

Oxford Flood Alleviation Scheme: Environmental Update

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1 Introduction

Overview

This technical note, which supports the pre-planning application for the Oxford Flood Alleviation Scheme (OFAS), has been prepared to update Oxfordshire County Council on environmental changes since submission of our Scoping Opinion Request Note (September 2016) and receipt of the formal scoping opinion.

The purpose of this technical note is to summarise the following:

- Changes to the environmental design of the scheme;
- Changes to our approach to the Environmental Impact Assessment (EIA) following environmental scoping;
- Environmental surveys and desk-based assessments that have been completed since the environmental scoping stage;
- Proposed surveys and future research to be completed prior to submission of the full planning application; and
- The proposed structure of the Environmental Statement for the scheme.

2 Changes to the Environmental Design of the Scheme

The design of the proposed scheme is described in the draft Planning Statement.

It is envisaged that surplus soils excavated during the construction of the scheme will be disposed of at restoration sites where we will be reinstating or creating new habitat. However, an alternative location for the disposal of soils is currently being investigated for land raising to the south of Hinksey Heights (see Indicative Landscape Plan 08 in Appendix A - IMSE500177-HGL-06-ZZ-DR-L-000210), which will be subject to a separate assessment and planning application.

Draft Indicative Landscape Plans have been prepared for the scheme and are presented in Appendix A of this technical note. These plans overlay existing environmental characteristics and the scheme proposals to highlight environmental constraints and opportunities including designated sites and landscape character. They show the current multi-beneficial scheme design including areas of habitat creation, together with the environmental issues, potential mitigation and enhancement opportunities. Landscape Masterplans and Landscape Maintenance Plans are also being prepared to support the planning application.

The key environmental changes to the scheme design since the scoping stage comprise: -

- Consideration of a two 'alternative' routes of the flood bund/wall at the rear of gardens to the north of Botley Road and east of Seacourt Park and Ride - to minimise disturbance to known badger setts as far as practically possible, to comply with relevant legislation including the Protection of Badgers Act 1992 and Wildlife and Countryside Act 1981, and to minimise the numbers of trees that would require felling in this area. Both the original route, which skirts along the northern boundary of close to rear gardens at residential properties at Botley Road, and the following two alternative routes, are currently being assessed, with consideration of the Seacourt Park and Ride proposals for extension:
 - Defences to go through the expansion site.
 - Build a wall to skirt the expansion site avoiding badgers located in the area.

The way in which we proceed in this area will be determined by external decision makers based on the outcome of the planning application.

The three scenarios are shown on drawing reference IMSE500177-CH2-ZZ-A1-DR-C-1000 submitted with the Pre-Planning Statement.

- Reduced footprint of temporary access routes in numerous areas to minimise environmental disturbance including (but not exclusive to): -
 - Reduced access width adjacent to bund (associated with all three scenarios under consideration) at the rear of gardens to the north of Botley Road and east of Seacourt Park and Ride, to minimise disturbance to badgers and trees.
 - Removed need for 20m wide haul route on eastern side of second stage channel between the new spillway and Willow Walk to reduce footprint in the ecologically important Hinksey Meadows and the floodplain meadows to the north of Willow Walk. Instead, the temporary access track will be located predominantly within the footprint of the proposed second stage channel, with the exception of a 1m wide strip to allow fencing to be erected.
- Significantly reduced the width of the second-stage channel of the Seacourt Stream between the new spillway and Willow Walk. Through further flood modelling we have evidence to support a reduction in land take in this area and subsequent reduced impact on the MG4 grassland.
- Consideration of two alternative alignments for the proposed flood channel crossing and culverts below Old Abingdon Road, shown on the Indicative Landscape Plans in Appendix A (and drawings IME500177-CH2-CSC-A4D-DR-S-4400/4411 accompanying the Pre-Planning Statement).

Option 1 is the most direct option crossing Old Abingdon Road, using the existing stream route, following the railway in a southerly direction, and running in two new box channels between the existing Redbridge Culvert East and Redbridge Culvert West.

Option 2 involves the channel swinging out to the west, crossing Old Abingdon Road via new culverts. As there is a buried former culvert in the area where the new culverts would be installed, the alignment of the new channel could be adjusted to avoid this, while passing closer to the extant culverts. This alternative option is being guided by archaeological sensitivities found during our investigations in early 2017 and the culverts under the road, which are designated as a Scheduled Monument. This option is preferred by Historic England. While this route would still cause harm to the truncated medieval historic causeway, this route would avoid the Old Abingdon Road Culverts Scheduled Monument and avoids aesthetic impacts through changes in view of the culvert mouths/arches further east.

- Re-designed the parapet height on Devil's Backbone bridge to cycleway standards (height of 1.4m) to enable the possibility of the path being upgraded to a cycleway in the future.

