacity at waste treatment centres in Surrey.
Option 5	High	This option has potential for high environmental effects from substantial additional waste generation and additional materials required for construction when compared to other options.
Option 6a	Low	Effects are likely to be mitigated through primary and tertiary mitigation measures and through development of a Materials and Waste, Handling, Treatment and Placement Strategy. More waste would be generated by these options compared with Option 1. However, waste generation from these options would be substantially lower than for Options 2, 3, 4 and 5.

Option	RAG Status	Justification
Option 6b	Low	Effects are likely to be mitigated through primary and tertiary mitigation measures and through development of a Materials and Waste, Handling, Treatment and Placement Strategy. Waste generation from these options would be substantially lower than for Options 2, 3, 4 and 5.
Option 7	Low	Effects are likely to be mitigated through primary and tertiary mitigation measures and through development of a Materials and Waste, Handling, Treatment and Placement Strategy. This Option requires the need for a modest volume of imported material, however it may be possible for some or all of this material to be site won.
Option 8	Medium	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Potential to generate more excavated waste and potentially contaminated materials, thereby reducing capacity at waste treatment centres in Surrey.

3.10 Noise and Vibration

Baseline

A number of receptors relevant to noise and vibration have been identified for the PEIR within 300m of Option 1 and lie close to Ferris Meadow Lake. The locations of these receptors are illustrated in Annex 1, Noise Receptors (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00139), and include:

- R108 – Ferry Lane Residential (north);
- R109 – Ferry Lane Residential (south);
- R110 – Ferry Lane Residential (central);
- R111 – Walton Lane Residential (north);
- R112 – Chertsey Road, St Nicholas Drive, Range Way, Farm Close and Desborough Close Residential (north);
- R113 - Chertsey Road, St Nicholas Drive, Range Way, Farm Close and Desborough Close Residential (south);
- R118 – Las Palmas Estate, Church Square, Church Road, Sandhills Meadow Residential; and
- R119 – Walton Lane Residential (south).

There will be some newly affected dwellings to the east of R113 along Chertsey Road which may be affected by the Ferris Meadow Lake alternative options.

Non-residential receptors including Shepperton Open Water Swim and Desborough Sailing, Skiff and Punting Clubs are also located close to the alternative options in this location. Effects may be felt upon these receptors, but they are not considered likely to be as sensitive to noise and vibration effects as residential properties.

Assessment of potential effects

The following construction effects in relation to noise and vibration may be experienced by any of the Ferris Meadow Lake options:

- Airborne noise causing a temporary disturbance to residential and non-residential receptors near construction areas. This includes noise from project construction activities including sheet piling, material excavation and earthworks, stockpiling of materials, the creation and use of the construction compounds (if required in this location), the movement of construction vehicles and equipment and other general construction activities.
- Vibration from piling activities causing a temporary disturbance to residential and non-residential receptors near to those activities.

Potential operational effects in relation to noise and vibration may include airborne noise to residential and non-residential receptors from the use of weirs and flow control structures. Potential noise associated with the creation of a marina (Option 8) has not been considered as the marina would not be delivered as part of the RTS.

Mitigation

Further survey effort and associated noise and vibration assessment is likely to be required to confirm the level of noise effect associated with options 2, 4, 5, 6a, 6b and 7 for residences along Chertsey Road. As with other sections of RTS, it is assumed that tertiary mitigation for noise and vibration effects would be implemented. Examples include Best Practicable Means Noise and Vibration Mitigation, a Traffic Management Plan and a Construction Logistics Plan.

Secondary mitigation may need to be adopted to minimise noise and vibration effects during construction and operation of the project, depending on the preferred option at Ferris Meadow Lake. This may include additional, location-specific Best Practicable Means or potential use of alternative piling methods (where practicable).

Table 10: Noise and vibration appraisal

Option	RAG Status	Justification
Option 1	Medium	The largest potential effects associated with this option are during construction to the Ferry Lane residential receptors located directly adjacent to the proposed channel alignment (R108-R110).
Option 2	Medium	The largest potential effects are during construction on residential receptors adjacent to the Chap (R112, R113 and R118, plus potential newly identified receptors will be affected, particularly associated with sheet piling).
Option 3	Medium	This option would affect the same receptors as Option 1 (i.e. Receptors R108-110), but the magnitude and duration of effects is likely to be larger due to the increased length of engineered/sheet piled channel.
Option 4	Medium	This option is likely to affect all receptors present to some extent (i.e. R108-110 and R112,113,118 plus newly affected receptors to the east of R113). This option would potentially have the greatest construction noise effects as it would have the combined noise of that considered for Options 2 and 3 above.
Option 5	Medium	This option is likely to result in less airborne noise during construction to some receptors than other options, though this would depend on more detailed information such as the size and position of shafts required and requirement for night-time working. There may be greater ground borne noise and vibration though likely distance from receptors would reduce potential effects. There may be some operational noise associated with pumps etc if required.
Option 6a	Medium	Similar residential receptors affected by construction to those affected by Option 1, though the highest noise levels and impact durations may be increased at properties on Chertsey Lane, north of Ferry Lane and Desborough Close due to works to construct the augmented flow channel.

Option	RAG Status	Justification
Option 6b	Medium	Similar residential receptors affected by construction to those affected by Option 1, though highest noise levels and impact durations may be increased at properties on Chertsey Lane, north of Ferry Lane and Desborough Close due to works to construct the augmented flow channel.
Option 7	Medium	This option is likely to affect all receptors present to some extent (i.e. R108-110 and R112,113,118 plus newly affected receptors to the east of R113) due to the extensive length of piling required.
Option 8	Medium	Similar residential receptors affected by construction to those affected by Option 1. The largest potential effects associated with this option are during construction – in particular, effects to the Ferry Lane residential receptors located directly adjacent to the proposed channel alignment (R108-R110).

3.11 Socio-economics

Baseline

Shepperton Open Water Swim operates on Ferris Meadow Lake, providing paid for open water swimming facilities to the general public.

Desborough Sailing Club is located on the Eastern bank of the Chap (part of the River Thames) and provides dinghy sailing facilities to club members. Sunbury Skiff and Punting Club also operates from the Desborough Sailing Club facilities.

There are a series of residential properties which back on to the Western bank of the Chap and have moorings for small boats, these are located off Desborough Close and Chertsey Road. There are also residential properties, and commercial and industrial businesses along Ferry Lane and Towpath. Some of the land on the right bank (south side) of the Chap is also private land and gardens associated with nearby residential properties and includes a small private chapel.

National Cycle Route 4 (NCR4) runs along Ferry Lane between Chertsey Road and the Shepperton-Weybridge pedestrian ferry. The TPNT also runs along Ferry Lane from Chertsey Road and along Towpath. The PRoW Walton & Weybridge 27a runs around the perimeter of Desborough Island.

Socio-economic and recreation receptors are shown on Annex 1 Socio-Economics and Recreation (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00140).

Assessment of potential effects

Option 1: Flood relief channel via the Lake

The construction of Option 1 has the potential to affect water quality within Ferris Meadow Lake, for example from material excavation, which could lead to a temporary closure of the lake to swimmers until water quality levels had returned to acceptable levels.

The operation of Option 1 has the potential to affect water quality within Ferris Meadow Lake through the introduction of water from the River Thames via the augmented flow. The deterioration of water quality is not anticipated to be sufficient to affect human health (see Section 4.7), however, the deterioration may still be perceived to affect human health, deterring people from swimming. This may have an impact on the Shepperton Open Water Swim business although it is not considered that it would result in a permanent loss of business and employment opportunities, or provision of a recreational facility. The impact is likely to be temporary as water will meet sufficient standards for swimming (see Appendix F) and confidence is expected to return over time.

