

TECHNICAL REPORT

Oxford Flood Alleviation Scheme: Multi-Criteria Options Appraisal

Prepared for

Environment Agency

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Executive Summary

1.1 Introduction

The report entitled '*Channel Corridor Options Report, November 2015*' identified various options for the potential corridors to form the western bypass flood channel around the western side of Oxford. The *Channel Corridor Options Report* divided the scheme into seven areas as shown on Figure 1 and then proposed three to four options in each area.

This report presents a Two-Phase Options Appraisal process for determining an optimised preferred option for the Western Conveyance Channel that is equally balanced across the five principal objectives used to evaluate the scheme, namely; economic, social, technical, environment, and institutional objectives.

1.2 Overview of Multi-Criteria

The criteria on which to assess the various options was developed by the CH2M technical specialists based on published flood risk guidance and the use of similar approaches on other schemes. It was then tailored to suit the specific requirements and objectives of the Oxford Flood Alleviation Scheme whilst trying to keep the process as simple and transparent as possible.

Consultation within the team then identified the key parameters within the sub-objectives which underpin the review. These parameters are not designed to be a comprehensive list of every topic which could be reviewed but include the key parameters that are representative of each of the sub-objective and likely to create a differentiation between options. Table 1 outlines the principal objectives and the sub-objectives.

1.3 Two-Phase Options Appraisal Process

The adoption of the Two-Phase Options Appraisal process enabled a progressive approach for determining a final Preferred Corridor that was equally balanced across all five Principal Objectives of the scheme. This allowed an initial ranking of options based on socio-environmental criteria, this also ensured the best option was chosen which not only delivers flood risk management benefits but also other benefits required by the various stakeholders.

All objectives were evaluated individually for each area with the exception of the Economic Objectives. The evaluation of the Economic Objectives cannot be appraised exclusively for each individual area as the hydraulic modelling will only show significant flooding benefits if the combined options are included in the hydraulic model.

Therefore the second phase of the assessment process was developed to allow combinations of the options for each of the scheme areas to be assessed as overall scheme options, this links in with the recommendations of the Strategy to investigate different channel sizes.

1.4 Summary of First-Phase Appraisal

The detailed appraisal tables for the seven areas are included in Appendix B. Following the First-Phase appraisal review based on socio-environmental aspects the Preferred Options and Sub-Preferred Options has been identified for each area. These are summarised in the table overleaf.

	Preferred Option	Sub-preferred Option
Area 2	Option 2D - Existing channel retained and second stage on farmland upstream of pylon	Option 2C - Existing channel retained and second stage on farmland downstream of pylon
Area 3	Option 3A - New 2-stage channel	Option 3D - New 2-stage channel with a series of offline ponds/lakes
Area 4	Option 4A - New single 2-stage channel	Option 4B - New two 2-stage channels
Areas 5&6	Option 5B&6C - New 2-stage channel and returning upstream of Sandford Lane	Option 5B&6B - New 2-stage channel and returning downstream of Sandford Lane
Area 7	Option 7C – New constrained channel across Iffley Meadow	Option 7B – New 3 culverts through Donnington Bridge Road

Table E1 - Table of Preferred Corridors at First-Phase Appraisal

1.5 Options development during the Second-Phase

One of the early outcomes from the hydraulic and economic analysis was the decision to omit Areas 5&6 and Area 7 from the scheme. The modelling results showed that a greater amount of flood risk reduction could be achieved by proposing alternative options at other areas upstream of Areas 5&6 and Area 7.

The omission of Areas 5&6 and Area 7 triggered a review of alternatives to try and provide additional flood risk reduction to the New Hinksey and Grandpont areas of Oxford. A review on the introduction of raised defences at various locations was carried out to determine the optimal alignment of the raised defences. A summary of this review is provided in Appendix E.

The design development in Area 1 progressed following the determination of the Preferred Corridor. The objectives of the design were; to maximise the conveyance capacity through Botley Bridge by deepening the channels through the bridge, and to protect the properties to the north of Botley Road by introducing a flood bund to the north of the area.

All of the options in the First-Phase Appraisal proposed channel widening works at the railway bridge on the A423 Southern By-pass to improve the flow conveyance. A buildability review on the widening design concepts raised numerous feasibility and safety concerns associated with working beneath a railway bridge and resulted in abandoning the widening works. Consequently, alternatives were considered and the optimum alternative for increasing the conveyance through A423 was found to be the introduction of jacked box culverts on either side of the rail bridge.

1.6 Summary of Second-Phase Appraisal

The preferred corridor was created by amalgamating the preferred options in each area which were determined from the First-Phase Appraisal process. The preferred corridor was then hydraulically and economically modelled to determine the optimal size of the preferred channel corridor (Optimised Preferred Corridor) with respect to the Economic and Social (flood risk) Objectives.

- Option 1 – Do Nothing
- Option 2 – Do Minimum
- Option 3 – Raised Defences only
- Option 4a - Small channel on its own
- Option 4b - Small channel with raised defences
- Option 5a - Medium channel on its own

- Option 5b - Medium channel with raised defences

Options 1 and 2 are baseline options for comparison and did not feature in the assessment. Option 3 is a fall back option. The assessment undertaken focused on the channel options as Options 4b and 5b include all the raised defence from Option 3 as wider integrated solutions. A large channel was found to be physically impractical to construct primarily due to the constraint on the culvert sizes through Botley Bridge and Old Abingdon Road.

A summary of the Phase 2 assessment is included in Appendix G. The results showed that Option 5b outperformed the other three options on all parameters. The results also indicated that Option 5b is the Optimised Preferred Corridor which would give the most flood risk benefits within the study area whilst providing the opportunity to achieve all the other objectives for the scheme.

Therefore, it is recommended that Option 5b from the Phase 2 assessment is taken forward as the preferred route corridor to outline design and onto the Outline Business Case. An outline of this route appears in the figure below.

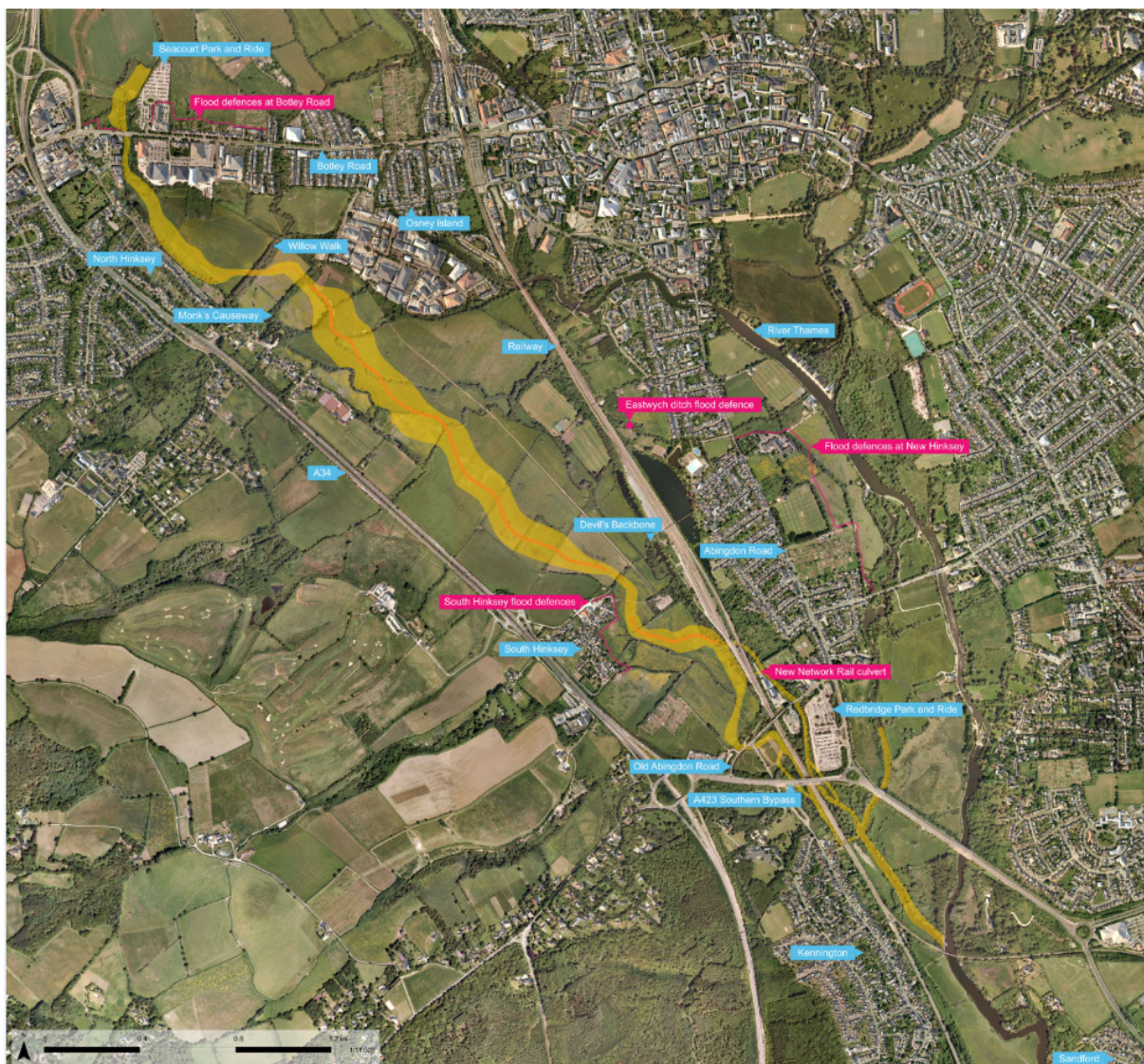


Figure E1 – Recommended Route Corridor

Introduction

2.1 General

The report entitled 'Channel Corridor Options Report, November 2015', hereinafter referred to as the Options Review Report, identified various options for potential corridors to form the western bypass flood channel around the western side of Oxford. The Options Review Report divided the scheme into seven areas as shown on Figure 1 and then proposed three to four options in each area with the exception of Area 1 where there were no separate options proposed, and Areas 5&6 which were merged.

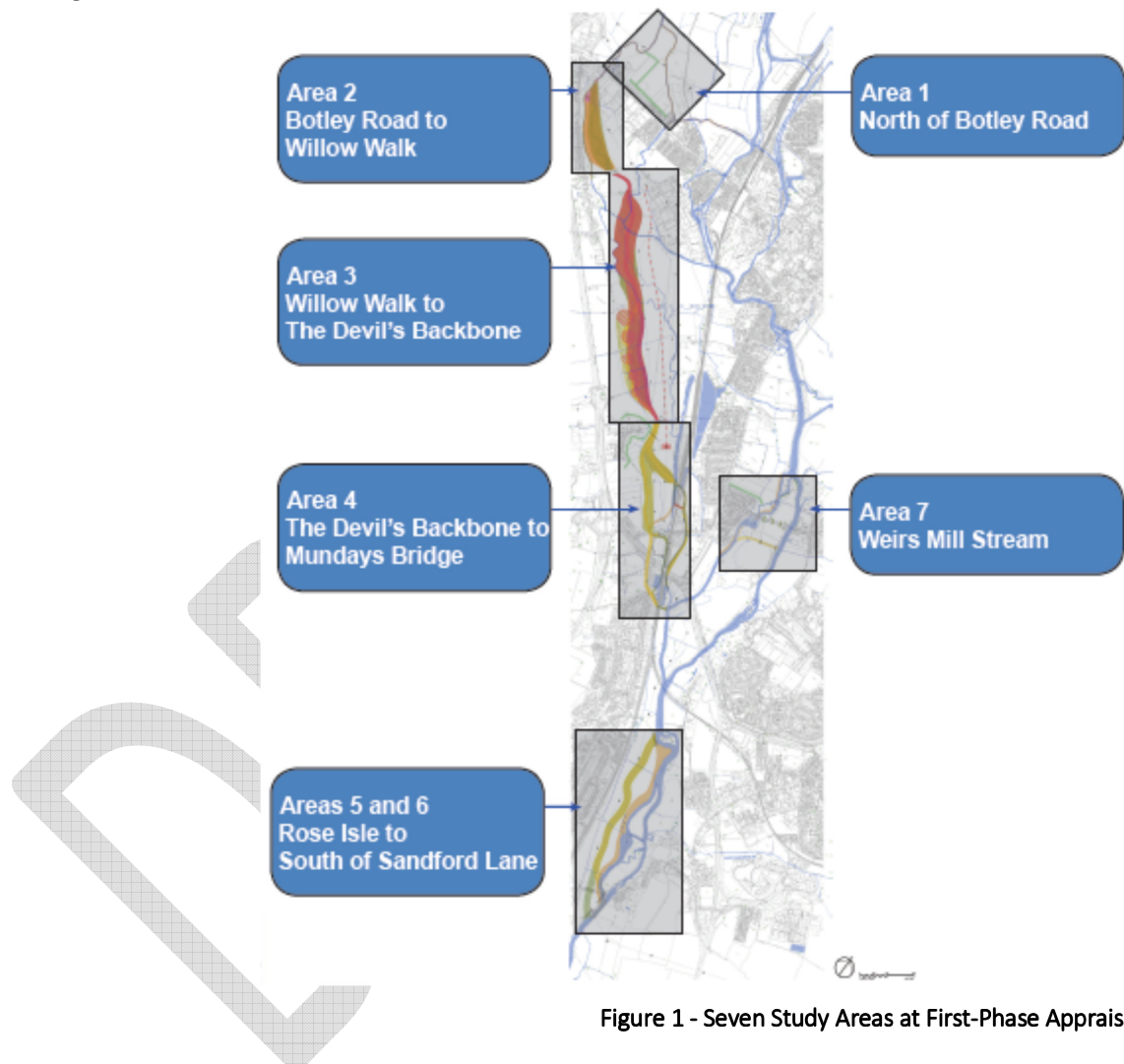


Figure 1 - Seven Study Areas at First-Phase Appraisal

Following on from the Options Review Report, this report presents a Two-Phase Options Appraisal process for developing an optimised preferred option for the Western Conveyance Channel that is equally balanced across the five principal objectives used to evaluate the scheme, namely; economic, social, technical, environment, and institutional objectives.

The Two-Phase process comprises the First-Phase wherein the preferred option is determined based on the social (excluding flood risk), technical, environmental, and institutional objectives. The resulting preferred option is then taken to the Second-Phase wherein it is optimised to meet the economic and social flood risk objectives to identify the preferred option which will be taken forward for design.

2.2 Background

Previous stages of the project undertook a detailed strategic appraisal of a whole range of technical solutions to flood risk management in the Oxford area. This culminated in the publishing of a Strategy in September 2010 which has since been verified by an Initial Assessment study. Subsequently, the Strategic Outline Case (SOC) was published in November 2014.

This stage of the project develops the recommendations of the previous studies which proposed the use of the flood conveyance channel through the western flood plain around Oxford. The current project does not revisit any of the previous decision points but adds more detail to the recommended option to develop the outline design and produce the Outline Business Case.

The SOC document outlined the Investment Objectives and the Critical Success Factors for the scheme. This options appraisal report used the same approach as outlined in the SOC. However the terminologies used herein are slightly different (nevertheless, parallel to the SOC) to enable a more detailed evaluation to be undertaken.

The work since the Strategy and the Initial Assessment stage has focused on gathering more detailed information on the area and reviewing the technical challenges to implementing the new conveyance channel. This resulted in the identification of a number of corridor options for each of the seven areas covered by the scheme. This options appraisal reviews the options via a number of socio-environmental criteria to select the optimum corridor option for each area which can be taken forward as a preferred option to the next stage of the scheme.

Overview of Multi-Criteria

3.1 Selection of the Multi-Criteria

There are a number of guidance documents published by the government for undertaking a multi-criteria analysis for options assessment. The key relevant documents are;

- *Multi-criteria analysis: a manual*. Published by the Department for Communities and Local Government in April 2013.
- *Integrating Cost-Benefit Analysis and Multi-Criteria Analysis of Flood and Coastal Erosion Risk Management Projects - R&D Project Record FD2018/PR2*. Published by the Joint Defra/EA Flood and Coastal Erosion Risk Management R&D Programme in April 2005.
- *Evaluating a multi-criteria analysis (MCA) methodology for application to flood management and Coastal defence appraisals. Guidance for the MCA-based element of the current approach to appraisal - R&D Technical Report FD2013/TR*. Published by the Joint Defra/EA Flood and Coastal Erosion Risk Management R&D Programme in November 2004.
- *Flood and Coastal Erosion Risk Management: Economic Valuation of Environmental Effects*
- *HANDBOOK for the Environment Agency for England and Wales*. Published by Eftec and Revised March 2010.

These documents provide a framework of guidance for undertaking multi-criteria analysis within the context of flood risk management projects. Whilst they provide guidance there is also an element flexibility in the processes to account for the diverse variability in the nature of flood risk management schemes.

The multi-criteria approach chosen encompasses the five objectives for the scheme, namely; economic, social, technical, environmental, and institutional. Within each objective, three sub-objectives have been identified to cover the topic areas within the scheme. These sub-objectives have been chosen to be mutually exclusive and to avoid overlaps between categories and the risk of any double counting.

The criteria on which to assess the various options has been developed by the CH2M technical specialists based on published flood risk guidance and the use of similar approaches on other schemes. It was then tailored to suit the specific requirements and objectives of the Oxford Flood Alleviation Scheme whilst trying to keep the process as simple and transparent as possible.

Consultation within the team then identified the key parameters within the sub-objectives which underpin the review. These parameters are not designed to be a comprehensive list of every topic which could be reviewed but include the key parameters that are representative of each of the sub-objective and likely to create a differentiation between options. Table 1 overleaf outlines the principal objectives and the sub-objectives.

PRINCIPAL OBJECTIVES	
	Sub-Objective
1	ECONOMIC OBJECTIVES
1i	Reduce the risk of floods impacting on infrastructure
1ii	Reduce the risk of flooding to commercial properties
1iii	Maximise the Net Present Value
2	SOCIAL OBJECTIVES
2i	Reduce the risk of flooding to residential properties
2ii	Improve landscape opportunities
2iii	Improve recreational opportunities
3	TECHNICAL OBJECTIVES
3i	Minimise engineering risks
3ii	Minimise infrastructure and services disruption
3iii	Safeguards health and safety in buildability and maintenance
4	ENVIRONMENTAL OBJECTIVES
4i	Improve ecological opportunities
4ii	Accords with WFD assessment
4iii	Keep environmental impact to acceptable levels
5	INSTITUTIONAL OBJECTIVES
5i	Provides Benefits and Minimises Impact on Interested Parties
5ii	Potential policy / legislative conflicts or conforms with wider planning outcomes
5iii	Provide opportunities for partnering/funding

Table 1– Outline of the Principal Objectives and Sub-Objectives

Two-Phase Options Appraisal Process

4.1 Overview of the Two-Phase Options Appraisal Process

The adoption of the Two-Phase Options Appraisal process enabled a progressive approach for determining a final Preferred Corridor that was equally balanced across all five Principal Objectives of the scheme. This allowed an initial ranking of options based on socio-environmental criteria, this ensured the best option was chosen which not only delivers flood risk management benefits but also other benefits required by the various stakeholders.

All Principal Objectives were evaluated individually for each area with the exception of the Economic Objectives. The evaluation of the Economic Objectives cannot be appraised exclusively for each individual area as the hydraulic modelling will only show significant flooding benefits if the combined options are included in the hydraulic model.

Therefore the second phase of the assessment process was been developed to allow combinations of the options for each of the scheme areas to be assessed as overall scheme options, this links in with the recommendations of the Strategy to investigate different channel sizes.

The approach outlined below summarises the Two-Phase Options Appraisal Process:

First-Phase	Phase 1A	<ul style="list-style-type: none"> Appraise all options in each area against Environmental, Social (excluding flood risk), Technical, and Institutional Objectives. Identify the Preferred Option in each area with respect to Environmental, Social (excluding flood risk), Technical, and Institutional Objectives. Identify Sub-preferred Option in each area with respect to Environmental, Social (excluding flood risk), Technical, and Institutional Objectives.
	Phase 1B	<ul style="list-style-type: none"> Integrate Preferred Options + Sub-preferred Options. Identify Preferred Corridor based on combining the respective Preferred Options and Sub-preferred Options in each area.
Second-Phase	Phase 2	<ul style="list-style-type: none"> Hydraulic and Economic modelling of the Preferred Corridor to analyse channel sizes and standards of protection, confirm the effectiveness in reducing flood risk to properties and infrastructure, and costs + economic attractiveness. Completed options appraisal. Produce Optimised Preferred Corridor.
	Gateway	<ul style="list-style-type: none"> Does the Optimised Preferred Corridor meet the flood risk and economic targets? <ul style="list-style-type: none"> If No, check sub-preferred options in further detail If No, abandon the Western Conveyance Channel concept and develop alternative options If yes, proceed to outline design and Outline Business Case.