- Changes to integrated ecological design including (but not exclusive to): -
 - Additional scrapes to the west of Seacourt Park and Ride
 - Removal of some scrapes previously proposed at Hinksey Meadows at request of landowner, but retaining Jubilee Scrape
 - Increased number of scrapes and backwaters in flood meadows to the north of South Hinksey, adjacent to the new channel
 - New areas of shrub and tree planting, and removal of some previously identified areas for planting at landowner request
- Re-located a proposed site compound for the scheme, outside of the Air Quality Management Area.
- Confirmed that land to the south of Hinksey Heights and to the west of the A34 for the permanent storage of excavated soils will be subject to a separate planning application; construction for this separate development will not take place if the main scheme does not proceed.
- Additional bund to reduce the level of flood risk at Osney Mead, which will require environmental assessment. The proposals at Osney Mead consist of constructing a landscaped earth embankment along the eastern edge of Oatlands Recreation Ground. This will enable the tree belt along the western side of Ferry Hinksey Road to be retained as a screen between the residential properties and the industrial area. Due to space constraints, a reinforced concrete wall will be constructed past the National Grid pylon and around the south of Osney Mead Industrial Estate. Flood gates will be provided in the wall to facilitate access for the public footpath and National Grid compound. The current alignment shown on the drawings will require the removal of two buildings to facilitate construction due to the presence of the National Grid cables and limited space within the industrial area. The exact alignment of the proposed defences is therefore currently under review to identify the route, which minimises impacts on a range of receptors including the buildings, recreation ground and significant number of trees bordering the southern side of the industrial estate. Alternative alignments will be tested using the fluvial model for the scheme and included in the final Flood Risk Assessment.

The key habitat changes associated with the scheme are detailed below.

Once the scheme is operational, the objective is that it should have an overall benefit for ecology. This means that the value of the new channel and the newly-created river and wetland habitats will need to be sufficient to outweigh the loss of terrestrial habitat. We are assessing the biodiversity gains and losses associated with the scheme by using the habitat impact assessment metric created as part of the Defra Biodiversity Offsetting pilots. This habitat impact assessment will include those Habitats of Principal Importance (under the NERC Act 2006).

Although the scheme will create significant amounts of river and wetland habitat, there will also be adverse impacts during operation, which we will need to weigh against the benefits in our assessment. The most significant operational impact on the river is the severing of two significant streams which will be diverted into the new channel. Mitigation will take the form of creating a new ecologically valuable channel and changing the character of the severed sections of the Bulstake and Hinksey Stream into backwaters, which will be valuable features in the new arrangement of channels. We are designing a scheme that re-naturalises the river habitats where possible. We anticipate that, with our proposed enhancements to the backwaters, the creation of backwaters and scrapes related to the new channel, and with encouragement of in-channel vegetation, the overall impact can be made to be positive. During construction there will be additional impacts from closing off the existing streams, prior to the new channel being available. The effects of this, over an extended period, will require careful management.

The scheme and associated working area will result in the loss of approximately 1.8ha of MG4a grassland (Cocksfoot *Dactylis glomerata* – the richest of the four sub-communities of MG4 *Alopecurus pratensis* –

Sanguisorba officinalis) at Hinksey Meadow, although significantly less (0.5ha) than the previous design which was provisionally estimated at 2.3ha loss. While new habitats of ecological value will be created in the second-stage channel and in the temporary working areas, there are limitations to recreating MG4a grassland in the area where the ground has been lowered, since it will be significantly wetter particularly on the lower slopes of the second stage. There may also be effects on the remaining grassland and the protected plant species snakes-head fritillary, if the presence of the new second-stage channel changes the groundwater regime, which we are currently assessing. The main focus of mitigation in the EIA will be on minimising the area of MG4a grassland lost (through making the second-stage channel as narrow as possible at this location), by ensuring if possible that the contractor works predominantly within the footprint of the excavation, without the usual haul roads at the side of the excavation, and by erecting fences to prevent vehicle access to habitats which are to be retained.

Kennington Pool will be significantly affected, with loss of a proportion of its surface area and works within the pond to establish a barrier between the remainder of the pond and the new channel. The assessment will look at ways to reduce the inevitable impact of construction to ensure the pond is not damaged more than necessary. The proposed scheme design is seeking to enhance some of the retained pond habitat and provide localised expansion to create new pond habitat to mitigate for the loss of part of Kennington Pool, and to ensure a net overall gain in pond habitat.

We are seeking to reduce the loss of mature trees and hedgerows as much as possible, but inevitably there will be significant numbers of hedgerows and trees felled, particularly at Kendall Copse but also throughout the scheme area. We will plant new trees and hedgerows as mitigation, while recognising that it will take many years before new trees will replace the habitat value of mature trees. As a matter of Environment Agency policy, all planted trees will be native species of local provenance rather than non-native ornamental species. We are currently seeking areas within the scheme area and nearby, which may be suitable for compensatory tree and hedgerow planting.

3 Changes to our EIA Approach

Table 1 summarises the key changes in our approach to the EIA following the scoping consultation, and presents further information and studies that we will undertake (e.g. scope of traffic/air quality modelling) to inform our environmental assessment and include in the Environmental Statement.

Impacts relating to the land raising to the south of Hinksey Heights will be documented separately as part of that planning application, but will also be included in the Environmental Statement for the OFAS for completeness.

4 Environmental Surveys

Table 1 also summarises the results of environmental surveys and desk-based assessments that have been completed since submission of the Scoping Opinion Request Note (September 2016), and describes further surveys that will be undertaken in advance of the planning application.

5 Proposed Structure of Environmental Statement

Table 2 presents the proposed structure of the Environmental Statement, based on the Scoping Opinion received.