Option 2: Flood relief channel via the Chap;

Construction has the potential to affect water quality within Ferris Meadow Lake, for example from material excavation, which could lead to a temporary closure of the lake to swimmers until water quality levels had returned to acceptable levels.

Option 2 would result in the loss of private land on the south bank of the Chap, although the private chapel would not be directly affected. Option 2 is likely to affect the ability of residents and Desborough Sailing Club and Sunbury Skiff and Punting Club members from using the Chap during construction. The widening of the Chap would result in the removal of moorings and berths and the clubhouse of Desborough Sailing Club, these would need to be reinstated and relocated respectively. While the widening of the Chap would reduce the land available to Desborough Sailing Club, assuming reinstatement of moorings, berths and the clubhouse are sufficient then there are not considered to be any substantial operational effects. There may be minor impacts (e.g. disturbance) during construction to the operation of Shepperton Open Water Swim, however this would not prevent the business from operating as usual.

Option 3: Flood relief channel west of the Lake

There may be minor effects (e.g. disturbance) during construction of Option 3 to the operation of Shepperton Open Water Swim, which could prevent the business from operating as usual. The realignment of some sections of the lake edge during construction has the potential to result in sediment entering the lake and affecting water quality, which could lead to a temporary closure of the lake to swimmers until water quality levels had returned to acceptable levels.

Option 4: Flood relief via both the Chap and west of the Lake

Option 4 is likely to have similar effects to that described for Options 2 and 3, but with a reduced impact to users of the Chap due to the channel not being widened and a reduced impact to the operation of Shepperton Open Water Swim as the new flood channel would not require the realignment of the lake edge.

Option 5: Underground engineered solution

Option 5 is not likely to affect the use of Ferris Meadow Lake or the Chap. There may be some disturbance to residences and recreational users of Ferris Meadow Lake and the Chap from noise and vibration during construction (see Section 3.10 for further details). Option 5 would require the permanent diversion of the PRoW around Desborough Island, which, due to the presence of the tunnel outlet, would result in a reduced length of footpath.

Option 6a flood relief channel via the Lake with augmented flow to the Chap and

Option 6b as above with additional control structure

Effects from the construction of Options 6a and 6b would be the same as that described for Option 1. The operation of Option 6a would reduce the effect on water quality (compared with Option 1) by diverting the augmented flow directly into the River Thames. However, the risk remains of a mixing of flow between the augmented flow and Ferris Meadow Lake and therefore the perceived risk to human health may remain thereby impacting the Shepperton Open Water Swim business, although this effect may reduce over time as effects are understood. This effect would be removed through the implementation of Option 6b. Options 6a and 6b would still result in the lake receiving river waters during a flood, which could result in a temporary deterioration of water quality but is similar to the current situation and more likely during winter months when the lake is not used for swimming.

Option 7: Division of Ferris Meadow Lake

Option 7 is likely to have similar effects during construction to those described for Option 1. There will however be an increased risk of a temporary deterioration of water quality within Ferris Meadow Lake due to the installation of the two rows of sheet piles through the middle of the lake. There may also be some additional disruption to the operation of Shepperton Open Water Swim in the event that a temporary closure is required during installation of the sheet piles.

There are not considered to be any effects during operation. As Shepperton Open Water Swim only use the eastern half of Ferris Meadow Lake they would be able to operate as usual.

Option 8: Permanent connection of the Lake to the River Thames

Option 8 is likely to have similar effects during construction to those described for Option 1. However, the creation of a direct connection between Ferris Meadow Lake and the River Thames has the potential to permanently affect the water quality within Ferris Meadow Lake through the introduction of water from the River Thames. This could result in permanent impacts to the Shepperton Open Water Swim business and recreational facility.

The permanent connection of Ferris Meadow Lake with the River Thames would provide the opportunity for alternative businesses to establish, for example a marina. There is however no guarantee that new business would be established, and the project is not responsible for delivering this.

All options

All options would require the temporary diversion of the Thames Path National Trail (TPNT) and NCR4 along Ferry Lane during construction.

Mitigation

Stakeholder engagement, temporary PRoW diversions and standard construction practices for air quality, noise, traffic and water would be required for all options.

Table 11: Socio-economic appraisal

Option	RAG Status	Justification
Option 1	Medium	Potential for impact to Shepperton Open Water Swim business and use as a recreational facility from perceived reduction in water quality, although this may reduce over time as confidence grows (water quality is anticipated to be Good).
Option 2	Medium	Adverse effects to residents and sailing clubs during construction including the removal of the clubhouse. Option has the potential to deliver enhanced facilities to sailing clubs.
Option 3	Low	Potential for disturbance to Shepperton Open Water Swim during construction and potential for temporary deterioration of water quality from realignment of lake edge. No negative effects anticipated during operation due to segregation of flood channel from swimming lake.
Option 4	Low	Similar effects to that described for Option 2 but with reduced impact to users of the Chap due to the channel not being widened.
Option 5	Low	Potential for disturbance to residences and recreational users of Ferris Meadow Lake and the Chap during construction. Permanent diversion of short section of PRoW around Desborough Island.

Option	RAG Status	Justification
Option 6a	Medium	Potential for permanent impact to Shepperton Open Water Swim business and use as a recreational facility from perceived reduction in water quality.
Option 6b	Low	Diversion of augmented flow through the Chap limits effects on recreational use of Ferris Meadow Lake.
Option 7	Low	Potential for disturbance to Shepperton Open Water Swim during construction and potential for temporary deterioration of water quality from realignment of lake edge. No negative effects anticipated during operation due to separation of flood channel from swimming lake.
Option 8	High	Potential for permanent impact to Shepperton Open Water Swim business and use as a recreational facility.

3.12 Soils and Land

Baseline

The shallow geology in the area surrounding Ferris Meadow Lake is a combination of Alluvium (clay and silt), and the Shepperton Gravel Member (sandy gravel). The bedrock geology comprises the London Claygate Member (sandy clay), the Bagshot Formation (sand), and the London Clay Formation (silty clay). The land does not suffer from any significant instability issues (BGS, 1999).

Made ground is soil or other materials (such as building demolition waste materials) that have been placed or altered by human activity. Made ground and landfill waste are known to be present throughout the area.

The land to the west of Ferris Meadow Lake is a historic landfill site. Landfills may contain hazardous waste that could pose a risk to humans and the environment. Contamination from sources such as the landfills, made ground, farming activities, or industrial land use has the potential to spread through the ground and groundwater. The contamination could cause effects to land and controlled water receptors in the study area, as well as to human health.

Shallow soils to the west of Ferris Meadow Lake and on Desborough Island are known to comprise loamy and clayey floodplain soils with naturally high groundwater levels. There is a small area of Agricultural Land Classification (ALC) Grade 2 (very good) agricultural land abutting the north east edge of Ferris Meadow Lake and the eastern extent of the Chap.

Assessment of potential effects

Option 1: Flood relief channel via the Lake

The option requires the flood channel to run through landfill potentially creating a risk of new pollutant pathways between the historic landfill site (as well as other areas of potentially contaminated land within the area) and receptors including human health, soils, controlled waters, and ecological receptors. However, these potential effects are likely to be managed by scheme design (the flood channel being designed to separate waters within the flood channel from the underlying landfill and risks managed by the waste permitting regime). This option requires the least amount of excavation within the landfill when compared to other options, minimising risks from contamination migration, ground gas release and negative effects from processing contaminated materials and waste.