Table 2– Outline of the Two-Phase Options Appraisal Process

4.2 First-Phase Options Appraisal

The objective of the First-Phase Options Appraisal was to discount the unfavourable options within the areas in respect to Environmental, Social (excluding flood risk), Technical and Institutional Objectives; and to reduce the different possible permutations of the overall preferred corridor. The outcome from the First-Phase Options Appraisal was the determination of a preferred corridor consisting of the preferred and sub-preferred options in each area.

4.2.1 Application of the assessment criteria in the First-Phase

The scheme has been split down into seven specific areas (as shown on Figure 1) and there are a number of options in each of these areas. The areas were chosen such that the options within each of the areas are mutually independent from a hydraulic aspect, with the exception of Area 5 and Area 6. Each area was subject to a separate review process and the options were assessed in relation to the best opportunities for that area.

Once the appraisal of each option against the Sub-Objectives had been carried out in Phase 1A, a five-point scoring system was applied against the relative performance of each option. The relative five-point scoring system ranges from 'highly++ positive' to 'highly-- negative' in the following order: **High++ (5)**, **Medium+ (4)**, **Low/Neutral (3)**, **Medium - (2)**, and **High-- (1)**.

The appraisal process was undertaken by the relevant technical specialists based on their knowledge and understanding of the scheme and the areas. The use of any specific specialist goal planning software was not utilised as these do not pick up the nuances of individual scheme and can give odd results. The options were chosen to avoid the likelihood of 'sudden death' criteria which would prevent an option from being taken forward.

The scoring process was undertaken by the CH2M team which consists of specialists from various disciplines, such as; landscaping, ecology, geomorphology, environmental, engineers, financial analysts, hydraulic modellers, etc. Additionally, due regard to the consultation process undertaken between January and March 2016 was also taken. The results from this consultation process fed into the appraisal process. This included feedback from landowners, residents, the public, Local Authorities, internal Environmental Agency technical specialists and other interested parties and groups.

In the First-Phase analysis the scores for the two Social Sub-Objectives were weighted to compensate for the modelling dependant Sub-Objectives which was not evaluated in the First-Phase. The weighting ensured the outcomes of the First-Phase Options Appraisal were equally balanced. Table 3 overleaf outlines the Principal Objectives and Sub-Objectives that were evaluated for each option at the First-Phase Options Appraisal.

In Phase 1B the preferred options were collated together to produce the Preferred Corridor to be taken forward to the Second-Phase of the assessment process.

Whilst the options were mutually independent from a hydraulic aspect; different options may have different characteristics, for example, from a landscape aspect. If the assessment criteria had determined that adjacent areas have preferred options which are of differing character then a further scheme wide review would be undertaken by the relevant technical specialists to assess any necessary alignment of options. However this additional review was found to be not necessary.

	PRINCIPAL OBJECTIVES	Weighting of scores on Sub-Objectives in the First-Phase Options Appraisal
	Sub-Objective	
1	ECONOMIC OBJECTIVES	
1i	Reduce the risk of floods impacting on infrastructure	Not evaluated in the First-Phase
1ii	Reduce the risk of flooding to commercial properties	Not evaluated in the First-Phase
1iii	Maximise the Net Present Value	Not evaluated in the First-Phase
2	SOCIAL OBJECTIVES	
2i	Reduce the risk of flooding to residential properties	Not evaluated in the First-Phase
2ii	Improve landscape opportunities	Weighted by multiplying by 1.5
2iii	Improve recreational opportunities	Weighted by multiplying by 1.5
3	TECHNICAL OBJECTIVES	
3i	Minimise engineering risks	Not weighted
3ii	Minimise disruption to infrastructure and services	Not weighted
3iii	Safeguards health and safety in buildability and maintenance	Not weighted
4	ENVIRONMENTAL OBJECTIVES	
4i	Improve ecological opportunities	Not weighted
4ii	Accords with WFD assessment	Not weighted
4iii	Keep environmental impact to acceptable levels	Not weighted
5	INSTITUTIONAL OBJECTIVES	
5i	Provides Benefits and Minimises Impact on Interested Parties	Not weighted
5ii	Potential policy / legislative conflicts or conforms with wider planning outcomes	Not weighted
5iii	Provide opportunities for partnering/funding	Not weighted

Table 3– Outline of Principal Objectives and Sub-Objectives for First-Phase Appraisal

4.3 Second-Phase Options Appraisal

The objective of the Second-Phase Options Appraisal is to produce a single Optimised Preferred Corridor that will then be taken forward to outline design and Outline Business Case.

In the Second-Phase, hydraulic and economic modelling will be undertaken on the Preferred Corridor that was borne from the First-Phase to optimise the economic and social objectives that are outlined in **Table 4**. Additional options of the Preferred Corridor that are primarily based on channel sizes will be introduced and evaluated with hydraulic and economic modelling to determine the optimised corridor size.

The results of the hydraulic and economic modelling will trigger a gateway to confirm whether the flood risk and economic targets have been achieved. Failure to meet any of these targets may result in the review of non-preferred options or ultimately could result in the abandonment of the Western Conveyance Channel solution.

4.3.1 Application of the assessment criteria in the Second-Phase

This phase off the assessment process took the results of the Phase 1 assessment and created the preferred route corridor. In line with the recommendations of the Strategy this corridor was then assessed for a variety of channel sizes to determine the optimum flood risk management solution.

The results of hydraulic and economic modelling of the a range of channel sizes for the preferred corridor were used to score the performance of each option based on the relative five-point scoring system ranges from 'highly++ positive' to 'highly-- negative' and it is in the following order: **High++**

(5), Medium+ (4), Low/Neutral (3), Medium - (2), and High—(1). The totals were summed following scoring of each sub-objective to determine the preferred size option for the corridor which is then defined as the Optimised Preferred Corridor. Table 4 below shows the criteria used to assess the outputs from the Phase 1 process.

	PRINCIPAL OBJECTIVES	Weighting of scores on Sub-Objectives in the Second-Phase Options Appraisal
	Sub-Objective	
1	ECONOMIC OBJECTIVES	
1i	Reduce the risk of floods impacting on infrastructure	Not weighted
1ii	Reduce the risk of flooding to commercial properties	Not weighted
1iii	Maximise the Net Present Value	Not weighted
2	SOCIAL OBJECTIVES	
2i	Reduce the risk of flooding to residential properties	Not weighted

Table 4 - Outline of Principal Objectives and Sub-Objectives for Second-Phase Appraisal

No weightings were applied to the scores in the Second-Phase Options Appraisal, the chosen number of Sub-objectives provided equal weighting between all the categories. Historically, applying weightings at the final appraisal creates a further layer of subjective assessment, and normally the un-weighted screening exercise sufficiently polarises and emphasises the differences between options. In the first instance, weightings in the Second-Phase Options Appraisal were completely avoided and only if there are two or three close-run options then a review of weightings could have been undertaken as a sensitivity exercise.

Principal Objectives in the First-Phase

This section will summarise the methodologies and parameters used to exclusively evaluate each option against each individual principal objectives.

5.1 Overview of Social Objectives

For Phase 1A Social Objectives in the First-Phase Appraisal were split down into two key Sub-Objectives, these are:

- 2ii Improvement on landscape opportunities
- 2iii Improvement on recreational opportunities

Each of the above Sub-Objectives were then expanded to focus on specific parameters. As noted previously, reduction of flood risk will be included in Phase 2 of the appraisal process and was not included at this stage.

The potential social impacts on residents, landowners and other persons were included in Institutional Objectives. This section focused on the social setting, appearance and use of the area.

5.1.1 2ii – Improvement on Landscape Opportunities

This Sub-Objective looked at the potential impact on views into and out of Oxford considering the ‘Oxford View cones’ to the west of the study area.

Consideration was given to the potential enhancements and effects on landscape and settings in the immediate context of each area. These were generally based on minimising impacts and improving and enhancing the existing landscape. A number of site walkovers and a detailed desk based studies to identify key constraints were undertaken to inform this process. The resulting Environmental Site Appraisal Plans have been used to help inform this part of the assessment.

5.1.2 2iii – Improvement on Recreational Opportunities

This Sub-Objective reviewed the long term recreational opportunities within each area individually and considered the wider possible connections. Activities included, pedestrian and cycleway route, fishing and other water based activities and horse riding.

The specific parameters used to evaluate the Social Objectives across all areas are outlined below:

	Sub-Objectives	Parameters
2ii	Improve landscape opportunities	Avoids impact on views of Oxford
		Enhances/adds to areas of classic landscape setting
2iii	Improve recreational opportunities	Maximises opportunities on dog walking and horse riding activities
		Maximises fishing and rowing
		Maximises future pedestrian and cycleway routes

Table 5 - Parameters for the Social Objectives

It is understood that the implementation of the scheme will have a number of significant temporary dis-benefits on recreational activities during construction and this will be reviewed as part of the Environmental Impact Assessment process for the project. At this stage it was considered that all

options will have similar temporary impacts which whilst needing investigating and mitigating will not impact on the option selection process.

5.2 Overview of Technical Objectives

Technical Objectives in the First-Phase Appraisal were split down into three key Sub-Objectives, these are:

- 3i Minimise Engineering Risks
- 3ii Minimise Disruptions to Infrastructure and Services
- 3iii Safeguards Health and Safety in Buildability and Maintenance.

Each of the above Sub-Objectives were then expanded to focus on specific parameters.

5.2.1 3i – Minimise Engineering Risks

This Sub-Objective looked at the potential engineering risks that would affect the functionality of the each option. The following major engineering risks were evaluated:

- Impacts on the groundwater regime
- Minimise introduction of engineered elements
- Reduce risk of blockages and frequency of maintenance

Ground investigations indicated the water table is high across the site with it being at its highest at Area 2, Area 3 and Areas 5 and 6. The ground investigation also showed that any potential deep excavations will be situated into a gravel strata below the water table. Working within these conditions could prove challenging. It is likely that any construction activity other than channel excavation such as structure foundations that occurs within the gravels will require temporary pumping and cofferdams.

The introduction of heavily engineered elements would add more risks and costs to the construction and operation stages of the scheme. The concept of the scheme is to reduce the number of structures and make the scheme as passive as possible to reduce ongoing operational requirements.

Reducing the risks of blockages and sedimentation at the design stage will be critical to the overall success of the project. The rural setting of the areas means there could be debris such as trees and branches that could potentially cause blockages and reduce the efficiency of the scheme. The required maintenance for this scheme could be intensive due to the lengths of proposed open channels. Therefore, minimising potential maintenance requirements at the design stage has a benefit in reducing the frequency and cost of interventions over the lifetime of the scheme.

5.2.2 3ii – Minimise Disruptions to Infrastructure and Services

This Sub-Objective looked at the potential disruptions to infrastructure and services, both during construction and after construction. The following parameters were used to evaluate this Sub-Objective:

- Impact on infrastructure, accesses and public highways
- Impact on existing buried and overhead services

The construction stage could physically impact the local infrastructure such as roads, private access points, bridges and the railway. Any proposed works on or nearby existing infrastructure could threaten the integrity of the existing infrastructure and would require careful design and construction. The reduction or avoidance of these impacts was assessed for each of the options.

The review on the services that could be potentially affected was undertaken and is outlined in Appendix D. This is a preliminary review based on returns from service providers, this will require updating at the detailed design stage.

The existing services that are within the footprints of the proposed options will require to either be protected or diverted. The presence of gravity drainage services are more limiting as it may not be possible to divert such services. Considerations were given to the presence of pylons within the vicinity of the proposed options as, based on discussions with National Grid, diverting these assets would be a major task with significant associated costs.

The existing services that are immediately outside the footprint of the proposed options may also require protection to ensure they are not damaged by the construction process.

5.2.3 3iii – Safeguards Health and Safety in Buildability and Maintenance

This Sub-Objective evaluated the overview of health and safety during construction and operation of the proposed options. The following parameters are used to evaluate this Sub-Objective:

- Buildability
- Working at height
- Confined spaces

The construction risks of each option would be very similar for all the different types of proposed channels. However, the high water table would impact on the construction of the deeper channels and measures such as installation of cofferdams and over pumping would be required to enable safe construction of structures.

Similarly temporary works such as scaffolding would be required for construction and maintenance activities that require working at height either on new bridge structures or around deep excavations or channels.

The creation of confined spaces or long lengths of culverts was reviewed in each option assessment to minimise and avoid these as the presence of confined spaces will introduce more risks during construction and maintenance.

The specific parameters used to evaluate the Technical Objectives across all areas are outlined below:

	<u>Sub-Objectives</u>	<u>Parameters</u>
3i	Minimise engineering risk	Impacts on groundwater regime
		Minimise introduction of engineered elements
		Reduce risk of blockages and frequency of maintenance
3ii	Minimise disruptions to infrastructure and services	Impact on infrastructure and public highways
		Impact on existing services
3iii	Safeguard Health and Safety in buildability and maintenance	Buildability
		Working at height
		Confined spaces

Table 6 - Parameters for the Technical Objectives

5.3 Overview of Environmental Objectives

Environmental Objectives in the First-Phase Appraisal were split down into three key Sub-Objectives, these are:

- 4i Improve Ecological Opportunities
- 4ii Accords with WFD assessment
- 4iii Keep environmental impact to acceptable levels

Each of the above Sub-Objectives were then expanded to focus on specific Parameters.

5.3.1 4i – Improve Ecological Opportunities

This Sub-Objective reviewed the likely impacts and benefits on the designated sites around the area which could be affected. In particular the impacts on the Sites of Special Scientific Interest (SSSI), notably Port Meadow, Hinksey Meadow Iffley Meadow, were assessed to try and ensure that any changes are neutral or net beneficial.

The options were reviewed to ensure that they maximise the wider environmental habitat created, this is mainly centred on the possibilities to maximise in-channel habitat created with the new channel and minimise impacts on existing channels where ever possible, although wider opportunities were considered. In addition to the biodiversity and ecological benefits fisheries improvements to the area were also assessed. In consideration of these aspect the inputs, comments and views of the relevant Environment Agency Technical Specialists and local conservation groups were sought and fed into the appraisal.

5.3.2 4ii – Accords with WFD assessment

The compliance of any new scheme in a riverine environment with the "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or, in short, the EU Water Framework Directive (WFD) is one of the key elements to consider. This section undertook a high level review of the likely impact on the following areas covered by the WFD;

- Impact on hydrological regime
- Impact on river continuity
- Impact on morphological conditions

This review was undertaken by a geomorphologist and an environmental scientist familiar with the requirements of the WFD. This was a high level review to screen out the most potentially damaging options, a further detailed WFD assessment of the preferred option will be required at a later stage of the scheme.

5.3.3 4iii – Keep environmental impact to acceptable levels

A scheme of this scale will have a number of potential impacts on a range of receptors. This section focused on the potential impacts on archaeology and ecological aspects of the existing area.

There are known archaeological deposits in the area and a number of Scheduled Monuments (SMs) below Old Abingdon Road. A Desk Based Assessment of the known information related to archaeology in the area was used to assess the potential impacts on buried deposits and SMs and inform the selection of the option which is likely to have the least impact.

Similarly ecological impacts on known habitats and species in the area was reviewed to try and minimise impacts as far as possible. A Phase 1 Habitat Survey along with site walkovers and

discussion with local wildlife groups and environment Agency Technical specialists have been used to assess this section.

The specific parameters used to evaluate the Environmental Objectives across all areas are outlined below:

	Sub-Objectives	Parameters
4i	Improve ecological opportunities	Any impacts on SSSIs to be neutral or net beneficial
		Maximises wider environmental habitat created
		Maximises in-channel habitat created and fisheries improvements
4ii	Accords with WFD assessment	Impact on hydrological regime
		Impact on river continuity
		Impact on morphological conditions
4iii	Keep environmental impact to acceptable levels	Minimises impacts to Scheduled Monuments and archaeology
		Minimises ecological impacts

Table 7 - Parameters for the Environmental Objectives

5.4 Overview of Institutional Objectives

Institutional Objectives in the First-Phase Appraisal were split down into three key Sub-Objectives, these are:

- 5i Provides Benefits and Minimises Impact on Interested parties
- 5ii Potential policy/legislative conflicts and conforms with best planning outcomes
- 5iii Provides opportunities for partnering/funding

Each of the above Sub-Objectives were then expanded to focus on specific parameters.

5.4.1 5i – Provides Benefits and Minimises Impact on Interested Parties

This Sub-Objective evaluated the options in terms of which option would provide benefits and minimise impacts to a range of parties who have a direct interest in the areas of the options. These parties are as follows;

- Residents/Landowners/Tenants
- Local Authorities
- Public
- Other interested local organisations and businesses

Five public drop-in meetings were held in various locations around the Oxford area and in Abingdon in January 2016 to gather opinions from the public and other interested organisations. These were generally well-attended with over 170 people attending each individual drop-in session. At these events, the public were asked to complete a questionnaire to indicate any preferences for the particular options presented. In addition, an online e-consultation process was undertaken in parallel to enable the public or other organisations to directly input to the consultation without the need to attend one of the meetings in person. All these responses have been collated and incorporated into the First-Phase Options Appraisal process.

Prior to the public drop in sessions, individual meetings were held with various landowners, residents and tenants across the areas who would be directly affected by any of the options. Where possible, the initial responses to the proposed options for the areas of direct interest from these parties have been incorporated into the First-Phase Options Appraisal process.

Presentations to the following interested local authorities for the area of interest were given to show the proposed options to the various internal departments within these local authorities;

- Oxford County Council
- Oxford City Council
- Vale of White Horse District Council
- South Oxfordshire District Council

Copies of all the public drop-in meeting display material and the options were also circulated to each of the local authorities. Minutes of these meetings and subsequent written feedback from the local authorities have been incorporated into the First-Phase Options appraisal process.

Other interested parties such as Natural England, Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust, statutory service providers and environmental groups were also invited to separate meetings as well as the general public drop in sessions to understand their concerns and comments on the proposed options.

No direct meetings were held with businesses if they are not landowners or tenants that would be directly impacted by the works. However, they were invited the public drop-in meetings and any responses have been incorporated into the First-Phase Options Appraisal process.

5.4.2 5ii - Potential policy / legislative conflicts or conforms with wider planning outcomes

The potential compliance or contradiction of the aims and objectives of the wider planning outcomes for the area were reviewed;

- Links to River Basin Management Plan
- Impacts on river navigation in the Oxford Area
- Links to existing local planning policy

An overview review of all the Sub-Objectives against the published 'Thames River Basin District River Basin Management Plan: 2009' and its updated 2015 Plan published on the 18th February 2016 was undertaken and any potential conflicts or variations were taken into account in the First-Phase Options Appraisal process. Many of the aims and objectives for the Plan are covered in other sections, in particular, the assessment of environmental aspects. This section undertook an overview of the general option concepts to avoid double counting of specific parameters covered elsewhere.

A review of the proposed options with respect to impacts on river navigation on the River Thames and other smaller watercourses was undertaken to assess any potential impacts of the options both in terms of water level management and additional hazards which may be created.

A number of meetings have been held with the planning departments from the four relevant local authorities and local planning guidance documents from these organisations have been reviewed. Care has been taken to avoid double counting where wider benefits include environmental or recreational outcomes as these are accounted for within other sub-objectives.

5.4.3 5iii - Provides opportunities for partnering / funding

The section looks at the various mechanisms for providing wider benefits from the scheme which may create opportunities to involve other public or private organisations - either directly or in the form of contributions or creation of wider benefits to the area. The following parameters were reviewed as part of the First-Phase Options Appraisal process;

- Meets wider stakeholder requirements and objectives
- Provides opportunities for developments
- Provides opportunities for public and private sector funding

Based on the aims and objectives from stakeholders, a number of wider flood risk benefits associated with keeping Oxford open for business during flood events have been identified. These are predominately associated with a reduction in flood risk to Botley and Abingdon Roads and key infrastructure. The direct benefits from this were included in the Second-Phase Options Appraisal process; however this review assessed the potential social benefits.

The Environment Agency and this scheme seek to maintain and optimise the use of existing floodplain and does not have a remit for removing land from the floodplain for development. However it is likely that some of the proposed options may free up some local brownfield sites surrounding the existing developed areas which are currently at flood risk. These brownfield sites could be suitable for re-development following the scheme which may attract re-generation opportunities for the private sector.