Table 1: Changes since Scoping Stage of Scheme

Changes to EIA Approach
<p>Socio-economics:</p> <ul style="list-style-type: none"> We will be incorporating a new section on socio-economics into the Environmental Statement as a result of the Scoping Opinion
<p>Air quality assessment:</p> <ul style="list-style-type: none"> The dust impact assessment during construction will follow the IAQM (2014) dust impact risk assessment guidance, considering impacts from demolition, earthworks, construction and trackout on human and ecological receptors. Appropriate mitigation measures will be recommended based on the results of the risk assessment. Construction traffic impacts will be assessed using a detailed dispersion model, ADMS-Roads, following Defra guidance LAQM.TG(16). The assessment will focus on the effects of heavy duty vehicles used to transport excavated material to the restoration sites. Model scenarios will be considered for a baseline, do-minimum (no construction), do-something (construction) and a sensitivity test for future trends in NO2 concentrations. Oxford City Council's (OCC) monitoring data and local air quality management reports will be reviewed, including the location of relevant Air Quality Management Areas. It is assumed that sufficient data will be available to verify the air quality model and that no further monitoring will be required. A separate air quality assessment may be required for the land raising scheme, which would consider the transportation of excavated soils from the OFAS to the land south of Hinksey Heights. However, as the levels of construction dust and construction traffic from land raising are likely to be less than that arising from the OFAS, this separate assessment may be omitted (although in-combination impacts would be considered). By utilising the land raising area to the south of Hinksey Heights, it is likely that material may be driven directly from the site of the excavation, across South Hinksey junction and to the land raising area, reducing the amount of unloading, storage and reloading. The alternative option for the disposal of soils is to restoration sites, which would increase lorry movements on the scheme by approximately 7,000 (equivalent to approximately 172,500 lorry miles). The proposed use of the land raising site to the south of Hinksey Heights would therefore help reduce traffic movements and also reduce impacts on the Air Quality Management Areas in Oxford.
<p>Traffic and transport impact assessment:</p> <ul style="list-style-type: none"> Closure of Old Abingdon Road (only relevant if Option 1 is selected – see Indicative Landscape Plan 05 in Appendix A - IMSE500177-HGL-06-ZZ-DR-L-000207) - it is assumed that the VISSIM model (Hinksey Hill interchange model) can be used (to be confirmed). The impacts will be assessed via manual addition of extra traffic to this model to inform the amount of traffic that will need to be diverted. Works north of Botley Road - the VISSIM model of the Botley Interchange, which we understand includes the section of B4044/A420 will be used, establishing the quantity and direction of staff and spoil movement trips, adding to the model and analysing the impact. Impact during general works - depending on where the HGVs are heading in the offsite storage scenario (to be confirmed) this may have an impact on the two interchanges, and the VISSIM models will again be used to assess this.
Completed or Future Surveys / Assessments and Investigations
<p>Trees (British Standard BS5837:2012) and arboricultural assessment</p> <ul style="list-style-type: none"> An arboricultural survey (tree condition status) is currently underway and will culminate in the production of an Arboricultural Impact Assessment, Tree Constraints Plan, Arboricultural Method Statement and Tree Protection Plan, which will inform the EIA and accompany the planning application for the scheme,

Completed or Future Surveys / Assessments and Investigations

Groundwater/fluvial studies (to assess impacts on biodiversity)

- The effects of the scheme on groundwater levels during normal flows and low flows have been modelled, as well as flood events, to understand effects on the designated sites due to the scheme. We will review the results with a particular focus on the groundwater regime at Oxford Meadows SAC/Port Meadow SSSI, to ensure there are no adverse effects, but we will also review potential effects on the wetness of ground in other groundwater-sensitive habitats within the scheme area including Hinksey Meadow (the MG4a grassland), due to lowering of ground levels nearby. We will check for indirect effects on ecologically-important areas (as well as on agriculture and residential areas). Early groundwater modelling predictions indicate that the scheme will not affect the groundwater regime (levels or frequency of flooding) at these sites. However, understanding the potential effects of changes in the groundwater and surface water regime on these ecologically important sites will be important for the EIA.
- We have commissioned the Floodplain Meadows Partnership (FMP) to help with our assessment of the impacts of groundwater changes on the MG4 grassland, to help us design a scheme that meets our environmental objectives and to undertake a thorough EIA. In particular, they are: -
 - providing advice on the potential translocation of the MG4a grassland and suitability of other areas within the wider floodplain for floodplain meadow creation.,
 - reviewing our assessment of potential effects on other groundwater sensitive sites
 - using our findings to explain how the groundwater levels are likely to affect the MG4/MG4a grassland at Hinksey Meadows in terms of species composition, NVC classification and long-term viability.
 - providing monitoring advice
- We have a programme of surveys recording groundwater levels at selected boreholes, both pre-existing BGS boreholes (chiefly around Port Meadow) and new boreholes created during our recent Ground Investigation survey. Piezometers are being installed at Hinksey Meadows and some other scheme areas (e.g. Hogacre Common Eco Park) to help monitor groundwater effects on existing floodplain meadow and on future areas of habitat creation

Habitat Regulations Assessment (HRA)

- We are consulting Natural England with regard to the environmental acceptability of the scheme and the requirement for a HRA. At present we anticipate a need to submit a formal screening document, but that the scheme will be determined to have no effect on the SAC.