Option 2: Flood relief channel via the Chap; Option 3: Flood relief channel west of the Lake; Option 4: Flood relief via both the Chap and west of the Lake

These options require the placement of a larger water control structure and wider flood channel within an area of historic landfill. This creates the possibility for additional effects associated with the potential for new pollutant pathways between the historic landfill site (as well as other areas of potentially contaminated land within the area) and receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill when compared to Options 1, 6a, 6b and 7 increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste.

Option 5: Underground engineered solution.

This option requires the placement of a larger water control structure and wider flood channel within an area of historic landfill. This creates the possibility for additional effects associated with the potential for new pollutant pathways between the historic landfill site (as well as other areas of potentially contaminated land within the area) and receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill for the tunnel excavation when compared to all other options increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste.

Option 6a flood relief channel via the Lake with augmented flow to the Chap and 6b as above with additional control structure

These options require an additional flood channel for the augmented flow and inlet structure within part of a historic landfill. This creates the possibility for additional effects associated with the potential for new pollutant pathways between the historic landfill site (as well as other areas of potentially contaminated land within the area)

and receptors including human health, soils, controlled waters, and ecological receptors. However, this effect would be substantially lower than for Options 2, 3, 4, 5 and 8 that would require more excavation within areas of landfill. These new structures would also generate additional risks associated with excavation. However, the features are relatively small, so the additional excavation required within the landfill and associated risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste is reduced compared to Options 2, 3, 4, 5 and 8.

Option 7: Division of Ferris Meadow Lake

Option 7 follows the line of Option 1 through an historic landfill with an additional bund to divide the portion of Ferris Meadow Lake used by swimmers from the portion flooding from the River Thames would travel. This option requires the same amount of excavation within the landfill as Option 1, minimising risks from contamination migration, ground gas release and negative effects from processing contaminated materials and waste.

Option 8: Permanent connection of the Lake to the River Thames

Option 8 involves the construction of a structure within an historic landfill that is a similar size to that of Options 2, 3, and 4. This creates the possibility for additional effects associated with the potential for new pollutant pathways between the historic landfill site (as well as other areas of potentially contaminated land within the area) and receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill when compared to Options 1, 6a and 6b increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste. The sheet piled channel edge and Footbridge (FBR7) would not have an impact on soils.

The erosion protection to the new channel bed would have a small positive impact as it would protect receptors from soil contamination (if any) arising from that portion of land, but this would be massively outweighed by the impact from constructing relatively large structures within the area of the landfill.

Mitigation

Mitigation would include application of standard construction practices in relation to handling of soils, in addition to risk assessment / modelling of landfill leachate / ground gas migration. Any works within or affecting landfills or involving waste would be subject to the requirement of an environmental permit under the Environmental Permitting (England and Wales) Regulations 2016.

Options that fall outside of the existing project boundary for EIA PEIR would require additional ground investigation (GI) which would inform mitigation measures. Geotechnical and geoenvironmental investigations, involving intrusive sampling and testing of the underlying soils, bedrock, and groundwater, and ground gas to determine characteristic geotechnical and chemical properties of materials underlying the site in

accordance with the Water Resources Act 1991 (as amended) and Part 2A of the Environmental Protection Act 1990 supplemented by the Contaminated Land Regulations 2012. Results and interpretation of the GI data informs development of primary, tertiary, and secondary mitigation that may influence design.

At this stage, it is considered that risks of not being able to fully mitigate effects are higher where new areas of landfill are encountered.

Table 12: Soils and land

Option	RAG Status	Justification
Option 1	Low	Effects are likely to be mitigated through primary and tertiary mitigation measures and through development of a Materials and Waste, Handling, Treatment and Placement Strategy.
Option 2	High	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Additional potential effects from new pollutant pathways to receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste.
Option 3	High	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Additional potential effects from new pollutant pathways to receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste.

Option	RAG Status	Justification
Option 4	High	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Additional potential effects from new pollutant pathways to receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill when compared increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste.
Option 5	High	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Additional potential effects from new pollutant pathways to receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill for the tunnel excavation when compared to other options increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste.
Option 6a	Medium	The option requires an augmented flow channel and inlet structure within part of a historic landfill. Additional effects associated with the potential for new pollutant pathways. However, this effect would be substantially lower than for Options 2, 3, 4, 5 and 8 that would require more excavation within areas of landfill.
Option 6b	Medium	The option requires an augmented flow channel and inlet structure within part of a historic landfill. Additional effects associated with the potential for new pollutant pathways. However, this effect would be substantially lower than for Options 2, 3, 4, 5 and 8 that would require more excavation within areas of landfill.

Option	RAG Status	Justification
Option 7	Low	Effects are likely to be mitigated through primary and tertiary mitigation measures and through development of a Materials and Waste, Handling, Treatment and Placement Strategy.
Option 8	High	This option requires the construction of a larger water control structure and wider flood channel within an area of historic landfill. Additional potential effects from new pollutant pathways to receptors including human health, soils, controlled waters, and ecological receptors. A larger weir structure within the area of landfill could create a greater risk of landfill gas and leachate release from compression. The increased amount of excavation required within the landfill increases risks from contamination migration and negative effects from processing contaminated materials, groundwater and waste.

3.13 Traffic and Transport

Baseline

The area around Ferris Meadow Lake is characterised by small local roads. Ferry Lane runs down the western side of the lake from Chertsey Road to the north down to the River Thames where it becomes Towpath. Here it runs east-west along the shore of the River Thames before terminating at the junction of Abbey Road (private road) and a one-way section of Towpath that runs east only.

National Cycle Route 4 (NCR4) runs along Ferry Lane between Chertsey Road and the Shepperton-Weybridge pedestrian ferry. The Thames Path National Trail (TPNT) also runs along Ferry Lane from Chertsey Road and along Towpath. The Public Right of Way (PRoW) Walton & Weybridge 27a runs around the perimeter of Desborough Island.

Assessment of potential effects

All options are likely to result in localised temporary disruption and delay to traffic, pedestrians, equestrians and cyclists along Ferry Lane during construction.

Each option will generate different volumes of excavated material and this will affect the number of HGV movements on the local road network required to move the material offsite. Approximate volumes of material to be excavated for each option and the associated number of hourly HGV trips required is provided in Table 13. The hourly

HGV trip numbers have been generated based on similar assumptions to those utilised for the assessment of Option 1 in the PEIR:

- All options will have a 6-month construction period
- All material will be transported to the Sheep Walk Processing Hub via internal haulage routes
- HGV capacity (8m^3) and construction hours (0800-1800)
- For Options 2-8 it is assumed as a worst-case scenario that all additional material excavated will be transported to market away from the processing hub via route K with none of the material reused within the project.

Table 13: Traffic and transport appraisal

Option	Approximate Material Excavated (m^3)	Total Hourly Trips (Total Daily Trips / 10)
Option 1	55,500	13
Option 2	105,000	24
Option 3	144,000	32
Option 4	125,000	28
Option 5	217,500	47
Option 6a	59,500	14
Option 6b	59,500	14
Option 7	55,500	13
Option 8	98,000	23

Options 1, 6a, 6b and 7 are likely to generate the lowest HGV movements, with Options 2, 3, 4, 5 and 8 likely to generate higher volumes of excavated material and waste leading to a higher number of HGV movements on the local road network.