As part of the funding strategy for the scheme, contributions from third parties and key stakeholders are being sought to close the funding gap which exists at the time of the First-Phase Options Appraisal process. These could potentially be various kinds of contributions such as costs waived, direct financial contributions, etc. A number of ongoing discussions are underway with various potential contributors and this sub-objective assesses the potential options which could be attractive to investors based on the discussions held before the date of publishing of this report.

The specific parameters used to evaluate the Institutional Objectives across all areas are outlined below:

	<u>Sub-Objectives</u>	<u>Parameters</u>
5i	Provides Benefits and Minimises Impact on Interested Parties	Residents / Landowners/ Tenants
		Local Authorities
		Public
		Other interested local organisations and businesses
5ii	Potential policy / legislative conflicts or conforms with wider planning outcomes	Links to River Basin Management Plan
		Impacts on river navigation in area
		Links to existing planning policy
5iii	Provide opportunities for partnering/funding	Meets stakeholder requirements and objectives
		Provides opportunities for development, both public and private
		Provides opportunities for public and private sector funding

Table 8 - Parameters for the Institutional Objectives

First-Phase Options Appraisal

6.1 First-Phase Options Appraisal at Area 1 – Botley Road

6.1.1 Background information on Area 1

Area 1 covers the location immediately upstream of Botley Road and also includes conveyance past Botley Road. It has been identified by the Oxford Flood Risk Management Strategy, Technical Report that the Botley Bridge near the Seacourt Park and Ride can be improved to have sufficient capacity to convey enough water for the western conveyance channel. The above report also found that the other existing conveyance routes under Botley Road were already operating at capacity without the opportunity to further increase capacity.

The main constraint to improvement works in this area is Botley Road itself. The limited flow openings below the road and traffic density creates a barrier between the upstream and downstream sides. This coupled with the density of services running along each side of the road also makes undertaking major bridge upgrade works or installing new bridges to increase capacity difficult and costly.



Figure 2 - Seacourt Stream at Botley Bridge

There are a number of properties, both residential and commercial along Botley Road which are at risk of flooding in relatively low return period events.

Preventing flooding and the associated traffic disruption to Botley Road is one of the objectives of the scheme. The road currently floods at relatively low return period events in the area to the east of the Seacourt Park and Ride. In previous flood events water has been pumped over the road at this

location however the pumping work still resulted in the road being closed to traffic due to pipe runs. A pipe is being installed below the road so that pumping can take place without closing the road in the short-term. The options will look at the opportunities to create a passive solution to reduce flood risk to the road.

6.1.2 Options Development at Area 1

The options available in this area are limited. The approach to the design development in Area 1 was to develop options that will supplement the preferred corridor by proportioning the flow splits at Botley Road towards the channels that will feed the new preferred channel route. Due to the cost constraints associated with new bridges the opportunities for increasing the capacity of existing structures was reviewed.

The overall scheme lowers flood levels in the area of Botley Road however it has not been possible to lower them sufficiently to reduce flood risk to property and infrastructure significantly, therefore a number of local raised flood defences in the form of earth embankments and walls are required to protect the residential properties located on the northern side of Botley Road. These have been located to minimise land take and impacts on the remaining flood plain.

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6.2 First-Phase Options Appraisal at Area 2 – Botley Road to Willow Walk

6.2.1 Background information on Area 2

Area 2 - Botley Road to Willow Walk covers the area immediately downstream of Botley Road to Willow Walk. A distance of approximately 1km.



Figure 3- Existing floodplain between Botley Road and Willow Walk

There are several constraints in this area including existing buildings on the right bank downstream of Botley Road Bridge and the narrow strip access from Botley Road on the left bank of the Seacourt Stream. There is also a line of high voltage overhead power lines and associated pylons crossing the area. One particular pylon at the northern end of the area is a significant constraint on the options.

A line of willow trees is present on the right bank of the Hinksey Stream. The willow trees have not been identified as environmentally significant however local residents have indicated the trees hold aesthetic value. The line of mature trees along Willow Walk also has significant visual and landscape value.

There are also other environmental issues and opportunities with the main concern being the presence of MG4 quality grassland which includes a number of rare species.

6.2.2 Available options at Area 2

There are four options proposed for the corridor at Area 2.

All the proposed options feature a constrained channel immediately downstream of Botley Road due to the presence of buildings close to the right bank of the Seacourt Stream. All options will also cross Willow Walk by replacing the existing culverts with a clear-span bridge through the existing culverts.

The proposed channels in all of the options will require to be constrained at the downstream end to facilitate a crossing through Willow Walk. The velocities at this constrained part of the channel are likely to be high enough to cause erosion and therefore there will be a requirement for erosion protection around the structure.

A brief description of each option is given in this report and separate drawings for each option are also provided in Appendix A.

6.2.2.1 Option 2A – Existing channel retained and shallow scrape to convey larger flows

Refer to Appendix A.01 for the conceptual drawing for Option 2A.

Option 2A will retain the Seacourt Stream as the primary channel during low rainfall events and proposes a natural shallow (approx. 1m deep) scrape channel that will be run in parallel to the Seacourt Stream. The proposed scrape channel will have a wide parabolic shape and it will activate before the water level inside Seacourt Stream reaches to the bank levels. A short length (approx. 100m) of the left bank for Seacourt Stream will be lowered to accommodate a spillway which will connect with the proposed scrape channel. The flows on the spillway could be high enough to cause erosion and therefore reinforced section of channel will be required in this location. The dimensions and construction details for the spillway have not yet been established but it is likely to be a grass-reinforced spillway.

It is not envisaged that any works will be required along the banks of Seacourt Stream, therefore the tree lines along both banks of Seacourt Stream would be retained. However, the trees located on the left bank at the upstream end of the channel, would require to be felled to accommodate the works. The ditch located at the upstream end of the proposed scrape channel, at the back of the industrial buildings, will discharge directly to the proposed channel.

The extents/width of the proposed scrape channel in-between its upstream and downstream ends has not yet been established and its required width will be determined by modelling. The current width as shown on the plans ranges from 60m to 130m.

6.2.2.2 Option 2B – New 2-stage channel across area 2B and existing channel modified to form a backwater

Refer to Appendix A.02 for the conceptual drawing for Option 2B.

Option 2B will turn Seacourt Stream into a backwater and proposes a 2-stage channel that will have a total maximum depth of approximately 2m. The proposed 2-stage channel will have a lower (first) stage which will be of similar size to Seacourt Stream; the first stage will likely be constantly wet and it may receive groundwater flows. The higher (second) stage will be a lot wider and will only be active once the capacity of the first-stage channel has been exceeded.

The upstream end of the proposed 2-stage channel will be connected directly to the Seacourt Stream and both channels will have the same invert level at the point of connection. At the upstream end, a small part of Seacourt Stream will require to be filled-in to divert all flows onto the higher (second) stage of the proposed 2-stage channel, therefore this will turn Seacourt Stream into a backwater channel. However, there is an opportunity to maintain a sweetening flow in Seacourt

Stream by constructing a culvert or a control structure at the point of connection with the proposed 2-stage channel. Another opportunity for maintaining a sweetening flow in Seacourt Stream would be to introduce a small channel to create a link between the two channels. However, some trees would require to be removed to accommodate the link channel.

Similar to Option 2A, it is not envisaged that any works would be required along the banks of Seacourt Stream and therefore the tree lines along both banks of Seacourt Stream would be retained. However, the trees located on the upstream end of the channel, near the footpath, would require to be felled to accommodate the proposed 2-stage channel. The single ditch is located at the upstream end of the proposed scrape channel, at the back of the industrial buildings, will discharge directly to the proposed channel.

The second-stage will be a lot wider than the first stage with its left bank being slightly higher than its right bank to prevent overflows onto Seacourt Stream. The extent/width of the second-stage channel has not yet been established and its required width will be determined by modelling. The current width as shown on the plans ranges from 60m to 130m.

6.2.2.3 Option 2C – Existing channel retained and second stage on farmland downstream of pylon

Refer to Appendix A.03 for the conceptual drawing for Option 2C.

Option 2C will retain Seacourt Stream as the primary channel during low rainfall events and proposes a natural shallow scrape channel that will be approximately 1m deep. The proposed scrape channel will have a wide parabolic shape and it will be activated before the water level inside Seacourt Stream reaches to the bank levels. A significant length (approx. 500m) of the left bank for Seacourt Stream will be lowered to connect with the proposed scrape channel. The spill flows from Seacourt Stream into the proposed scrape channel will be distributed across a long length of the channel and therefore the velocities will be much lower; hence there won't be a need to introduce any heavily engineered spillways.

Option 2C will require lowering the left bank of Seacourt Stream, therefore the tree line along left bank of Seacourt Stream would require to be removed. However, the trees located on the upstream end of the channel, near the footpath, will be retained. More flow will also be required to pass down the existing channel past the pylon which will require additional engineered scour protection to avoid long term erosion problems. This will also need to be replicated along the opposite private gardens on the right bank of the Seacourt Stream.

The extents/width of the proposed scrape has not yet been established and its required width will be determined by modelling. The current width as shown on the plans ranges from 60m to 150m.

6.2.2.4 Option 2D – As Option 2C but with second stage starting upstream of pylon

Refer to Appendix A.04 for the conceptual drawing for Option 2D.

Option 2D is very similar to Option 2C. The principal difference between these two options is that the upstream end of Option 2D will have an unconstrained channel which would isolate the pylon on an island.

6.2.2.5 Access for construction

Access to this area can be gained by existing routes from Botley Road to the north or via Willow Walk. The stone bridge at the entrance to Willow Walk is steep and has a weight limit which prohibits construction access.

The access for general construction traffic from Botley Road is prohibitive due to the existing volume of traffic on this route as it is a key route into the city centre. Whilst some access will be required

from Botley Road it is proposed the main access would be from the A34 at South Hinksey and then along the channel corridor route. This will also minimize traffic impacts on North Hinksey village.

Light maintenance vehicles could utilise the existing access points in the longer term to avoid creating new access points off the public highways.

6.2.3 Summary of First-Phase Appraisal at Area 2

6.2.3.1 Summary of Social Objectives at Area 2

Refer to Appendix B.01 for the evaluation of Social Objectives at Area 2. The scoring results following the evaluation showed that Option 2A is the preferred options with respect to the Social Objectives in Area 2. For this objective, Option 2A is the preferred option and Options 2C and 2D were the sub-preferred options.

6.2.3.2 Summary of Technical Objectives at Area 2

Refer to Appendix B.02 for the evaluation of Technical Objectives at Area 2. The scoring results following the evaluation showed that Options 2A and 2D are the preferred options with respect to the Technical Objectives in Area 2.

6.2.3.3 Summary of Environmental Objectives at Area 2

Refer to Appendix B.03 for the evaluation of Environmental Objectives at Area 2. The scoring results following the evaluation showed that Options 2D and 2C are the preferred options with respect to the Environmental Objectives in Area 2.

6.2.3.4 Summary of Institutional Objectives at Area 2

Refer to Appendix B.04 for the evaluation of Institutional Objectives at Area 2. The scoring results following the evaluation showed that all the options are of an equal score and this section made no difference to the option selection process in Area 2.

6.2.4 First-Phase Preferred Options at Area 2

Refer to Appendix C.2 for the First-Phase Scoring Matrix for Area 2. The results showed that overall; **Option 2D is the Preferred Option**, and **Option 2C is the Sub-Preferred Option** following the First-Phase Appraisal Process.

6.3 First-Phase Options Appraisal at Area 3 – Willow Walk to South Hinksey

6.3.1 Background information on Area 3

Area 3, Willow Walk to South Hinksey, extends from the section immediately downstream of Willow Walk to the area immediately downstream of the Devil's Backbone, a distance of approximately 2km.

There are a number of significant constraints in this area which have informed the location of the various options. On the eastern side of the area there are a number of significant buried high voltage power cables.

The 'Electric Road' track which runs north-south through the centre of the area between the railway line to the east and the A34 to the west creates a significant barrier to the possible route alignments. There are high voltage power cables in concrete cable trenches each side of this track. Diversion or crossing these cables is likely to be prohibitively expensive and disruptive to consumers.



Figure 4- 'Electric Road'

There are a number of overhead power cables running across the area, however these are less of a restriction, although the pylon locations do limit the extent of channel meanders which can be created.

To the west there is a Thames Water sewer running from North Hinksey to South Hinksey which has underground storm water tanks running alongside St Peters College sports ground and the Rugby Club which demarcates the western edge of the options corridor.

The landowner of the fields between North Hinksey and South Hinksey has identified the opportunity to undertake gravel extraction in this area in parallel with the scheme. Whilst this opportunity has not been reviewed in detail as part of this report it will be included as part of the materials management options which will be considered separately.

6.3.2 Available options at Area 3

There are four options proposed for the corridor at Area 2. All four options propose a 2-stage channel that will have a total maximum depth of approximately 2m. The extents/width of the proposed 2-stage not yet been established and its required width will be determined by modelling. The current width as shown on the plans ranges from 30m to 180m.

The main differences among the options is on how each option will accommodate a lake. Copies of the plans for the various options are provided in Appendix A.

6.3.2.1 Option 3A – New 2-stage channel

Refer to Appendix A.05 for the conceptual drawing for Option 3A.

Option 3A features a 2-stage channel without any inclusion of a lake. The second-stage of this proposed channel will have shallower banks along all of its length to support the existing watercourses at the point of crossings.

6.3.2.2 Option 3B – New 2-stage channel with an offline lake

Refer to Appendix A.06 for the conceptual drawing for Option 3B.

Option 3B proposes a 2-stage channel with the addition of a large offline lake at the southern half of Area 3. It is most likely that the pond will be constantly fed by groundwater and therefore it will have little capacity to store flood water.

6.3.2.3 Option 3C – New 2-stage channel with an online lake

Refer to Appendix A.07 for the conceptual drawing for Option 3C.

Option 3C proposes a 2-stage channel with the addition of a large online lake at the southern half of Area 3. This option will require a control structure to be constructed at the downstream end of the lake to retain the required water inside the lake and to prevent excessive flows exiting the lake. Given that the lake will likely be fed by groundwater, then the control structure will also prevent the conveyance of groundwater flows during periods of dry weather.

This lake has the most potential for being able to store some floodwater and therefore it could be designed to act as a flood mitigation feature.

6.3.2.4 Option 3D – New 2-stage channel with a series of offline ponds/lakes

Refer to Appendix A.08 for the conceptual drawing for Option 3D.

Option 3B proposes a 2-stage channel with the addition of a series of offline ponds at the southern half of Area 3. Effectively, these ponds would act the same way as the lake in Option 3B.

It is envisaged that the ponds would be used for environmental or ecological purposes and they will have limited recreational benefits.

6.3.2.5 Access for construction

The location of the South Hinksey interchange on the A34 and the direct access from the interchange into the works areas mean that this will be the main road vehicle access point for the entire area from Botley Road to Old Abingdon Road. However it may be necessary to carry out some

upgrade works to the short slip roads at this interchange. This will also have a significant temporary impact on the village of South Hinksey during the construction period.

The possibility of utilising the railway sidings to the east of the site is also being investigated to reduce reliance on road transport for materials management. If this proves to be a viable option then a temporary access across to the sidings will need to be installed, this may include temporarily bridging or creating a causeway across the lagoons in this area.

A main compound area for the works could be located in the fields just off the interchange junction which would facilitate access north and south to cover the whole of the area from Botley Road to Redbridge.

6.3.2.6 Proposed clear-span bridges

All the proposed options feature a constrained channel immediately downstream of Willow Walk. There is another footpath which is in parallel to Willow walk and located approximately 200m to the south. This footpath will also require an additional clear-span bridge to be constructed along with a constrained channel to facilitate a crossing for the proposed channels through this footpath.

It may also be necessary to provide an agricultural crossing in the area depending on the needs of local farming practices. However, the location and the type of agricultural crossing will be determined during the outline design stage.

All proposed options will also feature a constrained channel at the downstream end of Area 3 to facilitate a crossing for the proposed channels through this Devil Backbone. An additional proposed clear-span bridge at Devil's Backbone will be required to accommodate this crossing.

The velocities at the constrained channels at the vicinity of all the proposed clear-span bridges are likely to be significantly large to cause erosion. Therefore, there could be a requirement to introduce engineered channels at these locations.

All proposed bridges will need to be raised above the levels of existing footpaths to provide sufficient clearance below the soffits for the flood flows and reduce the risk of debris snagging. This will make them highly visible in the predominantly flat existing landscape and they will need a sympathetic design.

6.3.2.7 Crossings of existing watercourses

All of the proposed channels will cross various existing watercourses including; Bulstake Stream, Seacourt Stream, Hinksey Stream, Hogacre Ditch, and various smaller ditches. The crossing of existing watercourses will introduce a risk of changing the upstream and downstream flow characteristics of these watercourses. The change in characteristics could have significant environmental, ecological, and maintenance impacts for the watercourse.

The invert levels of the proposed channels have not yet been established, therefore it is not possible to predict the potential levels at crossing points with existing watercourses. The design approach for the proposed channels will be to try and situate proposed channels so that they will have same or similar invert level to the existing invert levels of watercourses at points of crossings. Note that there are opportunities available for managing upstream and downstream effects, such as: introducing flow control structures at crossing points, and by creating diversion channels to feed existing watercourses. All of these opportunities will be evaluated at outline design stage.

Potential upstream effects on watercourse

The relative invert levels between a proposed channel and an existing watercourse at their crossing point will govern the amount of potential changes to the upstream characteristics of that watercourse. If the invert level of a proposed channel is situated higher than the existing invert level

of a watercourse then there could be an increased flood risk at the upstream end of that watercourse.

Potential downstream effects on watercourses

Similarly, the amount of potential changes to the downstream characteristics of a watercourse will be governed by the relative invert levels between a proposed channel and an existing watercourse at the crossing point. The main potential downstream risk is the conveyance of additional flow into a watercourse from a proposed channel which could cause flooding at the downstream end of a watercourse. Another downstream risk is the discontinuation of flow into the watercourses during conditions of low flow within a proposed channel.

6.3.2.8 High water table

Based on the recent ground investigation, the first-stage of all proposed channels will be situated in the gravel strata which is below the water table. This has the benefit that the channel will be groundwater fed and avoid the reliance for a base flow from other watercourses. It will also improve the quality of the water in the channel over a fluvial fed option. However, there is a risk that the upstream groundwater regime could be affected and this risk will be evaluated further during detailed design.

The ground investigations also showed that the gravels are relatively unstable when exposed which means that creating steep sides to the primary channel will be difficult. Regardless of the construction profile erosion will take place until the natural angle of repose for the gravels is achieved which will form a dish shaped lower channel rather than a steep sided narrow channel. This could help accommodate a wider range of biodiversity but will impact on the visual appearance of the channel.

The high water table will also impact on the construction processes during the excavation of the channel. Some of the material from the lower sections of the channel will potentially be dug underwater and will need to be dried before re-use or disposal. This will require large temporary land areas to facilitate this processing.

Also, the high water table will mean that all proposed lakes are likely to be fed by groundwater and this is advantageous as there will be a constant supply of high quality water into the lake. However, this has the potential of impacting the upstream groundwater conditions and it will be evaluated further during outline design stage.

Where possible the proposed channels will be dug from within the footprint of existing channels to minimise impacts on areas outside of the permanent works footprint.

6.3.2.9 Proposed raised flood defences

The new flood defence around South Hinksey should be constructed using suitable material arising from the excavation of the channel. The height and extent of these raised defences will be dependent on the required level of protection.

A brief description of each option is given in this report and separate drawings for each option is also provided.

6.3.3 Summary of First-Phase Appraisal at Area 3

6.3.3.1 Summary of Social Objectives at Area 3

Refer to Appendix B.01 for the evaluation of Social Objectives at Area 3. The scoring results following the evaluation showed that Options 3B and 3C are the preferred options with respect to the Social Objectives at Area 3. For this objective, Option 3C is the preferred option and Option 3B is the sub-preferred option.

6.3.3.2 Summary of Technical Objectives at Area 3

Refer to Appendix B.02 for the evaluation of Technical Objectives at Area 3. The scoring results following the evaluation showed that Options 3A and 3D are the preferred options with respect to the Technical Objectives at Area 3. For this objective, Option 3A is the preferred option and Option 3D is the sub-preferred option.

6.3.3.3 Summary of Environmental Objectives at Area 3

Refer to Appendix B.03 for the evaluation of Environmental Objectives at Area 3. The scoring results following the evaluation showed that Options 3A and 3D are the preferred options with respect to the Environmental Objectives at Area 3. For this objective, Option 3A is the preferred option and Option 3D is the sub-preferred option.