Hydrological survey (including consultation with BBOWT)

- This relates only to the land south of Hinksey Heights – refer to separate planning application.

Protected/notable species and habitat surveys

- Otters *Lutra lutra* - otters are present in the area and use all the channels for feeding and travelling. The scheme will be designed to avoid potential holts, to enhance connectivity of watercourses and to improve the availability of wetland habitat for hunting and commuting, wherever possible e.g. enabling otters to use the new channel by designing the culverts under Old Abingdon Road and the southern bypass to have ledges that encourage otters to use the culverts rather than trying to cross the roads.

A pre-construction otter survey will be conducted several weeks in advance of mobilisation of works on site to identify and confirm any active holts that may not have been recorded during the survey and cannot therefore be avoided by design. Sufficient time will then be available in which to apply for an otter mitigation license from Natural England if necessary. Mitigation will be considered further during the EIA.

Completed or Future Surveys / Assessments and Investigations

- Water voles *Arvicola amphibius* – There were no findings of water vole signs during the summer 2016 survey (i.e. feeding stations, footprints and latrines), and therefore water voles are not currently thought to be present within the scheme area, unless present in isolated patches and very low numbers. However, the risk of water voles remains as populations can recover and appear quite quickly from neighbouring locations, and therefore further checks and mitigation will be undertaken.

A pre-construction check for water vole burrows will be undertaken in advance of mobilisation of works on site.

- Creeping Marshwort *Apium repens* - this species is present in a horse paddock immediately south of Willow Walk. Although visually unremarkable, this plant is very rare in the UK. Its successful growth at this location is dependent both on the nature of the soil and on grazing by horses. There is potential for this plant to be affected both during construction (through suspension of grazing) and operation (through any changes to the hydrological regime in this field).
- Great Crested Newts *Triturus cristatus* – our survey found great crested newts only on land south of Hinksey Heights. Measures to be taken to protect them will be covered in the separate planning application.
- Badgers *Meles meles* –The EIA will consider the direct and indirect disturbance to badgers resulting from vegetation clearance and construction works. A detailed survey of badger setts (with assessment and mitigation) will be required, and a licence from Natural England is likely to be needed to permanently close any affected setts which cannot be avoided. We are currently considering the alternative alignments of the new flood defence at Botley Road, and their impacts on badgers, together with associated mitigation that might be required.
- Reptiles – A very small population of reptiles were identified during the survey. Within the central part of the study area, it is likely that only grass snakes *Natrix natrix* are present, and low numbers of slow worms *Anguis fragilis* and grass snakes are likely across the wider scheme area. Some general mitigation will be required to avoid detrimental impacts on reptiles, which will be considered further in the EIA.

A survey of reptiles is currently being undertaken in additional small areas affected by the scheme.

- Bats – The scheme area supports a number of structures, buildings and trees, which have moderate potential to support roosting bats, and a variety of continuous features (e.g. linear hedges and river channels), likely to be of high value to commuting and foraging bats. Some of these structures, trees and hedges are likely to require clearance during the construction of the scheme. The roosts which have been found within trees are all small, temporary summer roosts, but the survey is currently in its early stages and we are working on the assumption that at least some trees will require mitigation measures to protect bats. Mitigation for bats will be agreed with Natural England as part of the EIA and incorporated into the Environmental Statement. Additionally, construction lighting, vibration, noise and human presence to facilitate the scheme may temporarily disrupt and sever forage and commuting corridors for bats using the scheme area.

The potential for permanent disruption of commuting routes due to removal of hedge lines or river channels is being addressed by further bat surveys in Spring 2017. These include dawn and dusk emergence surveys of trees/structures suitable for roosting and surveys of feeding areas/commuting routes. Also preliminary tree, building and structure roost inspections are planned together with elevated inspections of trees.

- Hedgehogs – We will assume that this species are present in at least low numbers and adopt best practice methods in terms of timing and methods of vegetation management, storage of materials etc, possibly with some trapping and removal if considered appropriate during the EIA.
- Toads – Our pond amphibian surveys covered the risk regarding the discovery of toad breeding sites. We will gather additional data on toads from various sources and adopt appropriate mitigation methods to reduce the risk to this species during construction.