Option 7 will require additional material movements into the site to construct the two rows of sheet piles filled with suitable material. Some of the infill material may be site won, this is to be confirmed.

Option 5 would likely require additional plant requirements, which could lead to an increase in abnormal deliveries and heighten the effect on the construction routes. Option 5 would also require the permanent diversion of the PRoW around Desborough

Island, which, due to the presence of the tunnel outlet, would result in a reduced length of footpath.

Mitigation

Effects would be mitigated through a Traffic Management Plan (TMP) (tertiary mitigation) to ensure that all highways works are safe, planned and co-ordinated to secure the expeditious movement of traffic on the road network and to minimise inconvenience to the public. The TMP would include for the safe diversion of pedestrians, equestrians and cyclists using the TPNT and NCR4.

Effects associated with an increase in HGV movements on the local road network would be greatest for Options 2, 3, 4, 5 and 8. An extended construction period, to the 6 months assumed, would reduce the number of daily and hourly trips. To bring the effects down to more acceptable levels an extension of one month for Option 2 and 8 and 2 months for Option 4 would reduce trip numbers down to levels comparable with Option 1. Option 3 would require a further five-month time extension with Option 5 needing over double the time frame to reduce hourly HGV trips to a manageable level.

Alternatively if a greater volume of the excavated material could be reused within the project (to be investigated) this would reduce the number of daily and hourly HGV trips.

Table 13: Traffic and transport appraisal

Option	RAG Status	Justification
Option 1	Low	Any effect on traffic, pedestrians, equestrians and cyclists are likely to be mitigated through the development of a TMP.
Option 2	Medium	Based on the assumptions stated, the number of daily and hourly HGV trips required would be difficult to manage with standard mitigation. This might require a programme extension of one month to reduce hourly HGV movements to manageable levels, unless reuse of excavated material within the project is feasible.
Option 3	High	Based on the assumptions stated, the number of daily and hourly HGV trips required would be very difficult to manage with standard mitigation. This might require a programme extension of five month to reduce hourly HGV movements to manageable levels, unless reuse of excavated material within the project is feasible.

Option	RAG Status	Justification
Option 4	Medium	Based on the assumptions stated, the number of daily and hourly HGV trips required would be difficult to manage with standard mitigation. This might require a programme extension of two months to reduce hourly HGV movements to manageable levels, unless reuse of excavated material within the project is feasible.
Option 5	High	Based on the assumptions stated, the number of daily and hourly HGV trips required would be very difficult to manage with standard mitigation. This might require a programme extension of six months to reduce hourly HGV movements to manageable levels, unless reuse of excavated material within the project is feasible.
Option 6a	Low	Any effect on traffic, pedestrians, equestrians and cyclists are likely to be mitigated through the development of a TMP.
Option 6b	Low	Any effect on traffic, pedestrians, equestrians and cyclists are likely to be mitigated through the development of a TMP.
Option 7	Low	Any effect on traffic, pedestrians, equestrians and cyclists are likely to be mitigated through the development of a TMP.
Option 8	Medium	Based on the assumptions stated, the number of daily and hourly HGV trips required would be difficult to manage with standard mitigation within the project programme. This might require a programme extension of one month to reduce hourly HGV movements to manageable levels, unless reuse of excavated material within the project is feasible.

3.14 Water Environment

Baseline

All waterbodies related to this study are shown in Annex 1, Water Environment (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00141), including Ferris Meadow Lake (the main lake), Ferry Lane West Lakes 1, 2 and 3, the River Thames and another main river, the Chap.

Ferris Meadow Lake

Ferris Meadow Lake is an offline, still, water body that is hydraulically connected to the River Thames through groundwater (Chobham and Bagshot Beds groundwater body). It is not designated as a water body under the Water Framework Directive (WFD).Although it is maintained and used for swimming, it is not a designated Bathing Water (although an application for Bathing Water status has been made by the lake owners). Microbiological monitoring for bathing water quality has been carried out on the lake, as part of the collection of baseline information for the Project, although the results have not been formally reported to the Environment Agency. Based on this monitoring[1] the lake would theoretically be classified as 'Excellent', when compared with the standards set out in the Bathing Water Regulations. Other recreational uses include boating.

Lake condition assessment (which is an assessment as to how close to natural conditions a lake is based on its physical, hydrological, chemical and biological characteristics) has determined a fairly good condition for the bed, bank and vegetated margins. Although the vast majority of the lake edge is shaded by overhanging trees which limits development of marginal vegetation; one stretch has been cleared and supports a diverse range of aquatic and wetland plants.

The benthic invertebrate species found in the lake is indicative of an enriched, heavily sedimented water body.

The Ferris Meadow Lake Water Quality Assessment (Appendix F) covers the current water quality of Ferris Meadow Lake in detail. In summary, nutrients such as Total Nitrogen (TN) and Total Phosphorous (P) are present in the lake at low levels. Biochemical Oxygen Demand (BOD) and Dissolved Oxygen (DO) levels also indicate that the lake has good water quality and the presence of chemical pollutants is also low.

Normal water level range is between 8.4m AoD and 9.28m AoD and has clear seasonal variation. Average total lake area is 104,916m^2. Modelled lake volume comprises 283,954m^3 (during drought conditions reference year 2016/17) to 300,516m^3 (during wet conditions reference year 2009/10). Ferris Meadow Lake typically has a wet period residence time of 25 days and dry period residence time of 299 days.

[1] Which measures numbers of bacterial colonies in a 100ml water sample, as an indication of the presence of faecal matter in the water, to classify the bathing water status as Excellent, Good, Sufficient or Poor

Ferris Meadow Lake currently floods during moderate fluvial flood events from the River Thames. This typically occurs for a flood event with a 50% (1 in 2) annual chance flood. During floods, riverine fish can become trapped within the Lake once waters have receded.

Ferris Meadow Lake lies on bedrock geology of Claygate member formation and superficial geology of Shepperton gravel member. This forms part of the WFD groundwater body Chobham and Bagshot beds, which has a an overall WFD status of Poor (quantitative and chemical status combined). Lake level interaction with groundwater is based on RTS surveys, which concluded that the lake appears to be in good hydraulic connection with the gravel aquifer. However, there are large areas of landfill to the north and west which would reduce groundwater flows in this direction.

The water quality data available for the lake indicates that the lake water quality is good despite being influenced by the ingress of groundwater from the Chobham and Bagshot Beds, which is of poorer chemical quality. In addition, infrequent ingress of flood water from the River Thames (albeit mainly outside of the summer season) could also be adversely contributing to the present water quality of Ferris Meadow Lake as water quality monitoring and analysis suggest comparatively poorer levels of P in the River Thames - although the impacts of such ingress do not appear to be adversely affecting the current levels of P in the lake.

The lake is known to support the South West London Waterbodies SPA by providing an open water habitat for two key species of migratory birds (Gadwall, *Anas strepera* and Shoveler, *Anas clypeata*). Aquatic Invasive Non-native Species (INNS), Himalayan (Balsam *Impatiens glandulifera)* and Canadian waterweed *(Elodea canadensis)* are present within the lake.

As with other lakes in the area, Ferris Meadow Lake is within the Lower Thames Drinking Water Protected Area and Safeguard Zone (Cookham-Egham-Teddington). Drinking Water Safeguard Zones (Surface Water) are catchment areas that influence the water quality for their respective Drinking Water Protected Area (Surface Water). They are identified where the protected area has been assigned as being "at risk" of failing the drinking water protection objectives of the Water Environment (Water Framework Directive) (England & Wales) Regulations 2017.