6.3.3.4 Summary of Institutional Objectives at Area 3

Refer to Appendix B.04 for the evaluation of Institutional Objectives at Area 3. The scoring results following the evaluation showed that Options 3A and 3D are the preferred options with respect to the Institutional Objectives at Area 3. For this objective, Option 3D is the preferred option and Option 3A is the sub-preferred option.

6.3.4 First-Phase Preferred Options at Area 3

Refer to Appendix C.3 for the First-Phase Scoring Matrix for Area 3. The results showed that overall; **Option 3A is the Preferred Option**, and **Option 3D is the Sub-Preferred Option** following the First-Phase Appraisal Process.

6.4 First-Phase Options Appraisal at Area 4 – Redbridge

6.4.1 Background information on Area 4

The Redbridge area extends from the area immediately downstream of the Devil’s Backbone to Munday’s Bridge. This area has multiple key infrastructure crossings; Old Abingdon Road, the Southern Bypass Road and the railway line.



Figure 5- Old Abingdon Road at Redbridge Crossing

There are numerous existing infrastructure in this area which creates a significant number of constraints. The two lines of electricity pylons between the Devil’s Backbone and Old Abingdon Road restrict the opportunities for utilising the whole of this area.

The railway runs north-south and flood flows need to cross this line to return to the River Thames at this location. There are currently three existing crossings on watercourses below the railway, Stroud’s and Munday’s Bridges are located south of Old Abingdon Road and the existing Hinksey Stream culvert (Cold Harbour Bridge) is to the north of Old Abingdon Road. Network Rail are also installing a fourth culvert upstream of Old Abingdon Road.

Old Abingdon Road creates a significant challenge to the scheme. There are a number of existing culverts below the road but these are of insufficient capacity to accommodate the flood flows and additional capacity will be required. This is complicated by the fact that the existing culverts have Scheduled Monument status. There is a significant risk that any additional crossing at this location could encounter more buried archaeology.

The A423 Oxford Southern Bypass cuts across the route on a wide embankment and flood flows need to pass this embankment. The land between Old Abingdon Road and the A423 consists of historic landfill sites. To the east the Park and Ride car park facility restricts opportunities. Kennington Road corridor carries a large number of critical services which restricts work to this corridor.

At Munday's Bridge, there is an electricity pylon and a residential garden bounded by a sheet piled wall that restricts access into this area.

6.4.2 Available options at Area 4

There are three options proposed for the corridor at Area 4. The general philosophy behind the options chosen in this area is to optimise the capacity of the openings under the railway and under the Oxford Bypass and minimise the scale of engineering works.

Immediately adjacent to the proposed flood defence bund at South Hinksey, all of the options would require the construction of a clear span bridge to take the access track for the electricity substation. This bridge will also take some service (electricity) cable diversions.

All options utilise existing watercourses and these watercourses would require widening and dredging to increase their flow capacities. Any proposed widening works on the existing watercourses that span within close proximity and in parallel with the railway embankment will require a more engineered channel to protect the railway embankment.

Similarly, widening and deepening of existing railway and highway crossings will also be required to increase flow capacity. Copies of the plans for the various options are provided in Appendix A.

6.4.2.1 Option 4A – New single 2-stage channel

Refer to Appendix A.09 for the conceptual drawing for Option 4A.

Option 4A proposes a 2-stage channel that will start from Devil's backbone and end at the first railway crossing at Cold Harbour Bridge. The flow will then go into the first flow-split and a proportion of the flow will cross the railway at Cold Harbour Bridge into Hinksey Stream. The remaining flow from the first flow-split will go into the lagoon. A second flow-split will be located downstream of the lagoon to utilise a new culvert that will be constructed by Network Rail. The remaining flow from the second flow-split will go into a proposed constrained channel that will start from the downstream end of the lagoon and end at Old Abingdon Road. This constrained channel will have to meander away from a pylon before it reaches Old Abingdon Road.

Option 4A proposes two new crossings at Old Abingdon Road; one at the western side of Old Abingdon Road by the junction with Kennington Road. The other crossing will be at the eastern side of Old Abingdon Road and it will be situated to the east of existing Mayweed culverts. The flow after the proposed eastern crossing of Abingdon Road will follow the existing course of Hinksey Stream which crosses the A423 Southern By-Pass Road and then ultimately discharges into River Thames.

The flows after the proposed western crossing of Abingdon Road will flow directly into the railway crossing at Stroud's Bridge via a proposed constrained channel. Only a proportion of the flow will cross at Stroud's Bridge which will then enter Hinksey Stream. The remaining flows will flow in a proposed constrained channel along the western side of the railway embankment to connect with the railway crossing at Munday's Bridge. This proposed constrained channel will have to meander away from a pylon before reaching Munday's Bridge. The flows through the railway crossing at Munday's Bridge will then discharge to Hinksey Stream.

6.4.2.2 Option 4B – New two 2-stage channels

Refer to Appendix A.10 for the conceptual drawing for Option 4B.

Option 4B is very similar to Option 4A for the proposals at the southern side of Old Abingdon Road. At the northern side of Old Abingdon Road, Option 4B proposes a 2-stage channel at the upstream end but then the 2-stage channel will split into two 2-stage channels. A large flow control structure would be required to at the bifurcation point to manage the proportioning of flows across both channels. One of the 2-stage channels from the split will follow the course of Hinksey Stream and cross the railway via Cold Harbour Bridge and the new Network Rail culvert. The other 2-stage channel from the split will continue in a southerly direction to reach the proposed western crossing at Old Abingdon Road.

6.4.2.3 Option 4C – New two 2-stage channels and new constrained channel

Refer to Appendix A.11 for the conceptual drawing for Option 4C.

Option 4C assumes that the Network Rail culvert will not be constructed and proposes other ways of conveying flows across the railway line. Option 4C is very similar to Option 4B for the proposals at the northern side of Old Abingdon Road. At the southern side of Old Abingdon Road, Option 4C proposes a new constrained channel that will start from the proposed western crossing at Old Abingdon Road and end at the railway crossing at Munday's Bridge. The proposed constrained channel will span in parallel to the western side of Kennington Road and through the historic landfill site. To avoid the possibility of contamination to the watercourse, it is likely that this channel would have to be heavily lined/ engineered to separate the potential leachates from the landfill site and the watercourse. Additionally, this proposed channel will require two new crossings to be constructed to firstly cross the A423 Southern By-Pass Road and then Kennington Road.

Following the proposed crossing at Kennington Road, the extent of the proposed constrained channel will be limited by a pylon on the north side and residential properties on the south side before it reaches Munday's Bridge. As a result of this limitation, the proposed channel will require to encroach on the gardens of some residential houses.

6.4.2.4 Culvert crossings below transport infrastructure

All the proposed options split the flows upstream of Old Abingdon Road to utilise the openings underneath the railway at Cold Harbour Bridge and at the new Network Rail culvert (to be constructed). The remaining flow is then taken under Old Abingdon Road at the western end to utilise Stroud's and Munday's bridges. The flow split between the four structures will be adjusted during outline design stage to optimise capacities and operation of the system.

6.4.2.5 Access for construction

Access to the area to the North of Old Abingdon Road would be gained from the South Hinksey access from the A34.

Access to the south of Old Abingdon Road would be directly from this road. Installing new culverts below Old Abingdon Road would require road closures which will be disruptive to road users.

There may also be a need to close the Kennington Road junction at times depending on the exact alignment of any new culvert which will be very disruptive for the public although there is a relatively straight forward diversion via the A423 and the slip roads connecting to Kennington Road. Access to Redbridge Hollow and the businesses on Old Abingdon Road would need to be maintained at all times.

If Option 4C was taken forward there would be a significant impact on a long length of Kennington Road during construction.

New access points would need to be created to the areas to the south of the A423 to facilitate any upgrading of the existing bridges carrying the A423 over the watercourses.

As with any natural watercourses there will be some level of erosion and deposition of sediments and gravels. Given the long section of new semi-natural watercourse upstream of this area and the complexity of access for maintenance at Redbridge it may be worth considering a sediment trap system immediately upstream of Old Abingdon Road. This could provide easy vehicle access for clearance and reduce risk of blockages and need for periodic clearance of material more difficult to access areas and structures downstream.

6.4.3 Summary of First-Phase Appraisal at Area 4

6.4.3.1 Summary of Social Objectives at Area 4

Refer to Appendix B.01 for the evaluation of Social Objectives at Area 4. The scoring results following the evaluation showed that Options 4A and AC were the preferred options with respect to the Social Objectives in Area 4. For this objective, Option 4A is the preferred option and Option 4C is the sub-preferred option.

6.4.3.2 Summary of Technical Objectives at Area 4

Refer to Appendix B.02 for the evaluation of Technical Objectives at Area 4. The scoring results following the evaluation showed that Options 4A and 4B were the preferred options with respect to the Technical Objectives in Area 4. For this objective, Option 4A is the preferred option and Option 4B is the sub-preferred option.

6.4.3.3 Summary of Environmental Objectives at Area 4

Refer to Appendix B.03 for the evaluation of Environmental Objectives at Area 4. The scoring results following the evaluation showed that Options 4A and 4B were the preferred options with respect to the Environmental Objectives in Area 4. For this objective, Option 4B is the preferred option and Option 4A is the sub-preferred option.

6.4.3.4 Summary of Institutional Objectives at Area 4

Refer to Appendix B.04 for the evaluation of Institutional Objectives at Area 4. The scoring results following the evaluation showed that Options 4B and 4C were the preferred options with respect to the Institutional Objectives in Area 4. For this objective, Option 4B is the preferred option and Option 4C is the sub-preferred option.

6.4.4 First-Phase Preferred Options at Area 4

Refer to Appendix C.4 for the First-Phase Scoring Matrix for Area 2. The results showed that overall; **Option 4A is the Preferred Option**, and **Option 4B is the Sub-Preferred Option** following the First-Phase Appraisal Process.

6.5 First-Phase Options Appraisal at Areas 5&6 – North and South Sandford

6.5.1 Background information on Area 5 and Area 6

The Sandford North area runs from downstream of Munday's Bridge to Sandford Weir. The Sandford South area runs from Sandford Weir to downstream of Sandford Lock. Both areas are similar in nature and for the purpose of this report are considered together.



Figure 6 - Floodplain near Sandford Lock

Both Sandford North and South areas have similar characteristics. They have a rural aspect and north of Sandford Lane there is permitted public access which is regularly used by Kennington residents. A row of electricity pylons carrying high voltage cables runs north-south through the area which places restrictions on the alignment of any new channel through the area.

Sandford Lane presents a constraint as vehicle access needs to be retained along this route in the future for both public using the fisherman's car park and for agricultural access.

The fields to the south of Sandford Lane are crossed by a number of significant electrical services both overhead and underground and there is a major sewer crossing the River Thames at the downstream end of the area currently being considered.

Given the public access to the area there are opportunities to enhance the area for users and to improve the biodiversity in the area.

6.5.2 Available options at Areas 5&6

There are two options proposed for the corridor at both Areas 5&6.

Note that Area 6 is a continuation of Area 5 and therefore the selected option for Area 5 has to also be selected for Area 6.

All the proposed options in this area will intercept existing surface water drainage channels and will need to accommodate these. The bases of the existing pylons will require avoiding with any new channel and the area south of Sandford Lane is crossed with numerous overhead and underground cables, some of these will require diverting if Option 6B is taken forward. Copies of the plans for the various options are provided in Appendix A.

6.5.2.1 Option 5A and 6A - New second-stage channel on right Bank of River Thames

Refer to Appendix A.12 for the conceptual drawing for Option 5A&6A.

Option 5A&6A proposes to widen the River Thames by constructing a new channel that will act as a second stage to the existing channel of the River Thames. The proposed second-stage channel will be constructed by lowering the right bank of the River Thames from Rose Isle to downstream of Sandford Lock, a length of approximately 1.5 km.

The proposed second-stage channel will be approximately 60m wide and 1.0-1.5m deep. This channel would only become active before the water levels inside the River Thames begin to rise to the bank levels.

This option will have major impact on the setting of the River Thames and depending on the level of the second stage it could present a hazard to navigation at certain flows or increase risk of grounding.

6.5.2.2 Option 5B and 6B - New 2-stage channel

Refer to Appendix A.13 for the conceptual drawing for Option 5B&6B.

Option 5B&6B proposes a 2-stage channel to span in parallel to the River Thames from Rose Isle to downstream of Sandford Lock, a length of approximately 1.6 km. The proposed 2-stage channel will be approximately 70m wide and 1.5m deep.

Option 5B&6B will require a new footbridge to carry the Thames Path over the entrance to the new channel. These options could also require a form of control structure and heavy erosion control to manage the split of flows from the River Thames.

Option 5B&6B will also require the construction of a new vehicle bridge to carry Sandford Lane over the new channel. Again this will need to be a raised structure to achieve sufficient freeboard over the flood flows and will form a significant structure.

6.5.2.3 Options 6C - As Option 5B&6B but returning to the Thames upstream of Sandford Lane.

Refer to Appendix A.14 for the conceptual drawing for Option 6C.

Option 6C is practically a shorter version of Option 5B&6B as it will re-join the River Thames at upstream of Sandford Lock. Therefore Option 6C will avoid the need for a new bridge on Sandford Lane. However, it is likely to need some work the main River Thames channel downstream of the lock which may create an ongoing maintenance requirements as this is known location for material build up. A significant amount of clearance work has recently been undertaken by the landowner on the right bank in this area which has exposed a large amount of silt deposition along this section.

This option has the benefit of reducing the impact on services to the south of Sandford Lane compared to Option 5B&6B. It also reduce the impact on Sandford Lane itself including the trees along this stretch. A new footbridge will be required on the footpath alongside the weir channel and it may also be necessary to include an additional vehicle bridge to allow the hydro scheme to be serviced and for agricultural access. The outgoing cable from the hydro scheme will need to be diverted over the new bridge.

6.5.2.4 Access for construction

Access into both these areas is difficult. The site is bounded to the west by the railway line and to the east by the River Thames. Based on the above proposals there will be a significant quantity of material to be removed from the area. Current access is via Sandford Lane which is single track, it has two tight corners and a narrow and low bridge with a 3.73m height clearance carrying the railway over the track. This height restriction could limit the size of muck away vehicles to 6 wheel vehicles which would potentially increase the number of vehicle movements. The surfacing of the track is also poor and if subjected to significant heavy road traffic would need resurfacing upon completion.

Access from Sandford Lane to the A34 is either through Kennington village which is narrow and busy or via Radley. Using Kennington Road and White's Lane to the south of Sandford Lane would pass Radley College but skirt the edge of the residential areas. However the size of roads will cause problems with large numbers of vehicle movements.

An alternative could be to utilise the fields to the south west of the channel route for permanent storage if agricultural benefit can be achieved. The use of barges on the river has been discounted due to the need to double handle material and lack of suitable wharf facilities in the area. The use of a temporary Bailey Bridge or conveyor across the River Thames to take material off site via the left bank and to the south via Henley Road has also been discounted due to the height required to maintain navigation on the river and the limited production rates for a conveyor.

Future access for maintenance will be via Sandford Lane. Options utilising a new channel through this area will need to be carefully designed to minimize the risk of sedimentation and creating an ongoing maintenance requirement from this aspect.

6.5.3 Summary of First-Phase Appraisal at Areas 5&6

6.5.3.1 Summary of Social Objectives at Areas 5&6

Refer to Appendix B.01 for the evaluation of Social Objectives at Areas 5&6. The scoring results following the evaluation showed that Option 5A&6A is the preferred option. The other two options in this area ranked equally with respect to the Social Objectives in Area 4; therefore the other two options are both the sub-preferred option.

6.5.3.2 Summary of Technical Objectives at Areas 5&6

Refer to Appendix B.02 for the evaluation of Technical Objectives at Areas 5&6. The scoring results following the evaluation showed that Options 5B&6B and 5B&6C are the preferred options with respect to the Technical Objectives at Areas 5&6. For this objective, Option 5B&6C is the preferred option and Option 5B&6B is the sub-preferred option.

6.5.3.3 Summary of Environmental Objectives at Areas 5&6

Refer to Appendix B.03 for the evaluation of Environmental Objectives at Areas 5&6. The scoring results following the evaluation showed that Options 5A&6A and 6C are the preferred options with respect to the Environmental Objectives in Areas 5&6. For this objective, Option 5A&6A is the preferred option and Option 6C is the sub-preferred option.

6.5.3.4 Summary of Institutional Objectives at Areas 5&6

Refer to Appendix B.04 for the evaluation of Institutional Objectives at Areas 5&6. The scoring results following the evaluation showed that Option 5B&6B and 6C are the preferred options with respect to the Institutional Objectives in Areas 5&6. For this objective, Option 5B&6B is the preferred option and Option 6C is the sub-preferred option.

6.5.4 First-Phase Preferred Options at Areas 5&6

Refer to Appendix C.5&6 for the First-Phase Scoring Matrix for Areas 5&6. The results showed that overall; **Option 5B&6C is the Preferred Option**, and **Option 5B&6B is the Sub-Preferred Option** following the First-Phase Appraisal Process.

6.6 First-Phase Options Appraisal at Area 7 – Weirs Mill Stream

6.6.1 Background information on Area 7

The Weirs Mill Stream area covers the whole length of the Weirs Mill Stream from the River Thames at Long Bridges to the confluence with the Hinksey Stream.

The strategy study identified the need for widening works, mainly along the upper section of this channel but also around the Weirs Mill pool area. This is required due to the River Thames being the restrictive control during flood flows through the Iffley reach.

Weirs Mill Stream has multiple house boat moorings located around the weir pool, these are mainly located on the left bank downstream of the weir pool. These are long standing permanent residential moorings. Residents and landowners from this area have already voiced concern over the scheme and indicated they are likely to object to a solution which has a detrimental impact to the residential moorings.



Figure 7 - Weirs Mill Stream

Iffley Meadows to the east of Weirs Mill Stream is designated as a SSSI which is home to a number of important species including the rare Snakes Head Fritillary which is present in a number of locations at the site. This presents both a constraint and potential opportunity.

Weirs Lane divides the area on a raised embankment across the floodplain with bridge openings to accommodate Weirs Mill Stream.

6.6.2 Available options at Area 7

There are three proposed options at Area 7. Copies of the plans for the various options are provided in Appendix A.

6.6.2.1 Option 7A – Widening of Weirs Mill Stream

Refer to Appendix A.15 for the conceptual drawing for Option 7A.

Option 7A involves widening and straightening of Weirs Mill Stream to increase the flow capacity through the existing stream. The majority of the proposed widening and straightening works are mainly on the right bank of Weirs Mill Stream. However, there will be a small stretch of widening works on the left bank at the length immediately downstream of Weirs Mill Pond.

Option 7A will have the most impact on the boat moorings; it will also require some dredging work on Weirs Mill Stream especially at the Weirs Mill Pond area.

6.6.2.2 Option 7B – Proposed additional culverts at Donnington Bridge Road

Refer to Appendix A.16 for the conceptual drawing for Option 7B.

Option 7B proposes to use the natural floodplain by encouraging the floodwater to flow through Iffley Meadows. The banks of the River Thames at the area north of Donnington Bridge Road will be lowered to allow floodwater to flow southwards towards Donnington Bridge. Option 7B will then require additional culvert crossings at Donnington Bridge Road to convey the additional floodwater. The size and number of the proposed additional culverts are not yet known, however it is likely there will be three new proposed culverts.

Option 7B will require raised flood defences due to the additional floodwater.

6.6.2.3 Option 7C – Proposed constrained channel

Refer to Appendix A.17 for the conceptual drawing for Option 7C.

Option 7C proposes a constrained channel to link the River Thames with Weirs Mill. The proposed constrained channel will be approximately 20m wide and 1.5m deep. This channel will be active before the water levels inside the River Thames channel reaches the bank levels. Option 7C will require a control structure at its upstream side to ensure the water is retained in the River Thames channel during periods of low flows.

6.6.2.4 Access for construction

Access for construction of any works in this area will be difficult and disruptive as all vehicles will need to access the area from Weirs Lane. It may be possible to bring plant in by barge on the River Thames however the headroom on Long Bridges prevents access to the upper reaches of Weirs Mill Stream for anything higher than a standard narrow boat. Boat access to the reach of Weirs Mill Stream downstream of the control structures is possible although the depth of water in the weir pool would be restrictive.

Road access from the A34 and Oxford Ring Road is relatively short via Abingdon Road and Weirs Lane. However this passes through a heavily developed residential area and the areas suffers from congestion at peak traffic times.