Completed or Future Surveys / Assessments and Investigations

- Signal crayfish *Pacifastacus leniusculus* were also identified during the survey within the Hinksey Stream and are likely to be present throughout streams and rivers in the study area.
- Aquatic invertebrate and mussel survey – surveys in Spring 2016 identified a range of macroinvertebrate species and communities across 13 sample sites. Several notable species were identified: the depressed river mussel *Pseudanodonata complanata* in the River Thames, Seacourt Stream, Bulstake Stream; the smooth Ramshorn *Gyraulus laevis* in Hinksey Stream; and a caddisfly *Brachycentrus subnubilus* in Seacourt Stream. The mussel survey found that Seacourt Stream, Bulstake Stream, Hinksey Stream and the River Thames recorded the highest diversity and abundances of unionids, However, there was significant variability between sites on the same watercourse. The depressed river mussel was recorded in low abundances from three waterbodies, the River Thames, Seacourt Stream and Bulstake Stream. The analysis and appraisal of the different species and communities recorded (in terms of diversity, presence of notable species and pollution sensitivity) found that there are some sites of high conservation value and sensitivity on Seacourt Stream, Bulstake Stream and the River Thames. Other waterbodies (Hogacre Ditch, Kennington Pit and Chiswell Stream) appeared to be of less conservation value and lower sensitivity.
- Invasive species - There are areas of invasive plants within the scheme area including Japanese knotweed *Fallopia japonica* and Himalayan balsam *Impatiens glandulifera*. The isolated clumps of Japanese knotweed identified between Abingdon Road and the Southern by-pass are currently being managed by the relevant landowners. Opportunities are being sought for the scheme to help remove invasive plants, which will need to be dealt with during the early stages of the works to avoid any risk of spreading them.
- Wintering birds – these surveys have been completed. The wintering bird surveys will help us to better understand areas of value to wintering birds and thus inform our scheme design and assessment.
- Breeding birds – A number of thorough transect walks to record the presence of avian species within the scheme is being undertaken between April and June 2017 to better understand areas of value to breeding birds and thus inform our scheme design and assessment. Surveyors will also be noting potential features for other breeding birds, which might not be easy to identify during a transect. For example, potential nesting cavities for owls or large suitable sand banks for kingfishers or sand martins. The survey methodology allows for an estimate of the number of birds using the site during the breeding season, along with identifying key breeding habitats including arable/grassland mosaics, woodland and scrub. The survey will also record any red and amber-listed species, as well as ground-nesting birds.
- Additional habitat surveys in areas where the scheme design has changed – An additional survey will be undertaken in May 2017 in an area not previously surveyed.
- River Corridor Survey to map aquatic and riparian plant communities.

Topographic survey

- A topographic survey has been produced. This provides information to support the detailed design of the scheme and also enables the assessment of effects on river morphology.

River modelling

- Once the scheme is in operation, there will be a permanent diversion of the affected streams into the new channel, in addition to changes to flows under flood conditions due to the new stretches of second stage channel. Our model of the river provides predictions of water flows in various sections of the river channel network under various conditions, including low flows, which will allow impacts on geomorphology to be assessed. We are reviewing the fluvial modelling results to assess whether there will be effects on sediment transport and whether mitigation may be needed, this includes assessing the flow regime in the newly-created backwaters, where existing streams are cut off by the new channel. Water will flow into these under normal flow conditions and will only be cut off under low flows; we anticipate flows will be sufficient to keep the channels open rather than silting up in most if not all cases. Our proposals for ecological management will need to take account of the results

Completed or Future Surveys / Assessments and Investigations

of this model. The scheme has been designed to avoid impacts or changes to the flows during normal conditions in the main River Thames to avoid any impacts on navigation.

- The outputs from the 'downstream of the OFAS model' have been run through a model of the River Thames and surrounding floodplain, which covers the section from Sandford to the upstream side of Reading, to review any implications of flood risk management downstream of the area. The results from this exercise for a range of flood flows, including climate change predictions, have been compared to the existing levels and flood outlines in the model. The results of this modelling comparison showed that any downstream changes are limited to +/-0.01m (10 millimetres), which is within the expected modelling tolerances and thus indicates that there are no downstream impacts in any developed areas as a result of the scheme. This comparison was also undertaken for two real recorded flood events, which occurred in 2003 and 2007. Again, the majority of the results were within the +/-0.01m range with a local variance around Days Lock for the 2003 event, however the telemetry system at Days Lock was compromised at the peak of this flood and readings were taken visually, which increases the uncertainty around the recorded levels at this location for this particular event.

Flood Risk Assessment (FRA)

- In parallel with the EIA, we are carrying out a FRA to demonstrate that the scheme does not result in increased flood risk elsewhere. The FRA will address measures to prevent flood risk within Oxford from being elevated during the construction period, as well as maintenance measures required to ensure the effective ongoing function of the scheme.

Water Framework Directive

- Preliminary WFD assessment – a preliminary assessment has been produced and a range of negative impacts have been identified together with opportunities to mitigate potentially adverse impacts and enhance the water bodies. These include: -
 - Maintaining at least existing water quality in all channels of the river, including proposed new channels, is a key constraint for the project. Water quality in the Thames has improved significantly over the course of recent decades; it is crucial that the project does not interfere with this positive trend by harming water quality.
 - Reduction in water depth, width and velocity within Botley Stream channel due to flow being routed down Seacourt Stream.
 - Loss of river bed habitat and possible sedimentation as flows and flow width reduced in Botley, Bulstake and Hinksey Streams with associated negative impacts on fish (e.g. fish stranding and reduced habitat quality). However, the habitat in Botley Stream will re-adjust over time to changes in flow depth and width, and the improved Hinksey/Seacourt Stream channel and new channel will provide additional habitat for invertebrates and macrophytes, and should provide an overall increase in flow-dependent habitat.
 - Potential for new and improved wetland habitats including scrapes, improved fish passage and in-stream habitat diversity (e.g. for fish spawning). Longitudinal connectivity.
 - Loss of trees could result in destabilisation of banks and loss of shade and increased water temperatures.
- Detailed WFD compliance assessment - will be undertaken during the EIA due to the range of potentially significant effects identified on the biological and hydromorphological quality elements of the relevant water bodies.