Ferry Lane West 1 Lake

Ferry Lane West 1 Lake is a small still waterbody part of the Ferris Meadow Lake system, predominantly groundwater fed but seasonally connected to the River Thames, via the Chap. It is not designated under the WFD.

No survey information is available for Ferry Lane West 1 Lake and a condition assessment has not been carried out. There is no data on residence times, although based on proximity to Ferris Meadow Lake and the size of the Lake, it is expected to be shorter, but frequency of flooding from the River Thames potentially similar. Water quality is expected to be of similar quality to Ferris Meadow Lake.

For surface water dependent habitats, there are no species or habitats of conservation concern based on desk-based assessments.

There is no in-water recreational use, and therefore there is no direct dependency on water quality and hydromorphology.

Ferry Lane West 2 Lake

Ferry Lane West 2 Lake is also a small still waterbody part of the Ferris Meadow Lake system, predominantly groundwater fed but seasonally connected to the River Thames, via the Chap. It is not designated under the WFD.

No survey information is available for Ferry Lane West 2 Lake and lake condition assessment has not been carried out. There is no data on residence times, although based on proximity to Ferris Meadow Lake and the size of Ferry Lane West 2 Lake, it is expected to be shorter, but frequency of flooding potentially similar. Water quality is expected to be of similar quality to Ferris Meadow Lake.

For surface water dependent habitats, there are no species or habitats of conservation concern based on desk-based assessments.

There is no in-water recreational use, and therefore there is no direct dependency on water quality and hydromorphology.

Ferry Lane West 3 Lake

Ferry Lane West 3 Lake is also a small still waterbody part of the Ferris Meadow Lake system, predominantly groundwater fed but seasonally connected to the River Thames, via the Chap. It is not designated under the WFD.

No survey information is available for Ferry Lane West 3 Lake and lake condition assessment has not been carried out. There is no data on residence times, although based on proximity to Ferris Meadow Lake and the size of Ferry Lane West 3 Lake, it is expected to be shorter, but frequency of flooding potentially similar. Water quality is expected to be of similar quality to Ferris Meadow Lake.

For surface water dependent habitats, there are no species or habitats of conservation concern based on desk-based assessments.

There is no in-water recreational use, and therefore there is no direct dependency on water quality and hydromorphology.

The Chap

The Chap is a main river, directly connected with the River Thames at Desborough. It is a an artificially dug channel, with boat moorings and is used for in and on water recreation.

No direct water quality monitoring has been undertaken on the Chap, however as it is directly connected with the River Thames, it has the potential to be of similar water quality. It is not designated a WFD waterbody, however, is considered as part of the Thames (Egham to Teddington) waterbody. It is assumed that the Chap is different within its upper reaches away from the River Thames where there is no flow and direct input from the River Thames (e.g. it could act more like a canal and have potentially low dissolved oxygen concentrations). The Chap therefore provides a backwater

habitat for the River Thames and is observed to provide fish refuge habitat during high flows and also fish spawning habitat.

For surface water dependent habitats, there are no species or habitats of conservation concern based on desk-based assessments.

Assessment of potential effects

Potential construction effects

Construction impacts would be able to be minimised through the use of construction standard practice. During general construction of the channels upstream of Ferris Meadow Lake, excavation through areas of historic landfill may mobilise contaminants in groundwater with a risk of their transferral to downstream receptors including Ferris Meadow Lake. However, these impacts on controlled waters (which include Ferris Meadow Lake) are considered to be low to moderate and would be able to be validated through a hydrogeological risk assessment to assess any risks to contamination of groundwaters and surface waters from construction.

During construction all options would have a risk of spillage of chemicals (such as oils, cleaning products, etc.), which could result in contaminated or polluted run-off entering water bodies temporarily although such risks would be mitigated through standard practice in storing and handling such chemicals. Other construction impacts could be bed/bank disturbance and increased turbidity leading to a potential overall temporary decline in water quality, which would also limit recreational use. This effect for Option 2 would be reduced within Ferris Meadow Lake but increased for the Chap as there would be works within its channel and vice versa for Option 1, where affects to the Chap would be reduced. Option 5 would avoid construction effects to all water bodies.

During construction in Option 2 and 4, bed and/or bank lowering, and excavations would be required for the Chap, potentially increasing hydromorphological effects.

Potential operational effects

The potential operational effects of the options will vary according to whether the augmented flow and/or flood flows pass through Ferris Meadow Lake, the Chap or the other lakes. Depending on the option selected, the augmented flow and flood flows will both have the potential to introduce water from the River Thames into Ferris Meadow Lake.

Ferris Meadow Lake is currently subjected to periodic inundation from the River Thames and, with RTS in place (under all options) will be receiving flood flows from the River Thames on a similar frequency to existing conditions, which will include the input of nutrients, microbes, and pollutants. However, with options 1, 6a, 6b and 7, it will be less likely to receive poor quality water from the Wey and Chertsey Bourne catchment under flood conditions as flood flows will be diverted through the channels and flooding of the lake via overtopping of the River Thames, as occurs currently, will be reduced, which would be an improvement from current conditions. For Options 2 and 5 flood flows to the lake from the channels will be avoided as well as the frequency of overtopping being reduced.

When the RTS is not in operation under flood conditions, the augmented flow will provide a continuous source of River Thames water to the online sections of the Spelthorne Channel, including Ferris Meadow Lake (depending on the option). The lake is used for swimming and therefore the potential impacts of the augmented flow on lake water quality are more relevant than the impacts of flood flows which, as stated above would be unlikely to make water quality worse within the lake (under options 1, 6a, 6b, and 7) even in the situation where there was a 1 in 20-year flood during the summer months.

The focus of the assessment below therefore relates mainly to the potential impacts of the augmented flow (i.e. non flood conditions) on water quality with reference to flood flows where applicable.

During augmented flow conditions, of all the options, Options 1, 6a, 7 and 8 are likely to lead to the greatest negative effects to Ferris Meadow Lake from mixing of river water with the lake water as the lake is not avoided (although noting that the operational effects for Option 7 are less, as half of the existing lake would be separated by a bund and therefore not receive the augmented flow or flood flows). These potential affects for all of these options are described below.

For hydromorphology, the augmented flow would potentially result in some erosion of the bed and deposition at the lake margins. Flows would permanently change the sediment carrying capacity within the lake. In addition, there would be a permanent increase in lake level. It is expected lake edge habitats and characteristics would be permanently altered. Such hydromorphological changes are not necessarily detrimental (for example deposition of sediment at the lake margins may favour the establishment of marginal vegetation) but do represent a change compared to current conditions.

For water quality, the increased fluvial input would result in increased nutrients, in addition to contaminants from the River Thames, connected lakes upstream and from landfill (e.g. through providing a pathway for pollutants to enter the lake). The increase in nutrients would potentially increase the risk of algal blooms occurring over and above existing occurrences. However, algal blooms are related to residence times (i.e. the longer the residence time, the longer the length of time water stays in the lake without being replaced through circulation and therefore the higher the risk of algal blooms occurring) and since the augmented flow would help reduce residence times in the lake this would help to mitigate the risk of such algal blooms. However, it cannot be guaranteed that this would reduce algal blooms over and above existing levels. For further information and evidence, see the Ferris Meadow Lake Water Quality Assessment in Appendix F.