Transport of materials by barge is possible but would present a number of problems. The river and navigation structures restrict the size of barges. It is likely that 20 tonne barges could be utilised but numbers of barges per tug would be restricted by lock sizes. However the speed of operation would also be prohibitive due to the need to load, lock down or up the river and unload at a suitable slipway to transfer into road going vehicles. There are also known gravel shoals in the river in the

local area which, whilst navigable by pleasure craft would need to be removed by dredging to allow fully laden workboats to navigate without difficulty or risk of grounding.

Road transport, whilst not ideal, is likely to be the preferred option in this area to maintain production rates during construction although this could be supplemented by river borne transportation on a limited basis.

Access for any future maintenance works is also difficult in some areas. As noted above access for light vehicles is straight forward from Weirs Lane into the meadow, however there will be restrictions on frequency and type of plant due the SSSI status of the area on the south side of the road.

6.6.3 Summary of First-Phase Appraisal at Area 7

6.6.3.1 Summary of Social Objectives at Area 7

Refer to Appendix B.01 for the evaluation of Social Objectives at Area 7. The scoring results following the evaluation showed that Options 7B and 7C are the preferred options with respect to the Social Objectives in Area 7. For this objective, Option 7C is the preferred option and Option 7B is the sub-preferred option.

6.6.3.2 Summary of Technical Objectives at Area 7

Refer to Appendix B.02 for the evaluation of Technical Objectives at Area 7. The scoring results following the evaluation showed that Options 7A and 7B are the preferred options with respect to the Technical Objectives in Area 7. For this objective, Option 7A is the preferred option and Option 7B is the sub-preferred option.

6.6.3.3 Summary of Environmental Objectives at Area 7

Refer to Appendix B.03 for the evaluation of Environmental Objectives at Area 7. The scoring results following the evaluation showed that Option 7B and 7C are the preferred options with respect to the Environmental Objectives in Area 7. For this objective, Option 7C is the preferred option and Option 7B is the sub-preferred option.

6.6.3.4 Summary of Institutional Objectives at Area 7

Refer to Appendix B.04 for the evaluation of Institutional Objectives at Area 7. The scoring results following the evaluation showed that Options 7A and 7C are the preferred options with respect to the Institutional Objectives in Area 7. For this objective, Option 7C is the preferred option and Option 7A is the sub-preferred option.

6.6.4 First-Phase Preferred Options at Area 7

Refer to Appendix C.7 for the First-Phase Scoring Matrix for Area 7. The results showed that overall; **Option 7C is the Preferred Option**, and **Option 7B is the Sub-Preferred Option** following the First-Phase Appraisal Process.

Results of First-Phase Appraisal

The detailed appraisal tables for the seven areas are included in Appendix B. Following the First-Phase appraisal review based on socio-environmental aspects the Preferred Options and Sub-Preferred Options has been identified for each area. These are summarised in the table below;

	Preferred Corridor	Sub-preferred Corridor
Area 2	Option 2D	Option 2C
Area 3	Option 3A	Option 3D
Area 4	Option 4A	Option 4B
Areas 5&6	Option 5B&6C	Option 5B&6B
Area 7	Option 7C	Option 7B

Table 9 - Table of Preferred Corridors at First-Phase Appraisal

It is noted that there are a number of technical challenges surrounding Option 5A&6A in relation to the Sandford hydro-scheme and fish pass and the additional navigational hazards this option may create if this was to be taken forward in the event of the Preferred Option becoming unviable for any reason.

Options Development during the Second-Phase

8.1 Omission of Areas 5&6 and Area 7

One of the early outcomes from the hydraulic and economic analysis was the decision to omit Areas 5&6 and Area 7 from the scheme. The general design concept for the options at Areas 5&6 and Area 7 was to provide a drawdown effect to the upstream flood levels. However, modelling results showed that a greater amount of flood risk reduction could be achieved by proposing alternative options at other areas upstream of Areas 5&6 and Area 7.

Subsequently, the omission of Areas 5&6 and Area 7 triggered a review of alternatives to try and provide additional flood risk reduction to the New Hinksey and Grandpont areas of Oxford. A review on the introduction of raised defences at various locations was carried out to determine the optimal alignment of the raised defences. A summary of this review is provided in Appendix E.

8.2 Preferred options at Area 1 – Botley Road

The design development at Area 1 progressed following the determination of the Preferred Corridor. The objectives of the design were; to maximise the conveyance capacity through Botley Bridge, and to protect the properties to the north of Botley Road.

8.2.1.1 Maximising conveyance capacity through Botley Bridge

Modelling results showed that increasing the flow rates through Seacourt Stream has a direct effect on reducing the water levels in the River Thames to the east where it is more urbanised. Hence, a number of options for maximising the conveyance capacity through Botley Bridge were considered.

The main options considered were:

- A large single stage channel on the Seacourt Stream with a new bridge: this option was discounted due to the amount of disruption it would cause to the traffic in this area. Additionally, the cost to benefit ratio of this option would have been prohibitively low.
- A new culverts beneath Botley Road – this option was also discounted for the same reasons as above.
- A multi-stage channel on the Seacourt Stream and modifications to Botley Bridge – modelling results showed that the multi-stage channel provided the required conveyance with the least amount of ecological and environmental impacts. The proposals to modify Botley Bridge include lowering the channel bed (~0.5m) beneath the bridge and creating a hard bed at the lowered level. This option is the preferred option for increasing the conveyance through Botley Bridge.

8.2.1.2 Raised defences at Botley Road

The properties to the north of Botley Road are situated across the floodplain and are also located in-between two main rivers. The options review in this area showed there are limited amount of available options in this area and the most viable solution was some form of raised defences to the north of the properties. The majority of the proposed raised defences are in the form of an earth bund in keeping with the landscape. However, floodwalls are proposed at the allotments and at the Park & Ride site to reduce the land take at these locations.

8.3 Jacked box culverts through A423 Southern By-pass



Figure 8 - Underside of the A423 Railway Bridge by Kennington

The flow capacity of the channels at either side of the railway embankment is critical to the conveyance of upstream flood water. The channels narrow at either side of the A423 Rail Bridge which reduces the flow capacity and causing higher upstream flood levels. All of the options in the First-Phase Appraisal included channel widening works at this location to improve the conveyance.

The design concept was to try and widen the existing openings below the bridge by excavating the existing sprayed concrete slope on both sides. Once excavated, a new concrete U-channel section would be constructed to support the slope and provide the flow capacity. A sketch of the design concept is provided in Appendix F. A buildability review of this design concept along with other designs was undertaken with the Early Supplier Engagement contractor (Team Van Oord) and the following construction concerns were raised:

- Risk associated with working either side of live railway – this could be managed through solid fencing and temporary works but would require constant track monitoring during the works.
- Risk associated with working below and around the foundations of a 45 year old bridge structure. Based on discussions with Oxfordshire County Council Highways, it appears some remedial works are planned to this bridge in the near future which may raise questions over its current condition.
- Difficulties with installing temporary support for the existing tied sheet pile wall to retain the existing slope during the first phase of the works.
- Access for a suitable size piling rig, sheet piles are not practical to install in this location, bored piles were considered but the size of rig to install the estimated pile diameter required is too large to fit within the existing channel. Widening the channel without temporary support which will further restrict access is not considered practical.
- There is insufficient headroom on the channel side closest to the bridge abutment to allow access for the pile drilling head above pile top.

- There are a number of other issues such as dealing with flows, access for plant, insufficient space to segregate workers from plant and confined space working which could be managed but would create further problems.

Given the construction concerns outlined above, a review was carried out to determine alternatives options which avoid doing any works to the railway bridge which would involve creating a new opening below the bypass embankment on each side of the existing bridge. The existing channels would remain untouched other than minor remedial works to some local scour as maintaining the flow capacity through the existing channels will help reduce the size of the new openings.

The A423 embankment is over 10m high which excludes the use of traditional open trench culvert construction due to the significant temporary works and large amount of earthworks that would be required to excavate the trenches for the culverts. Subsequently, two options were considered for the new openings through the A423 embankment; thrust boring pipes through the embankment, and jacked box culvert through the embankment.

Thrust boring of relatively small pipes is a well proven technology and is cost effective, however a review of the additional capacity required indicates that up to 7 number of 1.8m diameter pipes would be required on each side. Given the space constraints and maintenance issues, this option was discounted.

Box jacking a new culvert through the road embankment at either side of the railway bridge. The hydraulic modelling results indicated the required internal culvert sizes would be in the region of 8m wide and 3.5m high. This option is feasible and again uses proven technology, although it does have a number of specific safety considerations associated with such operations. However, initial discussions by Team Van Oord with a specialist sub-contractor have been positive. This option has the benefit of working in an isolated controlled environment with better access away from the existing bridge structure and railway. The result of the options review concluded that the jacked box culvert is now the preferred option for increasing capacity in this area.

Principal Objectives in the Second-Phase

The Preferred Corridor obtained from the First-Phase Appraisal was then hydraulically and economically modelled to determine the optimal size of the channel corridor (Optimised Preferred Corridor) with respect to the Economic and Social (flood risk) Objectives.

The hydraulic modelling was carried out using the latest industry standard modelling software, Flood Modeller Pro version 4.1. The model schematisation of the Preferred Corridor is given in the report entitled 'IMSE500177-HGL-00-ZZ-RE-N-000124-Modelling_Report'.

Also, a summary of the methodology and assumptions used to calculate the flood damages are given in the report entitled 'Economic Assessment of Oxford Flood Alleviation Scheme'. The construction cost estimates were provided by the Early Supplier Engagement cost consultant, Arcadis and the maintenance costs were given by the Environment Agency.

9.1 Determining the Optimised Preferred Corridor

9.1.1 Evaluating corridor sizes

The following combined route corridor options using the preferred options from the Phase 1 assessment for each area combined together were taken forward for detailed hydraulic and economic modelling:

- **Option 1 – Do Nothing**

Refer to the document entitled "IMSE500177-HGL-00-ZZ-RE-N-000078-Modelling_Do_Min_and_Do_Nothing" for details on the schematisation of the Do Nothing option. In summary, this scenario is consistent with the Do Nothing scenario within the FCRM Appraisal Guidance (2010) wherein it is defined as: *"An option used in appraisal to act as a baseline against which all other options are tested. It assumes that no action whatsoever is taken. In the case of existing works, it assumes for the purposes of appraisal that operating authorities cease all maintenance, repairs and other activities immediately. In the case of new works, it assumes that there is no intervention, and natural and other external processes are allowed to take their course."*

- **Option 2 – Do Minimum**

Refer to the document entitled "IMSE500177-HGL-00-ZZ-RE-N-000078-Modelling_Do_Min_and_Do_Nothing" for details on the schematisation of the Do Minimum option. In summary, this scenario is consistent with the Do Minimum scenario within the FCRM Appraisal Guidance (2010) wherein it is defined as: *"An option where an operating authority takes the minimum amount of action necessary to maintain an asset."*

- **Option 3 – Raised Defences only**

This option assumes only the three proposed defences are constructed as a standalone option. Hence it assumes the scheme will only comprise of the proposed raised defences at; Botley Road, South Hinksey, and New Hinksey.

- **Option 4a - Small channel on its own**

The small channel is defined as approximately half the size of the Medium channel (Option 5b).

- **Option 4b - Small channel with raised defences**

This option is a combination of Option 4a and Option 3.

- **Option 5a - Medium channel on its own**

The size of the Medium channel is similar to the 'Medium Channel' as described in the Strategic Outline Case. In summary, this channel size is based on achieving the channel capacity that is slightly more than the combined capacity of the existing plus proposed culvert crossings.

- **Option 5b - Medium channel with raised defences**

This option is a combination of Option 5b and Option 3.

9.1.2 Scope of evaluation

Options 1 and 2 are baseline (hypothetical) options which are used only as a comparator for the other options. Option 3 is a fall back option should the full economic assessment indicate that the channel options are not viable or if funding not be available in the future to implement the channel options. All of these options are evaluated and reported in the document entitled "*IMSE500177-HGL-00-ZZ-RE-N-000161-Economic_Assessment_at_Outline_Business_Case*".

The evaluation within this report focuses on Options 4b and 5b as these two options include all the raised defence from Option 3 as wider integrated solutions.

A large channel was found to be physically impractical to construct primarily due to the constraint on the culvert sizes through Botley Bridge and Old Abingdon Road, therefore the 'Large Channel' option described in the Strategic Outline Business Case has been qualitatively discounted and not investigated further.

9.2 Overview of Economic Objectives

Social Objectives in the Second-Phase Appraisal have been split down into three key sub-objectives, these are:

- Reduce the risk of floods impacting on infrastructure
- Reduce the risk of flooding to commercial properties
- Maximise the Net Present Value

9.2.1 Reduce the risk of floods impacting on infrastructure

Reducing the impact of flooding on the infrastructure is essential in keeping Oxford open for business and accessible by emergency services. Additionally, reducing the flooding impact on the infrastructure also creates more opportunities to attract third party funding.

This sub-objective evaluates each option against the flood extent on key roads and also evaluates which option would take out the most amount of business from the high to very high risk bands, 1 in 20 and 1 in 10 return periods, respectively.

9.2.1.1 Keeps strategic roads open, Abingdon Road and Botley Road

The two roads above are two main road routes into the centre of Oxford and both roads are prone to regular flooding. The method use for evaluating the impact of flooding on these two roads is based on the onset of flooding and the Multi Coloured Manual's approach for quantifying the present value Road Delay Damages.

9.2.2 Reduce the risk of flooding to commercial properties

9.2.2.1 Number of commercial properties taken out of high (1:20) and very high risk (1:10)

There are many business premises that are situated within and around the periphery of the floodplain which flood. The evaluation was based on interrogating the flood depths on the commercial properties for each option against the Do Minimum scenario. The commercial properties that have a flood depth for the Do Minimum Scenario but not in the option run will be counted and defined as *taken out of flood risk*. The threshold levels still remain valid.

9.2.2.2 Number of commercial properties taken out of insurance benchmark (1:75)

Taking properties out of the insurance benchmark will deliver tangible benefits to the businesses and reduce the impact on the local economy. Similarly, the evaluation was based on interrogating flood depths for the 1 in 75 return period.

9.2.3 Maximise Net Present Value

This Sub-Objective determines the option with the highest standalone Net Present Value (NPV) which is one of the criteria on which the Flood and Coastal Erosion Risk Management Grant in Aid (FCERM GiA) is based upon.

NPV is defined as the difference between total present value of benefits minus the total present value of costs. Details of the assumptions used for the calculations are given in the report entitled 'Economic Assessment of Oxford Flood Alleviation Scheme'.

9.3 Overview of Social Objectives

9.3.1 Reduce the risk of flooding to residential properties

This Sub-Objective determines which option would take out the most amount of residential properties from the high and very high risk flood bands, 1 in 20 and 1 in 10 return periods, respectively. Additionally, this Sub-Objective also determines the option that would take out the most amount of residential properties from the 1 in 75 return period which is the typical benchmark standard of protection that is used by insurers.

9.3.1.1 Number of residential properties taken out of high (1:20) and very high risk (1:10)

Similarly, the evaluation was based on interrogating the flood depths on the residential properties for each option against the Do Minimum scenario. The residential properties that have a flood depth for the Do Minimum Scenario but not in the option were counted and defined as *taken out of flood risk*. The threshold levels still remain valid.

9.3.1.2 Number of residential properties taken out of insurance benchmark (1:75)

Taking properties out of the insurance benchmark will deliver tangible benefits to the residents and could open more land for development. Similarly, the evaluation was based on interrogating flood depths for the 1 in 75 return period.

Summary of Second-Phase Appraisal

Option	Benefits to Road Infrastructure (£M)	Reduction in Flooding to Commercial Property (number of properties taken out of flood envelope)			Net Present Value (£M)	Reduction in Flooding to Residential Property (number of properties taken out of flood envelope)		
		1:10	1:20	1:75		1:10	1:20	1:75
4a	2.31	39	40	80	946	199	331	385
4b	2.31	43	60	105	977	215	462	535
5a	2.67	43	49	101	979	215	469	663
5b	2.69	46	65	123	1001	215	508	885

Table 10 - Results of Second-Phase Appraisal

The results in Table 10 have been translated into an assessment scoring matrix similar to the Phase 1 assessment to determine the preferred route corridor option. This matrix is presented in Appendix G of this report and shows that Option 5b outperformed the other three options on all parameters.

The results also indicated that Option 5b is the Optimised Preferred Corridor which would give the most reduction to the flood risk within the study area whilst meeting all the other objectives for the scheme. Therefore, it is recommended that Option 5b route corridor and channel size is taken forward to outline design and onto the Outline Business Case.

An image of the recommended route corridor and channel size and alignment is shown in Figure 9 overleaf.

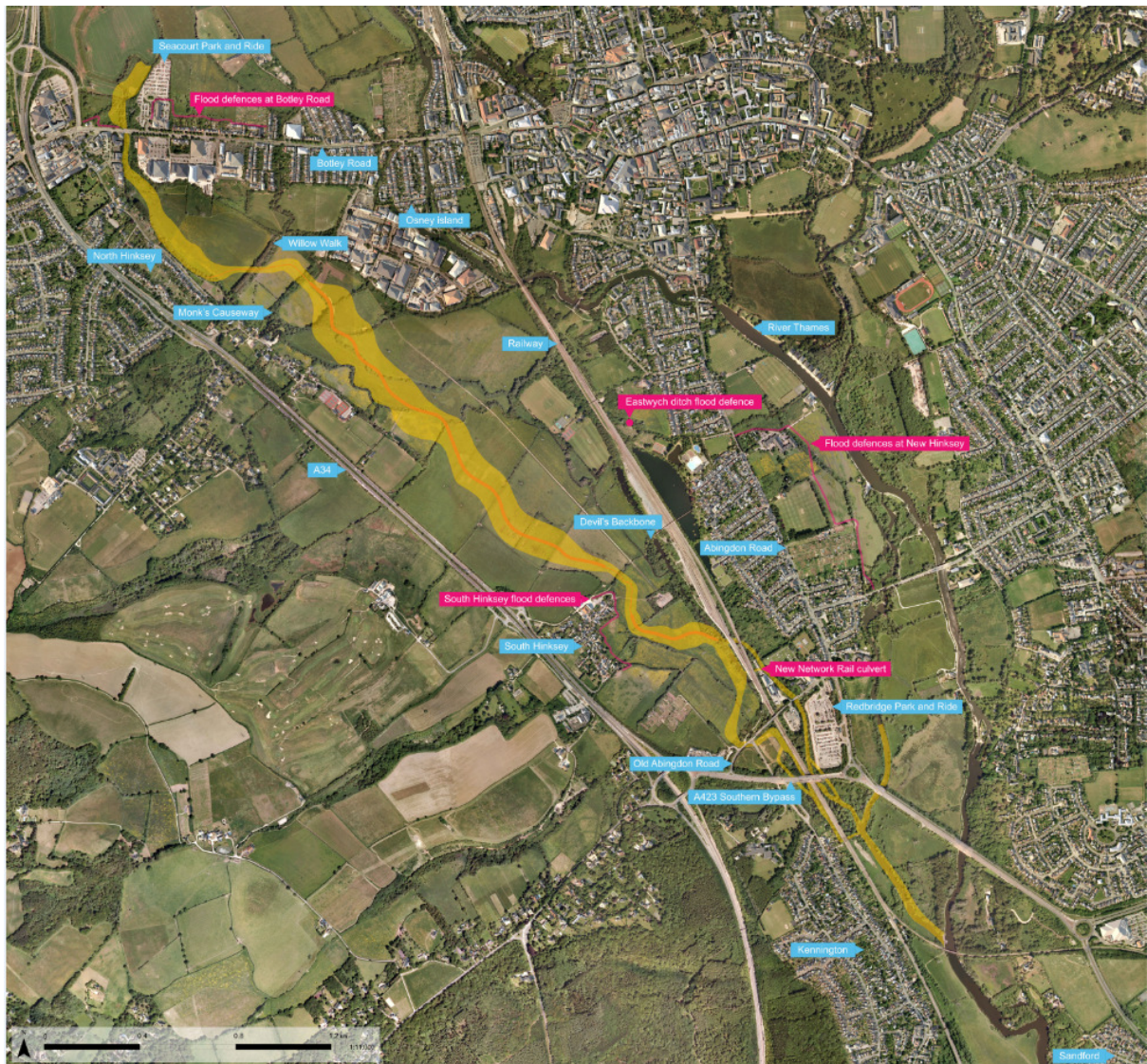


Figure 9 – Recommended Route Corridor

Appendices

Appendix A – Individual Conceptual Drawings for Each Option

- A.01 Conceptual Drawing for Option 2A
- A.02 Conceptual Drawing for Option 2B
- A.03 Conceptual Drawing for Option 2C
- A.04 Conceptual Drawing for Option 2D
- A.05 Conceptual Drawing for Option 3A
- A.06 Conceptual Drawing for Option 3B
- A.07 Conceptual Drawing for Option 3C
- A.08 Conceptual Drawing for Option 3D
- A.09 Conceptual Drawing for Option 4A
- A.10 Conceptual Drawing for Option 4B
- A.11 Conceptual Drawing for Option 4C
- A.12 Conceptual Drawing for Option 5A&6A
- A.13 Conceptual Drawing for Option 5B&6B
- A.14 Conceptual Drawing for Option 6C
- A.15 Conceptual Drawing for Option 7A
- A.16 Conceptual Drawing for Option 7B
- A.17 Conceptual Drawing for Option 7C