Archaeological/Cultural Heritage Studies and Investigations

- Archaeological Desk-Based (DBA) in draft (December 2016)– we can provide a copy if required.
- Old Abingdon Road Archaeological Evaluation - 36m long borehole transect (at 1m centres), and four trenches within the live modern carriageway of Old Abingdon Road revealed evidence for: the truncated remains of 13th – 14th century medieval road surfaces and an associated although earlier roadside ditch, early and later

Completed or Future Surveys / Assessments and Investigations

post-medieval road surfaces, including an early 17th to 18th century phase of major rebuilding, plus the remains of a stone structure, probably a bridge/culvert abutment of medieval or post-medieval date associated with historic southern route to and from Oxford, within the route of the proposed new OFAS culverts. Draft report prepared (January 2017) and revisions currently underway.

- Geo-archaeological investigation carried out along the footprint of the channel including hand auger transects and boreholes, accompanied by an Electro-magnetic Conductivity Survey. The purpose of investigation was to provide additional baseline data on the nature and archaeological potential of the sedimentary sequences. This work builds on an initial stage of deposit modelling associated with a programme of geotechnical works in 2015. Based on the results of the investigation, ten contrasting geoarchaeological zones have been identified along the route. These zones address the perceived archaeological and palaeoenvironmental potential of the sediment sequences and will inform the evaluation strategy in May 2017. Draft report prepared (January 2017) and revisions currently underway.
- Geophysical investigations including a magnetometer survey to test for evidence of any buried archaeological remains which may be present within the area under consideration for the proposed scheme. Draft report prepared (February 2017) and revisions currently underway.
- Archaeological watching brief of geotechnical ground investigation in March 2017 – awaiting results
- Photographic walkover survey of key features and detailed documentary research at Hinksey Causeway (March 2017)
- Research at Ruskins Causeway (March 2017) with detailed review of maps and historic sources.
- Plotting of individual cropmarks (March 2017) including transcriptions that the Oxfordshire County Council Historic Environment Records holds
- Historic Study of Botley Mill (May 2017) – this study is currently underway and will include a review of historic material (available maps and plans of Botley, historic photos and prints/drawings of Botley mill) as held by the Oxfordshire Record Office, a walkover survey of the potential mill site (to the south of Botley Road) and the area of possible related water control structures to the north of Botley Road, and a review of published sources upon the mill in particular and upon Oxfordshire Mills in general as held by Oxfordshire Records Office and the Bodleian Library Oxford.
- Archaeological trenching and evaluation in Summer 2017 throughout the route of the scheme and working areas. The scope of the trenching will be agreed with Oxfordshire County and Oxford City Archaeologists. The results will inform the archaeological impact assessment in the Environmental Statement.

Additional Geotechnical ground investigation

- Investigation in March/April 2017 with some limited soil sampling for phosphates – awaiting interpretative results

Soil Resource Survey

- We will carry out a targeted soil resource survey with fertility testing in Summer 2017 to better understand the suitability of soils for their intended purpose such as for habitat creation.

Table 2: Structure of Environmental Statement

Chapter of ES	Issues Scoped In	Issues Scoped Out of ES
Non-technical Summary – provided as a stand-alone document to the ES.		
1 - Background	<ul style="list-style-type: none"> • Introduction to scheme • Location and site description • The problem - need for the scheme, description of existing flood risk, description of the benefits of the scheme associated with reduced flood risk to the local community (including health improvements) • Project objectives • Legislative and regulatory requirements • Structure of the ES • Review and comments 	
2 – Project Development	<ul style="list-style-type: none"> • Strategic context including links to green infrastructure, flood risk management strategies, NPPF and plans and policies • Consultation • Alternative options 	
3 – Scheme Description	<ul style="list-style-type: none"> • Description of works • Qualitative summary of construction, operation and maintenance activities. Opportunities to integrate biodiversity, landscape, heritage and fisheries improvements, ensuring linkages with the initiatives of others to provide appropriate habitat enhancement. 	
4 – EIA Methodology	<ul style="list-style-type: none"> • EIA scoping methodology including reference to the PEIR (2016) and this table in an appendix • EIA assessment methodology • Uncertainties, difficulties and assumptions 	
5 - Local Community	<p><u>Noise and Vibration</u></p> <ul style="list-style-type: none"> • direct noise/vibration from construction plant and increased traffic, and the locations most likely to be affected e.g. residential and other occupied buildings, including schools, hospitals and offices, recreational areas. • Reference to quantitative noise section in a Construction Environmental Management Plan. This will include measures that the contractors will take to manage noise and vibration disturbance. • The assessment will consider need for noise restrictions 	<ul style="list-style-type: none"> • We are not planning to carry out any baseline noise surveys. It is possible that this may change if our impact assessment identifies a significant number of sensitive receptors which might be exposed to construction noise, requiring survey and/or more detailed calculations. • Noise and vibration during operation of the scheme.
	<p><u>Socio-economic</u></p> <ul style="list-style-type: none"> • Socio-economic impacts of scheme on people, shops and businesses 	<ul style="list-style-type: none"> •
	<p><u>Health</u></p> <ul style="list-style-type: none"> • Impacts on health of temporary loss of recreational land/footpaths • Changes in air pollution on public health during construction, operation and ongoing maintenance. 	<ul style="list-style-type: none"> • We have not and do not propose to carry out any health surveys for the scheme (see air quality section).