Microbial ingress into the lake could potentially increase, although this is not expected to have a significant impact on bathing water quality, and Ferris Meadow Lake faecal indicator organisms (FIOs) would remain below the minimum standards (under the Bathing Water Regulations) and therefore remain safe for in water recreation. Analysis of decay rates of FIOs suggests a T90 value (the amount of time for 90% of viable cells to die) of 20 days. This is less than the estimated annual average time of travel

for anything travelling from the Spelthorne Channel intake to reach Ferris Meadow Lake, of approximately 45 days, as predicted by modelling of residence times during years with no flooding (see Appendix F). As such, this indicates that during augmented flow conditions FIOs are unlikely to reach Ferris Meadow Lake, through the Spelthorne Channel from the River Thames, in a viable state or in such numbers to cause a risk to human health. Therefore, Ferris Meadow Lake would be expected to support a classification of at least a Good Bathing Water classification.

Potential water quality impacts would not prevent the use of the lake for recreational purposes. However, the augmented flow will generate a current which should be avoided in the immediate vicinity of the point where the channel joins the lake, for reasons of health and safety. For surface water dependent biodiversity, the altered flow regime and water quality has the potential to affect macrophyte, invertebrate, fish and marginal habitats. These effects represent changes, although these may not necessarily be negative and may have positive effects, for example potential increased growth of macrophytes may enhance the available habitats for migratory birds.

Reduced residence times, increased flow and greater turnover of sediment through the lake, have the potential to offset the increased nutrient concentrations which risk generating algal blooms. However, this is not necessarily to a greater level than would otherwise be occurring without RTS in place.

Options 2, 3, 4 and 5 would have reduced effects to Ferris Meadow Lake as there would be no direct input of water through the lake, however there would be construction nearby (see potential construction effects above), in addition to the continued likely ingress of flood waters. This ingress of flood waters is however similar to baseline conditions. In addition, Option 3 would require a realignment of the lake edge which would result in permanent hydromorphological change, however this may present an opportunity for enhancement. During construction this could result in a small decline in water quality and disruption to recreation but would be unaffected during operation. Options 6a and 6b are likely to lead to adverse effects to Ferris Meadow Lake as flood flows would enter the lake. Although the lake currently receives river waters during a flood, this would be more formalised. Upstream online waterbodies may attenuate some of the impacts of the inflows from the River Thames. This would also result in the influx of lake water from upstream waterbodies not previously hydraulicly connected. This could result in ingress of additional nutrients, microbes and pollutants reducing water quality within Ferris Meadow Lake, and also reducing bathing water quality for recreation, during a flood which is more likely to occur outside the summer season. Additionally, for Option 6a ingress of additional nutrients, microbes or pollutants, could occur into Ferris Meadow Lake during non-flood conditions due to the potential mixing of flow between the augmented flow and Ferris Meadow Lake. As the augmented flow will predominately flow through the Chap, circulation through Ferris Meadow Lake will be low, increasing the residence time of the lake, allowing sediments and nutrients to settle in the lake, between flood events. There is therefore a risk that the increased residence time and continual input of nutrients, will increase the risk of eutrophication in the lake.

Water quality impacts to the Chap from Options 1, 3, 7 and 8 would likely be very minor, due to little interaction with the channel.

Under Options 2, 4, 5, 6a and 6b the augmented flow would be diverted through the Chap but since the Chap is already directly connected to the River Thames as a backwater, water quality impacts resulting from mixing with the augmented flow would be likely to be minimal. For hydromorphology this would result in a change to flows and sediment transport. Residence time would also be reduced. Influx of water from upstream lakes would potentially add nutrients and pollutants, however effects to quality would likely be limited.

Likely impacts to Ferry Lane West 1 are expected to be similar for options 2, 4, 5, 6a and 6b as these options connect the augmented flow through the Chap which is connected to this lake. There will be ingress of nutrient rich waters from the River Thames known to be below EQS although it is not known what the water quality is within the Lake but itis expected to be similar to Ferris Meadow Lake and therefore may decrease against the EQS. There will also be an increase in lake level, change to flows, increase in sediment transport and change to lake characteristics due to effectively bringing this lake online.

Likely impacts to Ferry Lane West 2 Lake are expected to be similar for Options 2 and 4, as there will be ingress of nutrient rich waters from the River Thames known to be below EQS although it is not known what water quality is within the Lake, it is expected to be similar to Ferris Meadow Lake and therefore may represent a decrease in quality against EQS. There will also be an increase in lake level, change to flows, increase in sediment transport and change to lake characteristics due to bringing the lake online and permanent loss of a section of the lake.

Likely impacts to Ferry Lane West 3 Lake are expected to be similar for Options 1, 3, 6a, 6b, 7 and 8 as there will be ingress of nutrient rich waters from the River Thames known to be below EQS although it is not known what water quality is within the Lake, it is expected to be similar to Ferris Meadow Lake and therefore may represent a decrease in quality against EQS. There will also be an increase in lake level, change to flows, increase in sediment transport and change to lake characteristics due to bringing the lake online and permanent loss of a section of the lake.

Mitigation

All construction effects would be mitigated though, for example, the use of standard construction practices.

As operational effects between Ferris Meadow Lake and the Chap differ for all Options, the effects would be mitigated through hydromorphological design within those waterbodies, which would also consist of aquatic and marginal habitat enhancement. In addition, the flood channel could also be ecologically enhanced.

For Options 2, 4, 5, 6a and 6b water quality monitoring through construction and operation may lead to the requirement for remedial actions to be carried out pending the monitoring results at the Chap.

Table 14: Water environment appraisal

Option	RAG Status	Justification
Option 1	Medium	Mixing of water from the River Thames due to the presence of the augmented flow (in non-flood conditions and therefore mainly in the summer months) is not anticipated to introduce Faecal Indicator organisms (FIOs or bacteria) in a viable state or in numbers that would cause a risk to human health and would be expected to support a classification of at least a Good Bathing Water status at the Ferris Meadow Lake. Mixing river water with lake water is anticipated to increase nutrient conditions, and other contaminants in the lake. However, effects of increased nutrients and the consequent risk of algal blooms occurring over and above existing levels will be mitigated against by having a continuous augmented flow into the lake reducing the residence times in the lake (shorter residence times are known to help prevent algal blooms). In the case of contamination, risks will be significantly reduced through mitigation. In terms of flood flows, Ferris Meadow Lake is currently subjected to periodic inundation from the River Thames and, with RTS in place will be receiving flood flows from the River Thames on a similar frequency to existing conditions, which will include the input of nutrients, microbes, and pollutants. Under Option 1 it will not receive poor quality water from the Wey and Chertsey Bourne catchment as often (as flood flows will be conveyed through the channels), which would be an improvement from current conditions. Minor impacts to Ferry Lane West 3 due to localised changes in surface water flows

Option	RAG Status	Justification
Option 2	Medium	The Chap is already directly connected with the River Thames, therefore impact magnitude would be reduced. Permanent changes to the Chap water quality and hydromorphology would occur due to the existence of the flood channel route in its footprint, the augmented flow and increased flood flows. Minor impacts to Ferris Meadow Lake and Ferry Lane West 2.
Option 3	Low	Minor effects to Ferris Meadow Lake hydromorphology due to lake edge realignment with associated short-term effects to water quality and recreation during construction. No long-term water quality risk as flood flow directed away from the lake. Minor impacts to Ferry Lane West 3 due to localised changes in surface water flows.
Option 4	Medium	The Chap is already directly connected with the River Thames, therefore it is anticipated that conditions are similar to the River Thames at Desborough. However, there would be potential for permanent changes to the Chap water quality and hydromorphology due to the existence of the flood channel route in its footprint, the augmented flow and increased flood flows. Minor or no impacts to Ferris Meadow Lake and Ferry Lane West 2.