Appendix B – Evaluation Data for First-Phase Appraisal

- B.01 First-Phase Evaluation Data for Social Objectives
- B.02 First-Phase Evaluation Data for Technical Objectives
- B.03 First-Phase Evaluation Data for Environmental Objectives
- B.04 First-Phase Evaluation Data for Institutional Objectives

Appendix C – Score Matrices for First-Phase Appraisal

- C.1 First-Phase Scoring Matrix for Area 1 (placeholder)
- C.2 First-Phase Scoring Matrix for Area 2
- C.3 First-Phase Scoring Matrix for Area 3
- C.4 First-Phase Scoring Matrix for Area 4
- C.5&6 First-Phase Scoring Matrix for Areas 5&6
- C.7 First-Phase Scoring Matrix for Area 7

Appendix D – Preliminary Service Clash Review at First-Phase

Appendix E – Proposed New Hinksey Defence

Appendix F – Sketches for the Proposed Channels Modifications at the A423 Railway Bridge

Appendix G – Score Matrix for Second-Phase Appraisal

Appendix A - Individual Conceptual Drawings for Each Option

- A.01 *Conceptual Drawing for Option 2A*
- A.02 *Conceptual Drawing for Option 2B*
- A.03 *Conceptual Drawing for Option 2C*
- A.04 *Conceptual Drawing for Option 2D*
- A.05 *Conceptual Drawing for Option 3A*
- A.06 *Conceptual Drawing for Option 3B*
- A.07 *Conceptual Drawing for Option 3C*
- A.08 *Conceptual Drawing for Option 3D*
- A.09 *Conceptual Drawing for Option 4A*
- A.10 *Conceptual Drawing for Option 4B*
- A.11 *Conceptual Drawing for Option 4C*
- A.12 *Conceptual Drawing for Option 5A&6A*
- A.13 *Conceptual Drawing for Option 5B&6B*
- A.14 *Conceptual Drawing for Option 6C*
- A.15 *Conceptual Drawing for Option 7A*
- A.16 *Conceptual Drawing for Option 7B*
- A.17 *Conceptual Drawing for Option 7C*

Appendix B - Evaluation Data for First Phase Appraisal

- B.01 First-Phase Evaluation Data for Social Objectives*
- B.02 First-Phase Evaluation Data for Technical Objectives*
- B.03 First-Phase Evaluation Data for Environmental Objectives*
- B.04 First-Phase Evaluation Data for Institutional Objectives*

Appendix B.01 – First-Phase Evaluation Data for Social Objectives

Evaluation of social objectives at Area 2

Evaluating landscape opportunities at Area 2

Impact on views of Oxford

Option 2A retains the existing meadow appearance and views from Willow Walk towards the surrounding hills. Options 2A and 2B retain the trees along the left bank of the Hinksey Stream screening views to Osney Mead Industrial Estate from houses on the right bank of the stream.

Option 2B proposes a new 2-stage channel across farmland and the existing channel is to be modified to form a backwater. The new channel dissects the meadow and splits the area in two and would interrupt views across the meadow.

Options 2C and 2D retain the appearance of the meadow, but trees along the right bank of Hinksey Stream would be removed potentially opening views to and from houses on the west bank of the stream which will require infill planting on the right bank to mitigate against.

Options 2C avoids the existing pylon by starting downstream, however this will require additional engineered bank protection in the existing channel area as this will be a constraint and subject to erosion due to more water passing down this section of the channel than in the other options. The other options start upstream of the pylon and would isolate the pylon on an island in the channel during flood events.

Enhances/adds to areas of classic landscape setting

All of the options will have a significant impact on the setting and appearance of the existing meadow. The proposed shallow scrape for Option 2A would be a subtle difference in the topography of the meadow, however it would impact on a large area of the existing ecologically valuable MG4 grassland. It would also make the lowered section of the field wetter. The retention of the trees along the left bank of the Hinksey Stream retains the character and setting of a natural grassland meadow.

In all options, the alignment of the channel with existing trash screens utilises a break in the treeline along Willow Walk to minimise the removal of additional mature trees, although it is recognised that a number will be lost. Specifically to option 2B, the addition of a new first-stage channel dissects the meadow and splits the area in two altering its character. This would change recreational walking activities and reduce the remaining areas to two small areas which would be difficult to manage effectively through agricultural practice.

In Options 2C and 2D, the character of the meadow would be affected by the removal of the trees along the left bank of the Hinksey Stream. This would potentially need some infill planting on the right bank to maintain the tree screen. These two options are also pushed as sets in the meadow to try and reduce the impact on the MG4 grassland areas. The topography of the meadow itself would be subtly changed.

Evaluating recreational opportunities at Area 2

Opportunities for horse riding activities

Horse riding routes and activities along Willow Walk and around the meadow would be unaffected by the options.

It is not believed that any riding takes place within the meadow but Option 2B would be have the greatest impact due to the first-stage channel cutting through the middle of the area.

Fishing and water based activities

There will be temporary impacts on fishing and water based activities but in the longer term none of the options are considered to have impacts. Options 2C and 2D may create additional fisheries habitat in the Seacourt Stream by removal of the trees on the left bank which currently overshadow the channel.

Future pedestrian and cycleway routes

For Options 2A, 2C and 2D; the meadow remains fully accessible with all routes and access points for pedestrians remaining unchanged although the area available would potentially be smaller depending on water levels in the second stage of the channel. Any small channel in the area could be crossed with a small footbridge.

The introduction of a permanent water course in Option 2B splits the meadow and prevents circular walks around the meadow without the introduction of an additional crossing points and structures.

Scoring on social objectives at Area 2

Refer to Appendix C.2 of the main report for the scoring of all Sub-Objectives at Area 2.

Evaluation of social objectives at Area 3

Evaluating landscape opportunities at Area 3

Impact on views of Oxford

The new 2-stage channel shown in all options would alter the character of the farmland and existing waterways running through the fields. The permanent water flow through the farmland would have an impact on views. The shallow scrape of the second-stage channel banks would have less of an impact blending into the existing levels.

The off-line lakes proposed in Options 3B and 3C would have a significant visual impact with views from the protected view of the 'Oxford View Cones' to the west.

The series of smaller lakes proposed in Option 3D would have less of an impact as they are broken up and will be planted to create additional habitat opportunities with less focus on recreational activities.

Enhances/adds to areas of landscape character and setting

An additional permanently filled channel in this area would alter the landscape significantly in all options. There are numerous streams and ditches in this farmland, these remain largely hidden from view. The shallow scrape would subtly change the topography of the fields but would retain some of the character of the farmland.

The on-line and off-line lakes would further alter the character of the farmland giving a more formal appearance with activities associated with any water based recreation changing the pastoral nature of the area.

The series of lakes proposed in option 3D would fit into the farmland character and be more in keeping with the rural nature of the area with the creation of habitats around the lakes.

Evaluating recreational opportunities at Area 3

Pedestrian and cycleway routes

In all options, the new channel offers the opportunity for a riverside pedestrian and cycleway. East - West movement would be limited with the introduction of a substantial permanent water course without the addition of numerous crossing points.

There may be less proposed access associated with Option 3D if habitat creation around the series of lakes is given a greater priority.

Fishing and water based activities

In all options, the new channel offers a new route for water based activities with connections to existing waterways making vehicle-free access a possibility. Additional fishing locations are feasible in this location.

The off-line lake in Option 3B would make access difficult to undertake water sports on the lakes. Access for specialist activities may be required with vehicles e.g. rowing, this could be achieved by using the existing sports ground at South Hinksey. Additional fishing locations both on the proposed lake and channel is feasible in this location.

The proposed on-line lake in Option 3C would make access easier for water based activities and possibly connect with existing channels such as the Bulstake Stream and then into the River Thames.

The proposed off-line ponds in Option 3D would make access difficult to undertake water sports on the lakes and undesirable if habitat creation is the goal.

Opportunities for horse riding activities

New channels in all options offers the opportunity for a riverside bridle path. East - west movement around the farmland would be limited with the introduction of a substantial permanent water course. The new channel and lakes in all options heavily disrupt existing circular routes used by local horse riders.

Scoring on social objectives at Area 3

Refer to Appendix C.3 of the main report for the scoring of all Sub-Objectives at Area 3.

Evaluation of social objectives at Area 4

Evaluating landscape opportunities at Area 4

Impact on views of Oxford

The proposed new 2-stage channel in option 4A would have a noticeable impact on the farmland in this area. The introduction of a new channel near Old Abingdon Road would be seen from Redbridge and nearby allotments as well as the protected views in the 'Oxford View cones' to the west.

For both options 4B and 4C, the new split flow 2-stage channel would have a significant impact on the farmland in this area. The new channel would be seen from Redbridge and nearby allotments as well as the protected views in the 'Oxford View cones' to the west. Diverting the flow along existing streams and ditches lessens the visual impact in Option 4B.

A proposed new channel south of Old Abingdon Road in Option 4C would have a significant visual impact unless the channel is routed underground.

Enhances/adds to areas of landscape character and setting

The new 2-stage channel in all options would have a significant effect on the character of the farmland in this area. The introduction of a new channel near Old Abingdon Road blends in with the existing waterways and streams but would change the character of the area.

For both Options 4B and 4C, the new split flow 2-stage channel would have a significant effect on the character of the farmland in this area. The introduction of two permanent channels with shallow scrapes would noticeably alter the character of the farmland.

Option 4C proposes a new channel south of Old Abingdon Road, this is a significant feature and would alter the character of the area and nearby nature reserves.

Evaluating recreational opportunities at Area 4

Pedestrian and cycleway routes

Due to difficult site conditions in this area (existing railways and roads); connectivity is difficult for all options. The use of existing waterways and culverts in Option 4A reduces the need for additional bridges and access points for this option.

In Options 4B and 4C, the split flow channels would make the need for additional bridges/crossing points necessary to utilise access to all areas. A possible additional route could be created alongside the new channel south of Old Abingdon Road in Option 4C allowing greater connectivity and access to surrounding areas.

Fishing and water based activities

For all options, the new channel offers new opportunities for water based activities with connections to existing waterways making vehicle-free access possible. Additional fishing locations are feasible in this location.

Opportunities for horse riding activities

Due to difficult site conditions in this area (existing railways and roads); connectivity is difficult for all options. The use of existing waterways and culverts in Option 4A reduces the need for additional bridges and access points for this option.

In options 4B and 4C, the split flow channels would make the need for additional bridges/crossing points necessary to utilise access to all areas. A possible additional route could be created alongside the new channel south of Old Abingdon Road in Option 4C allowing greater connectivity and access to surrounding areas.

Scoring on social objectives at Area 4

Refer to Appendix C.4 of the main report for the scoring of all Sub-Objectives at Area 4.

Evaluation of social objectives at Areas 5&6

Evaluating landscape opportunities at Areas 5&6

Impact on views of Oxford

For Option 5A&6A, the appearance of the grassland meadow would be retained and any changes being aligned nearer the river. The new shallow second-stage on the River Thames would add a subtle change to the topography in the area.

For Options 5B&6B and 6C, the new secondary channel would have a significant visual effect on the grassland meadow. Option 5B&6B would require a vehicle bridge crossing for access via Sandford Lane and this would have a significant impact being a large structure. This would not be required for Option 6C.

Enhances/adds to areas of landscape character and setting

Option 5A&6A offers more opportunity to increase access into the river. The grassland meadow would retain a lot of its character and any changes being aligned nearer the river. The new shallow

second-stage would add a subtle change to the topography in the area. No structures would be needed to cross the channel including at Sandford Lane.

For Options 5B&6B and 6C, the new secondary channel would have a significant impact on the character of the grassland meadow. Due to the water in the channel, the creation for additional crossing points to retain access to all parts of the meadow and rivers edge would be required. Option B would require a vehicle bridge crossing for access via Sandford Lane, this would alter the character near Sandford Lock and the removal of a hedge and mature trees would be required.

Evaluating recreational opportunities at Areas 5&6

Pedestrian and cycleway routes

The Thames footpath would be greatly affected with Option 5A&6A. The footpath would have to be relocated away from the River Thames. Maintaining access to Rose Isle and Sandford Lock would require the addition of a pedestrian/cycle bridge. The Sustrans cycle route wouldn't be affected by this option.

The Thames footpath wouldn't be affected with Option 5B&6B except for the addition of 3 bridges and Option 6C requiring the addition of 2 bridges to retain the towpath connection along the River Thames. Options 5B&6B and 6C significantly affect the connectivity across the grass meadows in this area with a permanent channel dividing the area in two. Additional bridges and access points would be required. The Sustrans cycle route wouldn't be affected by these options.

Fishing and water based activities

For Option 5A&6A, access to the river would be enhanced with the second-stage channel offering a graded approach. Fishing is not permitted along large stretches of the river in this location.

For Options 5B&6B and 6C, connections with the existing waterways offers opportunities for water activities.

Opportunities for horse riding activities

Horse riding opportunities would remain largely unaffected with Option 5A&6A.

The introduction of a new channel in Options 5B&6B and 6C through the grassland meadow would make connecting circular routes in the area problematic. Similar to the activities above, the requirement for additional bridges and connection points would be required.

Scoring on social objectives at Areas 5&6

Refer to Appendix C.5&6 of the main report for the scoring of all Sub-Objectives at Areas 5&6.

Evaluation of social objectives at Area 7

Evaluating landscape opportunities at Area 7

Impact on views of Oxford

Option 7A would have a significant impact on the visual appearance in this area particularly around the orchard and residential moorings. Iffley Meadows SSSI would remain largely unaffected by this option.

In Option 7B, the bank modification works and culverts would have a small impact on the visual appearance in the area. The bank modification works would alter the appearance to a small part of the Thames towpath and a small part of Weirs Mill Stream. Views to and from Iffley Meadows SSSI would remain largely unaffected by this option.

Utilising an existing ditch reduces the visual impact to this area in Option C. Iffley Meadows SSSI would remain largely unaffected by this option. The introduction of a control structure for this option should be incorporated into any crossing required to lessen its visual impact.

Enhances/adds to areas of landscape character and setting

Option 7A would cause disruption to the residential narrow boat moorings in the area. The vegetation on the bank would suffer as a result of this option. This option avoids disruption to the nearby SSSI (Iffley Meadows).

A small section of existing trees and hedgerows along the River Thames would be sacrificed for Option 7B.

Option 7C utilises an existing ditch and would reduce any effects on the SSSI (Iffley Meadows) to a minimum. The character in the area as a whole would remain largely unchanged as a result of Options 7B and 7C.

Evaluating recreational opportunities at Area 7

Pedestrian and cycleway routes

The Thames towpath would remain untouched by Option 7A. Opportunities for additional connections would be reduced due to the nature of the widening of the stream.

Option 7B would require a short section of the Thames towpath to be relocated. Opportunities for additional connections would be reduced due to the nature of this option.

The Thames towpath would require a small amount of work to retain the connection for Option 7C. An opportunity for additional connections is possible for this option to link the River Thames towpath to other footpaths/cycleways in the area.

Fishing and water based activities

All options for Area 7 wouldn't offer any additional opportunities for water based activities. The fishing opportunities in this area would remain unaffected. Fishing on the River Thames is restricted in large areas in this location. Option 7C has a control structure and would make boat access unfeasible.

Opportunities for horse riding activities

All options for area 7 have no impact on the horse riding along Weirs Mill Stream. Horse riding is restricted along Weirs Mill Stream and none of the options offer additional opportunities or connections. Horse riding along this section of the Thames towpath is not permitted.

Scoring on social objectives at Area 7

Refer to Appendix C.7 of the main report for the scoring of all Sub-Objectives at Area 7.

Appendix B.02 – First-Phase Evaluation Data for Technical Objectives

Evaluation of technical objectives at Area 2

Evaluating engineering risks at Area 2

Impacts on the groundwater regime

The proposed channels for Options 2A, 2C and 2D are all in the form of second stages and their excavations are not likely to extend into the water table but will lower an area of the meadow which will be wetter than currently. Option 2B will require excavations into or close to the water table to create the new channel however this is not expected to have a impact on the groundwater regime in the area.

Minimise introduction of engineered elements

Options 2A will require a spillway to be constructed at the start of the proposed channel. The engineered spillway would require erosion protection along the spill, this will likely be of a reinforced grass type construction. The majority of the channel lengths for Option 2C and 2D will be directly linked to left bank of Hinksey Stream which prevents high velocities and therefore they should not require an engineered spillway

Option 2B however, proposes a narrow primary flow channel that would be in constant use. This option will require a control structure for managing flows into the new first stage.

Option 2C will require sheet piling to protect the base of the pylon as more water will be pushed along the Seacourt Stream at this location.

Reduce risk of blockages and frequency of maintenance

All options propose channels that have shallow banks and therefore functionality and capacity of the proposed channels will be very sensitive to any vegetation growth and sedimentation. The proposed shallow bank gradients will permit maintenance vehicles to be driven along the whole channel which will make it easier to mow and manage the vegetation growth. It is anticipated that grazing will still be achievable during drier months of the year on a large proportion of the second stage. This may be restricted closer to the channel where the land will be wetter.

Evaluating disruptions to infrastructure and services at Area 2

There is no significant infrastructure within the footprint of any of the options in this area, other than the National Grid pylon. Hence, it is not likely that any of the options would require the removal/diversion of significant infrastructure during their construction or operation.

Impact on infrastructure and public highways

At the southern end of the channels, all of the options require excavations at both sides of the bridge at Willow Walk. However, Option 2B will require a deeper excavation and therefore has the highest probability of requiring a heavier bridge. In addition, all options also require scour protection to the bridge.

There is a stone bridge in the south of the area on the western end of Willow Walk that is to remain.

Impact on existing services

All four options will involve constructing a channel within close proximity to a pylon at the upstream ends of the channels. Early communications with National Grid suggest that there would be acceptable mitigation solutions for all the proposed options if taken forward.

Evaluating health and safety in buildability and maintenance at Area 2

Buildability

All options would have similar construction risks with the exception of Option 2D which includes a high risk task of driving sheet piles within close proximity to a pylon.

Working at height

All of the options require the construction of a new bridge over Willow Walk, which may require some working from height.

Confined Space

All of the options will include a new clear-span bridge at Willow Walk and therefore none of the options would require confined space working.

Scoring on technical objectives at Area 2

Refer to Appendix C.2 of the main report for the scoring of all Sub-Objectives at Area 2.

Evaluation of technical objectives at Area 3

Evaluating engineering risks at Area 3

Impacts on the groundwater regime

All of the options propose a 2-stage channel that will be situated into or close to the water table and therefore introduces a risk of impacting on the upstream groundwater levels, this may have some beneficial flood risk reduction benefits but need to be carefully assess to minimise environmental impacts.

The risk level on impacting upstream groundwater by the proposed offline and online lakes will be balanced by the implementation of flow control structures. However, if there are no flow control structures introduced, or if they fail, then the risks on impacting upstream groundwater will be higher for the proposed online lake, Option 3C.

Option 3B proposes an offline lake that will most likely be constantly fed by groundwater.

Minimise introduction of engineered elements

All options will feature engineered erosion protection at their northern and southern extents where they are to be crossed by clear-span bridges. This is consistent in form throughout the options. Also, all of the options will require a raised defence around the village of South Hinksey at the far south of Area 3, in the form of an earthen bund. Although this is a significant engineered component, it can be landscaped to minimise visual impact to residents nearby.

Both of the proposed lakes for Option 3B and Option 3C will be of natural construction, with limited hard engineering required. The proposed online lake for Option 3C will require a large weir-type control structure to be constructed at its downstream side to maintain water in the lake.

Option 3D consists of a number of smaller lakes in sequence along the right bank of the channel, there lakes would also be of natural construction with no hard engineered structures required.