Chapter of ES	Issues Scoped In	Issues Scoped Out of ES
	<ul style="list-style-type: none"> • During operation, effects on health through changes in recreational use of the area and potential for increases or decreases in commuting by walking or cycling. • Reference to health impacts associated with ground contamination and land raising 	
<p>6 Recreation and Access</p>	<p><u>Recreational use of scheme area</u></p> <ul style="list-style-type: none"> • Impacts on recreation (cycling, horse-riding, walking etc), green belt, recreation space (e.g. at Osney Mead) and navigation and safety during construction • Positive recreational outcomes e.g. using the landscape and ecological design of the new channel to enhance informal recreation and green infrastructure, designing the new bund at Osney Mead in a manner that benefits recreation <p><u>Temporary and permanent disturbance to access</u></p> <ul style="list-style-type: none"> • Impacts on public access (public open land, public rights of way, permissive paths and other informal access routes) and associated recreational users, existing residents, tenants and businesses along the river corridor. 	
<p>7 - Landscape and Visual Amenity</p>	<p><u>Visual Amenity</u></p> <ul style="list-style-type: none"> • Impacts on the visual amenity of sensitive visual receptors (residents, users of public rights of way, public open space, public roads and railways, and worker) with views of the scheme, both during the construction works and operation. Receptors will be assessed as amalgamated groups where sensitivity and likely impacts are similar. • Impacts on protected views in Oxford, and views looking out from high points in the city and inwards • Reference to Oxford View Cones 	

Chapter of ES	Issues Scoped In	Issues Scoped Out of ES
	<p><u>Landscape Character</u></p> <ul style="list-style-type: none"> • Changes in local landscape character, National Character Areas and value of rural floodplain meadows • Impact on iconic landscape and green belt • Links to GI strategy • Impacts of construction, altering topography and associated vegetation, new structures and channels on the baseline landscape and cityscape potentially affected by the works, both during the construction works and operation. • Summary of historic influences on landscape character and changes in heritage landscape • Landscape and visual mitigation through integrated scheme design, use of locally appropriate hard and soft landscape works and careful consideration of the aesthetic appearance of flood defences in sensitive areas. • Impacts of changes in important landscape resources • Reference to arboricultural survey • Landscape masterplan 	
8 – Flora and Fauna	<ul style="list-style-type: none"> • Integrated scheme design that ensures habitat management and creation is fully integrated. <p><u>Designated Conservation Sites</u></p> <ul style="list-style-type: none"> • Temporary and permanent impacts on the interest features of designated nature conservation sites (SAC/SSSIs, LWS, pLWS, SLINC, pSLINC), Conservation Target Areas and Eco Park. • Habitat Regulations Assessment <p><u>Habitat</u></p> <ul style="list-style-type: none"> • Terrestrial and wetland habitat losses and gains (habitat creation) • Impacts on groundwater sensitive habitats and MG4a grassland • Impacts on other terrestrial habitats including trees (reference to arboricultural survey), hedgerows and community woodland • Impacts on wetland habitats of principal importance during the construction works including severing of ponds and watercourses <p><u>Protected and notable species</u></p> <ul style="list-style-type: none"> • Impacts on protected and notable species including otters, water voles, creeping marshwort, great crested newts, badgers, reptiles and bats, hedgehogs, toads, mussels and aquatic macro-invertebrates <p><u>Fish</u></p>	<p>Habitats assessed during Phase 1 Habitat Survey to be of low or negligible value</p> <p>Hedgehogs and toads will not be surveyed as these are not protected species. However, TVERC data for hedgehogs and toads will be included and records of breeding ponds for toads will be obtained from the Local Froglife Group.</p> <p>Terrestrial invertebrates will not be surveyed but consideration of the impacts on these species will be discussed with regard to their habitat.</p>

Chapter of ES	Issues Scoped In	Issues Scoped Out of ES
	<ul style="list-style-type: none"> Impacts of the construction works on fish passage and in-channel construction works and permanent impacts of improved fish passage. Appropriate mitigation including timing in-river channel works to minimise disturbance to migratory fish and to fish spawning (including bullhead, where information is available). 	
	<p><u>Invasive species</u></p> <ul style="list-style-type: none"> Management of invasive species. 	
	<p><u>Ecological Management Plan</u></p> <ul style="list-style-type: none"> Ecological management plan 	
<p>9 - Water and Hydromorphology</p>	<p><u>River flow and morphology</u></p> <ul style="list-style-type: none"> River catchment modelling Impacts on watercourses; notably River Thames, and Seacourt, Bulstake and Hinksey streams, and their geomorphology Changes in flood risk and FRA Changes in flows and water levels (and associated impacts on ecology, navigation etc) Construction methods <p><u>Groundwater</u></p> <ul style="list-style-type: none"> Impacts on groundwater regime (with associated impacts on ecology) and changes in flood risk to residential areas due to groundwater Groundwater modelling during normal and low flows, as well as flood events <p><u>Water quality</u></p> <ul style="list-style-type: none"> Changes in water quality during the construction works, as a result of sediment bound contaminants being mobilised into the water column, and from increased suspended sediment. <p><u>Water Framework Directive</u></p> <ul style="list-style-type: none"> Our WFD assessment will consider impacts on the existing condition of the river bed and bank, the potential for new modifications (i.e. new defences) to conflict with those morphological measures that are in place, and any requirement for mitigation elsewhere in the water body Opportunities will also be sought for improvements to water bodies through contributions to the Programme of Measures outlined in the River Thames River Basin Management Plan 	
<p>10 – Cultural Heritage</p>	<p><u>Archaeology</u></p> <ul style="list-style-type: none"> Assessment and associated mitigation based on findings of future survey work Impacts on Old Abingdon Road Scheduled Monument, and areas for potential high value unknown archaeology e.g. Old Abingdon Road, Ruskins Causeway and Hinksey Causeway 	<p>Archaeological impacts on completion of scheme</p>