Option	RAG Status	Justification
Option 5	Low	Potential for permanent changes to the Chap water quality and hydromorphology due to augmented flow. The Chap is already directly connected with the River Thames, it is anticipated that conditions are similar to the River Thames at Desborough. This option is unlikely to change the water quality of the Chap as it will continue to receive water from the River Thames and remain a backwater to the Thames for the majority of the time. The Chap will not be connected to the flood channel or receive flood flows and hence the hydromorphological impacts from these flows will not be realised. Minor or no impacts to Ferris Meadow Lake and Ferry Lane West 1 and 2.

Option	RAG Status	Justification
Option 6a	Medium	In terms of flood flows, Ferris Meadow Lake is currently subjected to periodic inundation from the River Thames and, with RTS in place will be receiving flood flows from the River Thames on a similar frequency to existing conditions, which will include the input of nutrients, microbes, and pollutants. Similar to Option 1 it will not receive poor quality water from the Wey and Chertsey Bourne catchment as often (as flood flows will be conveyed through the channels), which would be an improvement from current conditions. As the augmented flow will mainly pass through The Chap (noting that there will be no additional control structure to fully prevent some of the augmented flow entering Ferris Meadow Lake) in comparison to Option 1, flow and circulation through Ferris Meadow Lake will be less, increasing the residence time of the lake and enabling sediments and nutrients to settle in the lake, between flood events. There is a risk that the increased residence time and continual input of nutrients will increase the risk of eutrophication in the lake. Overall the level of risk will be similar to Option 1 (whilst the exact magnitude of any difference cannot be calculated between Option 1 and 6a, Option 1 has a shorter residence time and increased nutrient loading and Option 6a has a longer residence time and lower nutrient loading). As Ferris Meadow Lake is not entirely isolated from the augmented flow, this option would provide a permanent connection to sources of microbial organisms, however it is anticipated that due to the length of time it is predicted that water will take to pass through the flood channel and lakes (under average dry year conditions), most FIOs will decay before reaching Ferris Meadow Lake, reducing the scale of impact on the Bathing Water Standard criteria. Minor impacts to Ferry Lane West 3.

Option	RAG Status	Justification
Option 6b	Medium	Ferris Meadow Lake will receive flood flows from the River Thames on a similar frequency to existing conditions, which will include the input of nutrients, microbes, and pollutants. However, it will not receive poorer quality water from the Wey and Chertsey Bourne catchment, as often (as flood flows will be conveyed through the channels), which would be an improvement from current conditions. Residence times in Ferris Meadow Lake are likely to be similar to existing conditions in non-flood conditions, as it will be separated from the augmented flow, but will be likely lower during flood events. Water quality in Ferris Meadow Lake will potentially slightly improve due to the reduced sources of pollutants in flood conditions and reduced mixing of water during non-flood conditions. Although there is currently no water quality monitoring data or modelling outputs for the Chap, it is anticipated that conditions are similar to the River Thames at Desborough. This option is unlikely to change the water quality of the Chap, as it will receive the augmented flow. It will continue to receive water from the River Thames and remain a backwater to the Thames for the majority of the time due to the low rate of the augmented flow. Minor impacts to Ferry Lane West 3.
Option 7	Low	Under this option the eastern side of Ferris Meadow Lake will effectively become a separate water body to the western side which will receive augmented flow and flood flows (and will therefore be impacted to the same extent as in Option 1). The impacts on the eastern side will therefore be low. Minor impacts to Ferry Lane West 3.

Option	RAG Status	Justification
Option 8	High	Large permanent changes to Ferris Meadow Lake water quality and hydromorphology due to open connection to the River Thames. Water quality in the lake would likely deteriorate to be similar to the River Thames at Desborough due to open and direct connection. Boat usage of the lake will also potentially introduce new pollutants to the lake. No water quality impact on the Chap would result from this option. Minor impacts to Ferry Lane West 3.

4. Summary and Conclusions

Table 15 below sets out a summary of the Environmental Appraisal.

The remainder of this section then summarises the key environmental impacts identified for each option, focusing on those that were categorised as ‘high’. While the options considered, generate different environmental impacts for some topics, there is relatively little difference in impacts between options for others. This is the case for air quality (medium), climate change (low), cultural heritage (medium), and noise and vibration (medium). Therefore, while these environmental topics are important considerations requiring assessment and mitigation, they are not determining factors in the environmental appraisal of the options and are not discussed further.

Table 15: Summary of Environmental Appraisal

Topic	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6a	Option 6b	Option 7	Option 8
Air quality	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Biodiversity	Medium	High	High	High	Medium	Medium	Medium	High	High
Climate change	Low	Low	Low	Low	Low	Low	Low	Low	Low
Cultural heritage	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Flood risk	Low	Low	Low	Low	Medium	Low	Medium	Low	Low
Health	Medium	Low	Medium	Low	Low	Medium	Low	Low	High
Landscape and visual	Low	High	Medium	Medium	High	Low	Medium	Low	Low
Materials and waste	Low	Medium	Medium	Medium	High	Low	Low	Low	Medium
Noise and vibration	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Socio-economic	Medium	Medium	Low	Low	Low	Medium	Low	Low	High
Soils and land	Low	High	High	High	High	Medium	Medium	Low	High
Traffic and transport	Low	Medium	High	Medium	High	Low	Low	Low	Medium
Water environment	Medium	Medium	Low	Medium	Low	Medium	Medium	Low	High

Option 1

There were no high risks associated with Option 1.

Mixing river water with lake water is anticipated to increase nutrient conditions, and other contaminants in Ferris Meadow Lake. However, these effects will be mitigated against by the continuous augmented flow, reducing the residence times in the lake and reducing the risk of algal blooms and eutrophication. Therefore this is considered unlikely to cause a change on the distribution of macrophytes, invertebrate, fish communities and marginal habitats of the lake.

The potential negative permanent changes to Ferris Meadow Lake water quality and hydromorphology from the presence of the augmented flow is considered a medium risk for water, health and socio-economics. While the reduction in water quality is not anticipated to be sufficient to affect human health there may still be an effect arising from the perceived risk to health, due to potential discouragement of swimmers from using the Lake, and leading to potential physical and mental health impacts for regular users. This could have a potential impact on the Shepperton Open Water Swim business and the provision of the Lake as a recreational facility, although this effect may reduce over time as effects are understood.

With regards to landscape and visual amenity, trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree Preservation Order, although further consideration of routing of the track would minimise loss, resulting in a low impact.

Option 2

Option 2 is considered high risk for biodiversity due to the loss of a backwater habitat in the Chap, acceptable mitigation for this habitat will be difficult to achieve.

With regards to landscape and visual, Option 2 would have the greatest effects to the amenity of residents of the Chap. The widening of the Chap on the south side would also potentially impact trees in gardens which are subject to a Tree Preservation Order and mitigation would need to be agreed for loss which may be difficult to achieve.

Option 2 is considered high risk for soils and land as the construction of a large water control structure and wider flood channel within an area of historic landfill (as is the case to the west of Ferris Meadow Lake) could lead to additional potential effects from the creation of new pollutant pathways and risk of landfill gas and leachate release.