Of all the options, Option 3C has the most risk associated with engineered elements due to the requirement of a large flow control structure at the downstream extent of the online lake. The other three options have no discernible difference in terms of engineered elements.

Minimise risk of blockages and frequency of maintenance

Maintenance of all of the options would involve bank clearance (removing vegetation, debris etc, and grass cutting) along the length of the proposed 2-stage channels.

All of the options introduce a risk of blockages due to the inclusion of various flow controls on both existing and proposed channels. This risk could be mitigated by introducing an appropriate maintenance schedule and by appropriately sizing the structures to minimise blockages.

The required large flow control structure on the downstream side of the proposed online lake, as featured in options 3C will also introduce a risk of blockage. Given the wider larger flow area through this lake, which would reduce velocities, paired with the control structure, it is likely that this lake will be prone to accumulate sediment.

The proposed offline lakes in options 3B and 3C, which are likely to be fed from groundwater, are also at risk of sediment build up as a result of fast moving flood water overtopping into them from the banks of the proposed 2-stage channel. Velocity of the flood waters would drop significantly as it overtops into the lake causing sediment to settle.

Additional maintenance will be required at all control structures on a periodic basis, which would likely be determined based on the operations procedures for these controls. Due to this, there would be more maintenance required for Option 3C.

It is anticipated that in the long term the second stage will return to grassland and be able to be grazed during the summer months to reduce the frequency of maintenance mowing.

Evaluating disruptions to infrastructure and services at Area 3

Impact on infrastructure and public highways

All of the options are the same in this regard. Each of them cross a total of three public rights of way within this area. One at the upstream extent, one at the downstream extent and one adjacent to North Hinksey village. At each location, it is proposed that the channel be crossed by a clear-span bridge.

Construction tasks could be phased to minimise the impact that the construction of the channel options would have on these rights of way.

Options 3B and 3C would result in the largest amount of excavated material due to the size of the lakes that they feature. This would result in the largest amount of traffic movements around the site, and thus have the largest impact on the highways network.

Impact on existing services

All of the options have a similar impact on existing services. There are a number of services within the vicinity of the works that will be directly impacted by the works and these services will require to be protected or diverted. Also, there are numerous services that are outside the footprint of the proposed options and these services may also require to be protected to allow construction.

Furthermore, there are a number of electricity pylons directly to the north of the site, which may fall within the construction limits, but are not within the footprint of the design itself. This is in addition to the Electric Road, which features a number of high voltage lines along it. This is also directly to the north of the proposed channel and may have an impact of transport/access in and around the site.

Evaluating health and safety in buildability and maintenance at Area 3

Buildability

All of the options require large scale excavations in areas where the ground water table is known to be high. Also, all of the options will require pumping around the proposed control structures to allow for their constructions, this will be more of an issue during the construction of a large control

structure for Option 3C. The construction of Option 3A will be least affected by the high water table as it will have the smallest amount of excavations.

Working at height

All of the options include a number of clear-span bridges which may include some working from height. In this regards however, there are no differentiating factors between the options at this stage.

Confined spaces

None of the options at this stage are thought to require any confined space working due to the inclusion of clear-span bridges where the channel crosses any existing roads or access tracks. There are no differentiating factors between the options at this stage.

Scoring on technical objectives at Area 3

Refer to Appendix C.3 of the main report for the scoring of all Sub-Objectives at Area 3.

Evaluation of technical objectives at Area 4

Evaluating engineering risks at Area 4

Impacts on the groundwater regime

All of the options propose a 2-stage channel that will be situated into or close to the water table and therefore introduces a risk of impacting on the upstream groundwater levels.

Options 4B and 4C have larger footprints than Option 4A and would require significantly more excavations and therefore it has a higher risk on impacting upstream groundwater levels. This

Minimise introduction of engineered elements

Options 4A and 4B are very similar, both will utilise the same four crossing points on the railway line, and both would require a new culvert under the Old Abingdon Road. However, Options 4B and 4C split the proposed 2-stage channel into two channels and a large control structure would be required at the bifurcation point to ensure the appropriate split in flows between the two channels. This flow control structure would be of a considerable size due to the capacity of the channel in this location.

Option 4C would require a much larger channel to the west of the railway and this channel would be heavily lined/engineered as it passes a historic landfill site. This option will require a much larger culvert under Old Abingdon Road, and two new culvert crossings; under the A423 and Kennington Road.

Minimise risk of blockages and frequency of maintenance

All of the options propose a significant length of new channel that would require additional maintenance activities to maintain the required standard of protection. These works would require vegetation clearance, silt removal and grass cutting in the 2-stage channels. This area is very accessible and it would be the ideal location to design some form of passive debris collection feature.

Maintenance works will be required at all the culvert crossings and where new structures are introduced. There would be a need to hold discussions with Network Rail to determine the existing maintenance schedule and to assess whether there would be a requirement to undertake more frequent maintenance post scheme.

Option 4A would have the least number of culvert crossings and flow control structures and therefore would have the smallest probability for blockages.

The risk of blockage would be slightly higher for Options 4B and 4C due to the proposed large flow control structure at the point of bifurcation of the 2-stage channel.

Option 4C would have a higher risk of blockages than Option 4B due to the additional culverts required to cross the A4232 bypass and Kennington Road.

Evaluating disruptions to infrastructure and services in Area 4

Impact on infrastructure and public highways

All options propose crossings at Old Abingdon Road and this will have a significant impact on the traffic movements.

Options 4B and 4C, which include significant levels of additional excavation, due to their inclusion of a second 2-stage channel for much of their length, would result in higher levels of traffic in and around the site during the removal of this material.

In addition to those from options 4A and 4B, Option 4C would require new culvert crossings under the A423 and Kennington Road, this could have a major impact on the traffic movement during the construction period. The proposed channel for Option 4C would also encroach on the front gardens of some residential properties and its construction would have a considerable impact on the local community.

Impact on existing services

The main area in which there would be a significant impact on existing services is around the Old Abingdon Road and A423 Area. Kennington Road also carries a number of services.

All options would require a new crossing through Old Abingdon Road. This road has a high density of services and these would need to be diverted.

Option 4C also requires a new channel adjacent to Kennington Road and an additional crossing underneath the A423. Both of these roads have a number of services as well. Due to the larger footprint of the options, and the requirement of more culvert crossings, Option 4C would have more of an impact on existing services.

All of the options propose work around the pylons and other national grid assets in the Area, aiming to avoid any interaction with these assets. Meanders have been added to the channels where required in order to avoid pylons.

Evaluating health and safety in buildability and maintenance at Area 4

Buildability

The excavation of materials and the construction of structures within an area of high water table poses difficulties to all of the options. This is less problematic for option 4A as it has a significantly smaller footprint and only incorporates one wholly new structure at the road crossing at Old Abingdon Road.

For Option 4B, there is more of an impact due to the larger footprint, due to the inclusion of the second 2-stage channel and the requirement that brings for a large online control structure.

The problem is most significant for Option 4C, as this option has two additional structures on top of those discussed in Option 4B, at the crossings of the A423 and Kennington Road.

The most significant impact that has been identified, however, is due to an area of historic landfill between the A423 and Old Abingdon Road. Here, Option 4C incorporates a channel through the landfill. This would pose both significant engineering challenges, to isolate the channel from the landfill, and cost implications due to the removal of contaminated material. This material must be either treated on site, at huge cost, or taken to specialist landfill sites.

Working at height

All options include the construction of two bridges. One at the Northern extent, which has been discussed in Area 3, and a further one directly east of South Hinksey. The construction of these may require some working from height. There is no clear difference between options relating to working from height.

Confined space

All of the options include a number of culverted road crossings, and the improvement of a number of railway crossings. Whilst it is not clear at this stage whether or not any of these activities will require confined space working, it may be said that option 4C is more likely to involve these activities.

Scoring on technical objectives at Area 4

Refer to Appendix C.4 of the main report for the scoring of all Sub-Objectives at Area 4.

Evaluation of technical objectives at Areas 5&6

Evaluating engineering risks at Areas 5&6

Impacts on the groundwater regime

The level of the proposed second-stage channel on the River Thames for Option 5B&6B will likely be situated above the water table. Therefore, Option 5B&6B is not likely to affect the groundwater flows and any potential impact on the groundwater will only be localised.

The depth of the proposed channel for Options 5A&6A and 6C will be approximately 2m deep and it is likely that this channel will be situated within or quite close to the water table. This will create a new pathway for groundwater flows and it has the potential of depleting the groundwater especially during extended periods of dry weather.

Minimise introduction of engineered elements

A flow control structure will be required within the proposed channels for Options 5B&6B and 6C to manage groundwater levels.

There are various existing public footpaths along this stretch of the River Thames and all proposed options maintain these footpaths. All the options propose to construct bridges at locations where a proposed channel will intrude onto a footpath.

There are two existing footbridges located at either end of the island which was created by the parting of the River Thames. The first of these footbridges is located to the north of the island and the second is located to the south of the island nearby Sandford Lock. These two existing footbridges will require to be extended to accommodate the proposed channel in Option 5A&6A.

Option 6C will require a new bridge to be constructed to the west of Rose Isle to maintain the Thames Path across the proposed channel. Also, Option 6C will require the extension of the existing footbridge that is located to the south of Sandford Lock. The proposed channel for Option 6C will likely require erosion protection at the either side of the channel by the locations of the proposed bridges.

Option 5B&6B is a continuation of Option 6C and it will also require a new bridge to be constructed to the west of Rose Isle. Additionally, this option will also require a single-lane vehicle bridge to be constructed at Sandford Lane and a new footbridge to be constructed at the location where the proposed channel returns to the River Thames.

Minimise risk of blockages and frequency of maintenance

In this area, all options will require vegetation clearance and mowing, with special focus on the spillway for Options 5B&6B and 6C.

The proposed second stage channel in Option 5A&6A will be intermittently wet as it will only be active during periods of heavy rainfall. This periodic shift of dry and wet conditions will induce more vegetation growth and it will require to be mowed on a regular basis if it is to retain its full functionality.

Evaluating disruptions to infrastructure and services at Areas 5&6

There is a row of electricity pylons carrying high voltage cables runs north-south through the area. Also, there are numerous underground electricity lines that run east-west.

Impact on infrastructure and public highways

All options will obstruct the existing public access to this area and there could be a requirement to maintain public access by constructing an informal/temporary public footpath. The impact of construction activities on existing public access will be assessed at the detail design stage.

Option 5A&6A and Option 6C will require the vehicle bridge at Sandford Lane to be extended and this may require closure to Sandford Lane and to the car park for some duration of the construction period.

The channel proposed in Option 5B&6B will cross Sandford Lane and the construction of a new vehicle bridge will be required to facilitate this crossing.

Impact on existing services

Option 5A&6A will be situated far away from the pylons and therefore it will not affect the integrity of the pylons.

Option 5B&6B and 6C will be in close proximity to the pylons and the proposed channels will meander to avoid the pylons. There is a significant risk that the excavations for constructing Option 5B&6B and 6C could impact the structural integrity of the pylons and therefore there could be a requirement to protect the pylons during the construction period. Also, the proprietor of the pylons may impose an exclusion distance which will subsequently govern the layout of any proposed channel.

Options 5B&6B will also clash with the existing underground cables and these cables will require to be lowered or diverted in the area to the south of Sandford Lane. Option 6C avoids these but will need to cross the outgoing cable the hydro scheme at Sanford Weir, this should be straight forward to divert.

Evaluating health and safety in buildability and maintenance at Areas 5&6

Buildability

The construction of Option 5B&6B and 6C will involve working in close proximity to the pylons and introduces a remote risk of electrocution. A full Ground Penetration Radar survey will be required to mitigate the risk of accidentally contacting a buried electrical cable. The high elevation of the electric cables suspended from the pylons will prevent the cables being contacted by any of the construction equipment.

The construction of Option 5A&6A will require some form of cofferdam on the right bank of the River Thames for the duration of the construction period. The cofferdam may reduce the conveyance capacity of the River Thames and therefore it will require a flood risk assessment.

Working at height

All options will require working at height for the construction of the footbridges. Additionally, the construction the new vehicle bridge for Option 5B&6B will involve more of working at height.

Confined spaces

None of the options at this stage are thought to require any confined space working due to the inclusion of clear-span bridges where the channel crosses any existing roads or access tracks. There are no differentiating factors between the options at this stage.

Scoring on technical objectives at Areas 5&6

Refer to Appendix C.5&6 of the main report for the scoring of all Sub-Objectives at Areas 5&6.

Evaluation of technical objectives at Area 7

Evaluating engineering risks at Areas 7

Impacts on the groundwater regime

None of the options are thought to have a significant impact on groundwater within the area. Option 7A which features some channel widening will have no impact on groundwater levels nor will Option 7B which introduces three new culverts under Weirs Lane. Option 7C may have localised impact, but this will be limited to some infiltration from the underlying groundwater into the new proposed channel during periods of high water table.

Minimise introduction of engineered elements

Option 7A features no new engineered structures. It is likely that at the crossing of Weirs Lane, the bridge may need to be widened to allow the wider channel underneath but this is yet to be confirmed.

Option 7B would require the construction of three new culverts under Weirs Lane to pass floodplain flows and alleviate blockages and restrictions at the bridges. These could likely be constructed without major disruption to the road network or the current river navigation network.

Option 7C would require the introduction of a number of highly engineered elements, not least the new channel. This option would require, in addition to a new channel, a flow bifurcation structure on the River Thames end of the channel, erosion protection at its downstream end, and two separate new access bridges across the new channel. For this reason, Option 7C would have the most significant impact in terms of engineered elements.

Minimise risk of blockages and frequency of maintenance

Option 7A would not require any additional maintenance activities, above those currently undertaken in the area. As this option only requires channel widening, the current level of bank/vegetation clearance or mowing activities that are undertaken could still be sufficient post scheme.

Option 7B would require some additional maintenance to clear trash screen and check the culverts are clear from blockages and in a good state of repair. This would not be required very often, as the culverts would only be operational during high flow events, when there would be significant flow within the floodplain.

Option 7C would require significant additional maintenance. The new channel would add over 1km of new bank which would require maintenance to an operational standard. The two new bridge crossings would require routine inspections and periodic maintenance. The bifurcation control structure would require significant maintenance to structural, mechanical and electronic components on a routine basis to ensure correct operation during high flow events. This option would increase the risk of blockages within the network due to the addition of the structure, for these reasons, this option has the most risk associated with blockages and maintenance requirements.

Evaluating disruptions to infrastructure and services at Area 7

Impact on infrastructure and public highways

Option 7A proposes widening works on the Weirs Mill Stream at its crossing with Donnington Bridge Road. It is anticipated that this widening works will be undertaken under live traffic but there could be a requirement to introduce a slower speed limit during the duration of the works. The other proposed widening works at downstream of Weirs Mill Pool for Option 7A is in close proximity to the residential flats, these works will require special planning to avoid impacting on the residential flats.

Similarly, it is anticipated that the proposed culverts through Donnington Bridge Donnington Road will be undertaken under live traffic but there could be a requirement to introduce a slower speed limit during the duration of the works.

The works proposed for Option 7C are outside the highway boundary but the works will impact on public footpaths. Option 7C will require slight repositioning of public footpaths to allow the construction of the proposed channel and footbridges.

Impact on existing services

Option 7A will impact some of the numerous services that are currently serving the boat moorings. These services will require to be diverted or protected depending on the exact location of each individual service. Also, the boat moorings could be repositioned following construction of Option 7A and therefore the locations of the services may have to be repositioned to suit the new locations of the boat moorings.

There is a high density of services located on either side of Donnington Bridge road and there are less services at the central part of this road. The westernmost of the three proposed culverts in Option 7B will have the most impact on the services. The westernmost culvert could be positioned away from the services to mitigate the risk of clashes. The other two proposed culverts will have minimal impact on services.

The proposed flow control structure for Option 7C will be situated in close proximity to a high voltage electric cable and a gas service. These two services will either require to be diverted or protected depending on the actual positioning of the proposed control structure. Towards the west (downstream) of the proposed channel there is a communication cable that could require protection works. There is also a gas service to the west (downstream) of the proposed channel which is slaloming across the field and it will cross the proposed channel at three locations. This gas service will require diverting.

Evaluating health and safety in buildability and maintenance at Area 7

Buildability

Option 7A will be the most challenging to build as the works will be situated in close proximity to infrastructure and services.

Unfavourable ground conditions would only be a significant hindrance to Option 7C due to the large scale excavation required for this option. Ground conditions could also impact on the construction the control structure for Option 7C.

Working at height

The need for two new bridge crossings in Option 7C may require working from height during construction and operation of the scheme. There are no differentiating factors between the other options.

Confined Space

Depending on the construction methodology used, only Option 7B risks the need for confined space working during construction or operation of the scheme. There are no differentiating factors between the other options.

Scoring on technical objectives at Area 7

Refer to Appendix C.7 of the main report for the scoring of all Sub-Objectives at Area 7.

Appendix B.03 – First-Phase Evaluation Data for Environmental Objectives

Evaluation of environmental objectives at Area 2

Evaluating ecological opportunities at Area 2

Effect on SSSIs

There is no geographical or hydrological link to Iffley Meadows or Port Meadows, so no opportunities for improvement. However all options have a significant impact on the nationally important MG4 grassland in this location.

Wider environmental habitat created

All options:

Wide, shallow scrape will improve conditions (enhanced connectivity with ground water and surface water) for establishment of species-rich wet grassland sward (focus on improving conditions to increase extent of Creeping Marshwort).

Increased inundation via spillway and new connectivity with existing ditch (Seacourt Stream) present opportunities for creation of more sustainable wetland habitats.

Opportunities to create niche habitats within scrape (e.g. shallow pools, or ditches linked to existing or new water courses).

However, stringent maintenance requirements for the scrape channel in Options 2A, 2C and 2D, plus the second-stage channel in Option 2B is likely to affect establishment of diverse habitat and may reduce ecological potential.

Ecologically sensitive design of new scrapes and channels (planform and profiles) is critical to maximising ecological potential.

In-channel habitat created

Option 2B offers a net gain in channel habitat, as the new channel becomes the flowing channel and Seacourt Stream is retained as backwater habitat. However this also has a significant impact on the MG4 grassland.

Option 2A offers a minor potential benefit to Seacourt Stream, around the connection between the existing stream and the upstream end of the scrape, where re-profiling could provide enhanced habitat. This option has the largest footprint and hence the greatest impact on the MG4 grassland in the area

In both cases, ecologically sensitive design of new channel planform and profile is critical to maximising ecological potential.

Options 2C and 2D offer no net gain in overall channel habitat, although there are opportunities to create bays and backwaters through re-profiling of the banks, which is less possible with Option 2A.

Fisheries improvements

Option 2B provides additional river habitat for fish, with Seacourt Stream retained as backwater which provides valuable nursery habitat for juvenile fish. Maintaining a sweetening flow down Seacourt Stream would improve the ecological potential of this habitat, if this could be achieved without compromising optimum flow in other channels.

Options 2C and 2D offer lesser opportunities to enhance juvenile fish habitat in the Seacourt Stream through creation of bays and backwater habitats through re-profiling of banks as previously noted.

Option 2A provides no opportunities for enhanced fish habitat.

Evaluating WFD assessment at Area 2

Impact on hydrological regime

All options alter the existing hydrological regime by changing the flow split between the main Thames and the Seacourt Stream during the design event. Option 2B has the potential to make further changes during all flows through the creation of a new channel. Option 2B also has the potential to impact on groundwater level.

Impact on river continuity

All options alter the existing flow split between the main Thames and the Seacourt Stream as well as altering the local flood regime in terms of volume and timing of out of bank flows, and thus have the potential to alter downstream sediment transfer of the Thames and Seacourt stream. However continuity of flow and sediment transfer will be improved in Seacourt Stream with the replacement of culverts at Willow Walk with a clear-span bridge.

Impact on morphological conditions

Options 2B, 2C and 2D have the potential to improve morphological and flow diversity both within the channel and the floodplain of Seacourt Stream through the creation of a new channel/alterations to the existing channel. This could help reduce sedimentation in the channel improving the quality of the substrate, and improving heterogeneity. However it will result in the loss of the existing form and substrate in Option 2B. Option 2A does not cause a deterioration in the morphological diversity of the Seacourt Stream.

Evaluating environmental impact at Area 2

Impacts to Scheduled Monuments and archaeology

There have been some finds of local importance along Willow Walk. Archaeological mitigation is likely to be needed for all options, but there are no localised constraints which will affect option choice.