Chapter of ES	Issues Scoped In	Issues Scoped Out of ES
	<p><u>Cultural Heritage</u></p> <ul style="list-style-type: none"> Assessing impacts and mitigation on heritage identified in the Archaeological DBA and following archaeological field survey Effects on settings of cultural heritage features including the Scheduled Monument, Conservation Area at North Hinksey, a historic settlement at South Hinksey and Listed Buildings Impacts on the cultural heritage value in the use of the fields for recreation and of the River Thames for navigation. 	
11 – Traffic and Transport	<ul style="list-style-type: none"> Impacts on cycle paths and other public rights of way Impacts on road network, likely volumes of material and proposed routes of access for construction delivery vehicles. Reference to materials management Traffic flow modelling Reference to a Traffic Management Plan. A Traffic Management Plan will be prepared by the contractor to <ul style="list-style-type: none"> describe the access routes affected by construction traffic vehicles outline how traffic movements will be minimised, describe timings of movements to be agreed with Oxfordshire County Council highways describe traffic management measures including turning facilities, cleaning of roads, parking facilities, signage etc 	<ul style="list-style-type: none"> Traffic during operation of the scheme - traffic required during operation will be very occasional and involve very few vehicles (thus having no significant impact).
12 – Sustainable Use of Land	<ul style="list-style-type: none"> Geological sites Soils and the ecosystem services they provide as a natural resource Changes to current and proposed land uses Impacts on agricultural use, farm structure and viability from direct land-take, from change in the nature of the soil in the second-stage channel and from severance effects. agricultural improvements. geotechnical risks and potential for the disturbance of contaminated sediments/made ground and land contamination (e.g. at former landfills such as Kendall Copse), with links to associated risks to aquatic life in the 'Flora and Fauna' section. 	<ul style="list-style-type: none"> Land contamination during operation of the scheme. The channel is being designed to be water-tight where it passes contaminated areas, thus ensuring that engineering measures are adequate to avoid the risk of leachate entering the new channel and thereby reaching the main river. Financial losses to landowners or tenants, since these will be compensated as part of the scheme. We do not intend to carry out any soil sampling of contaminated land areas for the EIA (although some areas have been sampled for detailed design purposes). After the planning application we may need to test some areas to determine what precautions may be needed to prevent pollution.
13 – Air Quality	<ul style="list-style-type: none"> Air pollution resulting from increased traffic emissions due to construction vehicles. Construction traffic impacts will be assessed using a detailed dispersion model, ADMS-Roads, following Defra guidance LAQM.TG(16). The assessment will focus on the effects of heavy duty vehicles used to transport excavated 	<ul style="list-style-type: none"> We do not propose to carry out baseline air quality surveys for this project, as adequate data are available from Oxford City Council, Vale of White Horse District Council and Defra (the latter being the output of national models).

Chapter of ES	Issues Scoped In	Issues Scoped Out of ES
	<p>material to restoration site(s). Model scenarios will be considered for a baseline, do-minimum (no construction), do-something (construction) and a sensitivity test for future trends in NO2 concentrations. Oxford City Council's (OCC) monitoring data and local air quality management reports will be reviewed, including the location of relevant Air Quality Management Areas.</p> <ul style="list-style-type: none"> • A separate assessment for the construction element of the scheme will be undertaken for the transportation of excavated soils to the land south of Hinksey Heights as the magnitude of construction dust and construction traffic will change. • Increased dust emissions from the excavations and from temporary storage areas. • Impacts on Air Quality Management Areas (AQMA) and residential areas within AQMAs 	<ul style="list-style-type: none"> • Air quality during operation of the scheme as there is no mechanism for significant air quality effects to be caused during operation.
<p>14 – Carbon, sustainability and climatic factors</p>	<p><u>Carbon and sustainability</u></p> <ul style="list-style-type: none"> • Carbon dioxide emissions from construction and management • Carbon footprint • Investigate the use of excavated material for flood defence construction and identify opportunities to reduce waste, recycle and beneficial re-use of materials, including land raising • Opportunities for re-use of excavated materials within the scheme 	<ul style="list-style-type: none"> • Carbon management and sustainability during operation of the scheme • Climatic factors during operation of the scheme
<p>15 - Cumulative Impacts and Inter-relationships</p>	<ul style="list-style-type: none"> • Cumulative impacts of project itself and with other developments 	
<p>16 - Summary</p>	<ul style="list-style-type: none"> • Summary of EIA findings 	
<p>Glossary of Terms, Abbreviations and References</p>		

Appendix A Indicative Landscape Plans