By constructing the RTS channel through the Chap this avoids impacts on water quality within Ferris Meadow Lake and the subsequent effects on the use of the lake for swimming but would have other impacts such as loss of gardens on the south side.

Option 3

Option 3 is considered high risk for biodiversity due to the permanent terrestrial habitat loss within and outside of Ferris Meadows SNCI, including grassland and woodland. Compensatory planting will be required to mitigate the effect but there will be a permanent loss of terrestrial habitat residually.

With regards to landscape and visual, there are groups of trees in this area that are the subject of a Tree Preservation Order, both adjacent to the road and along the lake edge, as well as other individual protected trees in the southern area of the lake environment. It is likely that many would be lost to allow for the channel construction in this location and the impact is medium.

Option 3 is considered high risk for soils and land as the construction of a larger water control structure and wider flood channel within an area of historic landfill could lead to additional potential effects from the creation of new pollutant pathways and greater risk of landfill gas and leachate release.

Option 3 generates the second highest volume of excavated material of all of the options. The HGV traffic (and associated emissions to air) generated by the movement of excavated material is likely to be high and would be difficult to manage with standard mitigation, likely requiring a programme extension to reduce hourly HGV movements to manageable levels.

By constructing the RTS channel to the west of Ferris Meadow Lake this avoids impacts on water quality and the subsequent effects on the use of the lake for swimming.

Option 4

Option 4 is considered high risk for biodiversity due to the permanent loss of Ferris Meadows SNCI habitat (including grassland and woodland). Compensatory planting will be required to mitigate the loss of habitat but there will be a permanent loss of terrestrial habitat residually.

With regards to landscape and visual, there are groups of trees in this area that are the subject of a Tree Preservation Order, both adjacent to the road and along the lake edge, as well as other individual protected trees in the southern area of the lake environment. It is likely that many would be lost to allow for the channel construction in this location, although this is anticipated to be less than for Option 3.

Option 4 is considered high risk for soils and land as the construction of a larger water control structure and wider flood channel within an area of historic landfill could lead to additional potential effects from the creation of new pollutant pathways and greater risk of landfill gas and leachate release.

By constructing the RTS channel to the west of Ferris Meadow Lake this avoids impacts on water quality and the subsequent effects on the use of the lake for swimming.

Option 5

Option 5 is considered high risk for landscape and visual receptors due to the location tunnel outlet in the northwest corner of Desborough Island. It is potentially difficult to mitigate some / all of these effects.

Option 5 is considered the highest risk for soils and land as the construction of a larger water control structure and wider flood channel within an area of historic landfill could lead to additional potential effects from new pollutant pathways to receptors including human health, soils, groundwater and ecological receptors. A larger structure within the area of landfill could create a greater risk of landfill gas/and leachate release from compression. The increased amount of excavation required within the landfill for the tunnel excavation when compared to other options increases risks from contamination migration and negative effects from processing contaminated materials.

With regards to traffic and transport, the HGV traffic generated by movement of excavated material and waste is likely to be high and would be difficult to manage with standard mitigation, likely requiring a programme extension to reduce hourly HGV movements to manageable levels.

By tunnelling under Ferris Meadow Lake this avoids impacts on water quality and the subsequent effects on the use of the lake for swimming.

While this option meets the flood risk performance required of the RTS, a major structure with future maintenance and management risk, which makes it less resilient and was assessed as medium impact.

Option 6a

Option 6a is considered medium risk to biodiversity as flood flows would enter the lake inputting additional nutrients. As the augmented flow will be predominately through the Chap circulation through Ferris Meadow Lake will be low and there is therefore a risk that the increased residence time and continual input of nutrients, will increase the risk of eutrophication in the lake. Monitoring and mitigation for if oxygen levels do decline in the lake will be required to reduce the severity of this effect to a level where there is no impact on the Ferris Meadow Lake's aquatic ecology. All other effects on biodiversity receptors can also be mitigated with bespoke mitigation measures.

As some of the augmented flow would still enter Ferris Meadow Lake, there are potential negative permanent changes to the lake's water quality and hydromorphology, which is considered a medium risk for health and socio-economics. While the reduction in water quality is not anticipated to be sufficient to affect human health there may still be an effect of the perceived risk to health, discouraging swimmers from using the Lake, with potential for mental and physical health impacts. This could have a potential impact on the Shepperton Open Water Swim business and the provision of the lake as a recreational facility, although this effect may reduce over time as effects are understood.

With regards to landscape and visual, trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree

Preservation Order, although further consideration of routing of the track would minimise loss resulting in a low impact

Option 6b

No high-risk categories were identified for this option.

Option 6b is considered medium risk for biodiversity for the same reasons as Option 6a described above.

With regards to landscape and visual, trees in the location of the proposed and widened access track to the west of Ferris Meadow Lake are the subject of a Tree Preservation Order, although further consideration of routing of the track would minimise loss resulting in a low impact.

The diversion of the augmented flow through the Chap would reduce the likelihood of water quality effects to Ferris Meadow Lake, mean that there is a low impact on health, recreation and Shepperton Open Water Swim.

While this option meets the flood risk performance required of the RTS, a major structure with future maintenance and management risk, which makes it less resilient and was therefore assessed as medium impact from a climate resilience perspective.

Option 7

Option 7 is the highest risk for biodiversity as the splitting of the waterbody into two is considered likely to reduce the lake's function as a supporting waterbody to the SPA and Ramsar site. This is because there may be a reduction in foraging area and an increase in susceptibility to disturbance. There is a risk that the splitting of the lake could be assessed as causing an adverse effect on the integrity of the SPA and Ramsar site. Evidence to show that there are no "alternative solutions" to the option is likely to be required if this option is pursued, which will be difficult to achieve given the range of options being considered which have a reduced impact.

Option 7 would lead to large permanent changes to Ferris Meadow Lake, affecting water quality and hydromorphology but only on the western side of the lake with the eastern side of the lake effectively becoming a separate water body with minimal impacts on water quality and hydromorphology. As Shepperton Open Water Swim only use the eastern half of Ferris Meadow Lake for swimming, the separation of the RTS channel from this part of the lake could mean the area used by Shepperton Open Water Swim would be unaffected. There are also low impacts on landscape and visual receptors.

Option 8

Option 8 is considered high risk for biodiversity due to changes in water quality due to its open connection with the River Thames. There is the potential that this option could lead to a biodiversity opportunity through the creation a backwater for fish as there will be free access into and out of the lake. Option 8 could result in operational

disturbance to the interest features of South West London Waterbodies SPA and Ramsar Site due to the new access being created and more craft entering the lake.

Option 8 is also considered highest risk for water environment, health and socio-economics as it would lead to large permanent changes to Ferris Meadow Lake, affecting water quality and hydromorphology. The unrestricted flow of poorer River Thames water directly into Ferris Meadow Lake (as compared to journeying down the Spelthorne Channel) at all times could result in permanent impacts to Shepperton Open Water Swim facility. This has the potential to affect the physical and mental health of regular users.

Option 8 is considered high risk for soils and land as the construction of a larger water control structure and wider flood channel within an area of historic landfill could lead to additional potential effects from the creation of new pollutant pathways and greater risk of landfill gas and leachate release.

Impacts on landscape and visual receptors are predicted to be low.

5. References

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Annex 1: Figures

Designations (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00133)

Biodiversity (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00137)

Noise Receptors (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00139)

Socio-economic receptors (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00140)

Water Environment (ENVIMSE500260-CBI-ZZ-3ZZ-DR-EN-00141)

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