All the options require similar flow capacity through Willow Walk (and also through Monk's Causeway in Area 3), Option 2B involves deeper excavation in the meadow, so it is slightly less preferred, but there is no major difference between Options 2A, 2B and 2C. Option 2B involves excavation over a larger area than the other options and is therefore least preferred.

Ecological impacts

The meadow is of high ecological value, stated by BBOWT to be of near SSSI quality. It is species-rich and of a relatively rare vegetation type known as MG4. It is second only to Iffley Meadows SSSI in ecological importance within the scheme footprint and BBOWT are keen to see the footprint of the works minimised. They also wish to see new MG4 meadow created to replace that which is lost.

The scheme will need to mitigate the loss of meadow, through attempting to recreate the habitat. One possibility being examined is retaining the seedbank by keeping topsoil taken from the meadow separate. However it is not yet clear if the newly lowered ground will be too wet for the habitat type.

Modelling has not yet been done to determine the width of the lowered areas, so it is not clear which option would have the lowest land take. Option 2C may be preferred for keeping the works as far to the south-west as possible. However this involves loss of the trees along the bank of Seacourt Stream, which may have potential for otter holts or for bats, and are almost certain to be of value to bats as a commuting route.

Option 2B, by creating a new channel, bisects the meadow and will make it harder to manage it as meadow in the future.

Option 2A has more land take than the other options.

The area where Snakes Head Fritillary grows is within the footprint of all options. Therefore, although it is a significant negative impact, this is not factored into the option choice as a differentiator.

Immediately downstream of Area 2 is the horse paddock where Creeping Marshwort grows. Option B carries a risk that, through turning the downstream part of Seacourt Stream into a backwater which might silt up, it might change the drainage of the paddock unfavourably. This would be highly undesirable. Options 2A, 2C and 2D all involve the possibility of minor channel widening along the edge of the paddock. Our current understanding is that the Creeping Marshwort does not grow in the area that would be affected, however there would be additional construction noise.

Overall, Options 2B and 2A appear less favourable.

Scoring on environmental objectives at Area 2

Refer to Appendix C.2 of the main report for the scoring of all Sub-Objectives at Area 2.

Evaluation of environmental objectives at Area 3

Evaluating ecological opportunities at Area 3

Effect on SSSIs

There is no geographical or hydrological link to Iffley Meadows or Port Meadows, so no opportunities for improvement.

Wider environmental habitat created

The wide shallow second-stage channel will improve conditions (enhanced connectivity with ground water and surface water) for establishment of species-rich wet grassland sward. In the northern section, this should focus on improving conditions to increase extent of Creeping Marshwort.

All options offer opportunities to create niche habitats (e.g. shallow pools/scrapes, ditches, bays, backwaters).

Ecologically sensitive design of new channel and associated wetland habitat features (planform and profiles) is critical to maximising ecological potential.

Option 3A offers particularly increased inundation to floodplain via the new primary channel. This presents opportunities for creation of more sustainable wetland habitats. The other options also offer this, but to a lesser extent as more of the enhanced floodplain will be occupied by permanent water.

In Options 3B and 3C, the new lake provides additional wetland and open water habitat. Option 3B also provides 'off-line' refuge areas for fish, mammals, birds etc. under normal flow conditions.

The on-line nature of lake in Option 3C is not desirable from an ecological viewpoint (potential for pollution events from river).

The series of small ponds in Option 3D provide significant additional wetland and open water habitat and provides 'off-line' refuge areas for fish, mammals, birds etc. If suitably designed this habitat can be of more benefit than a single large lake.

Note that in Option 3B it is not certain that the off-line lake would be constructed; if it were not, the benefits of Option 3B would be similar to those of Option 3A.

In-channel habitat created

A net overall gain in channel habitat is currently anticipated (i.e. gains exceed losses). Ecologically sensitive design of new channel and lake (planform and profiles) is critical to maximising ecological potential and therefore ensuring that the in-channel habitat created is of more benefit than the existing channels which will be lost or converted to backwaters.

The new channel will be partly groundwater fed (as well as taking the flow from Seacourt Stream) which has potential to reduce the demand on other channels during normal and low flow conditions.

Fisheries improvements

The new channel provides additional river habitat for fish, in all options. In Options 3B, 3C and 3D, the additional waterbodies provide additional fish habitat compared to Option 3A.

In Options 3B and in particularly 3D, the lake/ponds are not linked to channel, so fish may become trapped and predated.

In Options 3B and 3C, and to a lesser extent 3D, there is a risk that fish will be introduced to the lake (e.g. by members of the public with good intentions), which could then affect native fish stocks in the main channel and downstream watercourses.

Note that in Option 3B it is not certain that the off-line lake would be constructed; if it were not, the benefits of Option 3B would be similar to those of Option 3A.

Evaluating WFD assessment at Area 3

Impact on hydrological regime

All options will change the flow dynamics in the area by reducing the number of channels and combining the flow in a single channel. All options will also impact on ground water connections. Options 3B and 3D will reduce downstream discharge (and resulting river energy) at design flow events. Option 3C will further impact downstream flow by controlling discharge at all flows. This change may be considered positive from an ecological perspective as it will reduce the likelihood of channels running dry under time of very low flow.

Impact on river continuity

The change in flow patterns created by all options will change sediment transport pathways in the area, impacting the side channels (that have been diverted into one channel) and potentially the main Thames. Flow control structures will further impact sediment transfer and possibly the passage of aquatic species. The addition of an online lake (Option 3B) will have the largest impact on sediment transfer, and is likely to be a focus of deposition on upstream sediments, with potential increased erosion downstream. It will also reduce peak flows (and energy) downstream of the lake within the Hinksey Brook.

Impact on morphological condition

All options involve a reduction in length and number of channels and so will reduce the variety of the bed, and bank form, however the options also have potential for the new low flow channel to have a more varied morphology, leading to more varied flow conditions and substrate. The required erosion protection and confined nature of the channel in some areas will have a negative impact on morphology and the ability of the channel to adjust over time.

Evaluating environmental impact at Area 3

Impacts to Scheduled Monuments and archaeology

All options involve works in the same place at Monk's Causeway. A mitigation plan will be needed to ensure any archaeology disturbed is recorded, but there will be no difference between Options 3A to 3D. There is a minor negative effect if Option 2B is chosen, as the channel would likely need to be slightly larger to accommodate the base flow diverted from Seacourt Stream.

Further south there is an area of crop-marks which may contain archaeology. As with any area of archaeological potential, there is a general preference to avoid unnecessary excavation, therefore Option A, without additional lakes, is preferred, while Option D is also preferable to the other options, if the lakes will be relatively shallow.

Ecological impacts

All options avoid the Creeping Marshwort, although there is concern that it may be harmed if the works cause too much noise for horses to be able to graze. Specific mitigation may be needed here, including potentially arranging alternative grazing, or possibly arranging the timing of works near the paddock to avoid losing a whole summer of grazing. This will require further consideration. It does not affect the choice of options in Area 3 does influence the choice of option for Area 2.

The land further south is of lower current value and in principle there is little to choose between the options. The higher ecological value of the ponds compared to the lakes is taken into account as an ecological opportunity. However, this area is the most likely to be suitable for creating new MG4 meadow as mitigation for that lost in Area 2, especially if the lowered ground cannot be made suitable for MG4. Therefore, Options 3B and 3C may reduce the capacity for mitigation of impacts elsewhere.

Impact on hydrological regime

All options will change the flow dynamics in the area by reducing the number of channels and combining the flow in a single channel. All options will also impact on ground water connections. Options 3B and 3D will reduce downstream discharge (and resulting river energy) at design flow events. Option 3C will further impact downstream flow by controlling discharge at all flows. This change may be considered positive from an ecological perspective as it will reduce the likelihood of channels running dry under time of very low flow.

Impact on river continuity

The change in flow patterns created by all options will change sediment transport pathways in the area, impacting the side channels (that have been diverted into one channel) and potentially the main Thames. Flow control structures will further impact sediment transfer and possibly the passage of aquatic species. The addition of an online lake (Option 3B) will have the largest impact on sediment transfer, and is likely to be a focus of deposition on upstream sediments, with potential increased erosion downstream. It will also reduce peak flows (and energy) downstream of the lake within the Hinksey Brook.

Impact on morphological condition

All options involve a reduction in length and number of channels and so will reduce the variety of the bed, and bank form, however the options also have potential for the new low flow channel to have a more varied morphology, leading to more varied flow conditions and substrate. The required erosion protection and confined nature of the channel in some areas will have a negative impact on morphology and the ability of the channel to adjust over time.

Scoring on environmental objectives at Area 3

Refer to Appendix C.3 of the main report for the scoring of all Sub-Objectives at Area 3.

Evaluation of environmental objectives at Area 4

Evaluating ecological opportunities at Area 4

Effect on SSSIs

There is no geographical or hydrological link to Iffley Meadows or Port Meadows, so no opportunities for improvement.

Wider environmental habitat created

Construction of 2-stage channels will provide the opportunity to create a more species-rich wet grassland sward. In Option 4A, the area will be limited as there would be only one such channel, compared to two in the other options.

Increased inundation to the second stage of the channels provides opportunities to create niche habitats along new channel (e.g. shallow pools/scrapes, bays, backwaters). Again, this is less so for Option 4A.

Ecologically sensitive design of new 2-stage channels and associated wetland habitat features (planform and profiles) is critical to maximising ecological potential.

In-channel habitat created

Construction of two 2-stage channels (or one for Option 4A) and constrained/semi-constrained channels further downstream, provide opportunities for a significant net gain in in-channel habitat.

Ecologically sensitive design of new 2-stage channel and constrained/semi-constrained channels (planform and profiles) critical to maximising ecological potential.

Fisheries improvements

The new channels provide additional river habitat for fish. Again, this is more so for Options 4B and 4C than for Option 4A.

Ecologically sensitive design of new channel planform and profile critical to maximising ecological potential.

Evaluating WFD assessment at Area 4

Impact on hydrological regime

All options will alter the hydrological regime, firstly by conveying additional flow from the upstream channels in Areas 2 and 3, and secondly by altering the flow paths and patterns of the existing channels. The creation of 2 channels as part of Options 4B and 4C have the potential to leave channels dry or with very little flow under low flows. Flows into the lagoons will also be altered by all options.

Impact on river continuity

The changes in flow will alter the sediment transport pathways of the channels through the area. The addition of bridges and culverts to all options may reduce the downstream continuity of sediment transfer, but especially in Option 4C with a longer length of culvert through landfill.

Impact on morphological conditions

All options will involve a loss of the current channel bed and bank form and substrate, however the options have potential for the new low flow channel to have a more varied morphology, leading to more varied flow conditions and substrate. Option 4C, however has reduced potential given the length of proposed culvert. The required bridges and culverts and the confined nature of the channel in some areas will have a negative impact on morphology and the ability of the channel to adjust over time.

Evaluating environmental impact at Area 4

Impacts to Scheduled Monuments and archaeology

All options pass through Old Abingdon Road at the same place, to miss the visible culverts which are the official Scheduled Monument. There is a high risk of encountering valuable archaeology even in the location chosen. The extent of likely damage is highly dependent on the capacity of the new channel; the smaller the channel, the more flexibility there is over its exact route and therefore the more chance that any archaeology encountered can be retained in situ.

Option 4C involves a higher-capacity channel, but also passes through the road at a more perpendicular angle, reducing the amount of excavation. Also, Option 4C involves loss of vegetation at the site boundary of Templeton College, which the local council has expressed concern about. However, this is some distance from the building itself and is unlikely to be judged to have a significant effect on the setting of the Listed Building.

On balance, there is little difference between the three options. All must be considered unfavourable due to the risk of damage to the highly-important causeway.

Ecological impacts

Hinksey Pond was not identified as of particularly high value during the Phase 1 Habitat Survey. Its value was much greater in the past, when it was at one time the last habitat in England for a rare species of snail, whose UK population is now confined to Wales. However the Freshwater Habitats Trust when consulted said they believe the snail to be locally extinct. We are awaiting survey data from FHT to determine if there are other valuable species present: if so, mitigation may be needed so that the pond loses some of its area to the new channel, rather than the whole of the pond becoming part of the channel.

Options 4A and 4B both go through the pond, which option 4C avoids it.

Kendall Copse is a relatively recently planted community woodland on a former landfill site. All three options take land from this site, with Option 4C taking most.

Scoring on environmental objectives at Area 4

Refer to Appendix C.4 of the main report for the scoring of all Sub-Objectives at Area 4.

Evaluation of environmental objectives at Areas 5&6

Evaluating ecological opportunities at Area 5&6

Effect on SSSIs

There is no geographical link to Iffley Meadows or Port Meadows. There is a minor hydrological link (the works are designed to draw water through from upstream) but this is anticipated to be a very minor effect. The magnitude of the effect cannot be judged until hydraulic models have been run, but for the current assessment it is assumed that (a) there is no opportunity for noticeable improvement for the SSSI and (b) any effect which does occur will be the same for all three options.

Wider environmental habitat created

In all options, construction of a second-stage channel will improve conditions (enhanced connectivity with ground water and/or surface water) for establishment of species-rich wet grassland sward.

Increased inundation via improved connectivity to main River Thames (Option 5A&6A) or the new channel (Options 5B&6b and 6C) presents opportunities for creation of more sustainable wetland habitats.

Options B and C may provide opportunities to introduce Creeping Marshwort, where appropriate.

There will be opportunities to create niche habitats (e.g. shallow pools/scrapes, ditches, bays, backwaters) at the interface between the first-stage and second-stage channel, in each option. This is of particular potential value in Option 5A&6A, where bays or backwaters in the main channel of the Thames could be created.

Conversely, in Option 5A&6A there would be less opportunity for new wetland features (e.g. scrapes) to act as 'off-line' habitat refuges than in the other options, as the lowered ground would be directly connected to main River Thames. Maintenance requirements to minimise/manage sedimentation in the navigable channel would be likely to affect establishment of diverse habitat

and may reduce ecological potential (although the potential would still be greater than the existing river).

In-channel habitat created

Options 5B&6B and 6C offer a net gain in overall channel habitat. The gain in Option 6C is slightly greater. Option 5A&6A offers no net gain.

Fisheries improvements

Options 5B&6B and 6C offer an increase in fish habitat. The increase in Option 6C is slightly greater.

Option 5A&6A offers opportunities to enhance juvenile fish habitat in the main River Thames through creation of bays and backwater habitats through re-profiling of banks; there would be no benefit to fish simply from constructing the second-stage channel.

Evaluating WFD assessment at Areas 5&6

Impact on hydrological regime

Option 5A&6A will alter the timing (increasing the frequency) and extent of out of bank flows. Options 5B&6B and 6C will lower water levels in the Thames during all flows as flow is directed down the new 2-stage channel. Both will impact of existing discharge and velocity within the channels.

Impact on river continuity

As all options will alter the discharge and velocity of the main channels resulting in changes to sediment transport and pathways. The scale of the changes is currently unknown.

Impact on morphological conditions

Option A will result in a loss of existing bank from along the length of the works, but re-profiling works have the potential to add a greater variety of bank form to the reach, with reduced bank protection measures. Bedform may also become more varied as a result of the works and the likely reduction of energy within the channel.

Options 5B&6B and 6C both have the potential to improve morphological diversity through the addition of the new channel, however this potential is reduced where there are areas of erosion protection.

Evaluating environmental impact at Areas 5&6

Impacts to Scheduled Monuments and archaeology

There are features of local cultural heritage value, including the obelisk near Sandford Pool and Sandford Pool itself. Neither has archaeological potential, but Option 5A&6A by changing the bank layout would have an effect on the cultural heritage value of the site.

For archaeology, there is no evidence that the footprint of any of the options is more or less sensitive than the others. Therefore the option which permits the excavation to be shallowest and narrowest is preferable; on current proposals this would support Option 5A&6A.

Ecological impacts

BBOWT have asked for a detailed survey of the meadow to identify which are the highest-value areas and whether a route for the option could be chosen to minimise loss of the highest-value areas. Option 5A&6A presents less chance to change the detail of the alignment, since it must follow the river throughout.

Option 5A&6A also involves the loss of significantly more trees than the other options, as all trees and hedgerow along the bank would be lost and could not be re-planted. The trees may have value for otters and bats, and will almost certainly have value in reinforcing the line of the river for bats, which follow such geographical features when flying.

BBOWT have noted a risk that Options 5B&6B or 6C could impact on the management of the meadow; if they were to interfere with the landowner's ability to manage the land as meadow, this would be ecologically damaging. However, since OPT are committed to maintaining the meadows, this in practice means a commitment to providing enough suitable crossing points to ensure management can continue.

A further risk with Options 5B&6B or 6C is that, because they have a permanent channel within them, they could lower the level of the River Thames during normal and low-flow conditions, as well as during floods. There is a risk of ecological damage to the river (covered in the section on WFD) but also a risk of damage to Fiddler's Elbow Marsh, which is likely to be sensitive to water levels in the river locally. This risk will only materialise if the river level is negatively affected. It is an established objective of the scheme to avoid this, so the risk is not likely to materialise.

Scoring on environmental objectives at Areas 5&6

Refer to Appendix C.5&6 of the main report for the scoring of all Sub-Objectives at Areas 5&6.

Evaluation of environmental objectives at Area 7

Evaluating ecological opportunities at Area 7

Effect on SSSIs

Modelling has not yet been carried out which would determine the effect of Option 7B on Iffley Meadows SSSI, but there are concerns that it may lead to increased frequency or duration of flooding during normal winters. Parts of the SSSI are currently too wet, including a unit in "Unfavourable (recovering)" condition. Increasing frequency of flooding in these areas is therefore likely to reduce opportunities for improvement in condition, resulting in a dis-benefit.

Option 7A has a minor dis-benefit due to the short stretch of widening works on the left bank. It presents no opportunities for improvements to the SSSI.

Option 7C offers potential for improvements to the SSSI through creation of wider flowing channel through meadows, along the route of an existing ditch or else along a former channel. Ecologically sensitive design of the new channel planform and profile would be critical to maximising ecological potential.

In all cases, there is the possibility of benefitting the SSSI through drainage improvements in the southern part of the meadows. Since this is independent of the option choice, it is not included in this assessment.

Wider environmental habitat created

Option 7A offers opportunities for habitat improvement along banks of river, through appropriate re-grading of banks as opposed to replacing the existing artificial banks like-for-like. However such opportunities are likely to be limited due to requirements for ongoing maintenance and dredging along the widened reach.

Option 7B offers very limited opportunities for wider improvements, as the works are confined to the SSSI. It is possible there could be very minor improvements in bank habitats resulting from re-profiling.

Option 7C offers some opportunities for habitat improvement along banks of river, through appropriate design of new channel. In principle, there could also be opportunities to create niche habitats along new channel (e.g. bays, backwaters, berms), although such changes would be restricted by the need for any additional land-take to be of benefit to the SSSI.

In-channel habitat created

Options 7A and 7B offer no net gain in channel habitat. Option 7B may have some very limited opportunities for improvement of the habitat through bank re-profiling where the banks would be

lowered. Option 7A is unlikely to offer opportunities for improvement, due to likely requirements for ongoing maintenance and dredging along the widened reach.

Option 7C does offer a net gain in channel habitat, if ecologically sensitive design is applied, and also possible opportunities to create niche habitats along new channel (e.g. bays, backwaters, berms), although such opportunities may be restricted by the SSSI designation.

Fisheries improvements

For all three options, the potential for fisheries benefits is the same as the potential for creation of in-channel creation.

Evaluating WFD assessment at Area 7

Impact on hydrological regime

All options will alter the hydrological regime of the Thames. Option 7A may reduce velocity, and reduce channel – floodplain coupling. Option 7B will increase the frequency of out of bank flows and Option 7C changes the flow splits between channels at all flows.

Impact on river continuity

All options will alter sediment transport downstream, with Option 7C likely to have the greatest change (at all flows). Option 7B will increase the frequency of over bank flows into Iffley Meadows, and allow better utilisation of the floodplain.

Impact on morphological conditions

Option 7A involves channel widening and straightening and will reduce result in a large loss of natural bank and bed and damage to substrate as well as reduced form diversity of the channel along the length of works. Option 7B will involve small losses of exiting banks, but will reconnect the channel and the floodplain, as well as improving connectivity of the floodplain downstream of the bridge through the addition of extra culverts, creating more natural floodplain processes. Option 7C will result in the loss of natural channel, but has the potential to improve morphological diversity through good design, however control structures and erosion protection will limit the adjustment of this channel over time.

Evaluating environmental impact at Area 7

Impacts to Scheduled Monuments and archaeology

The cultural heritage value of Area 7 lies in the meadows themselves. There are no archaeological features or Listed/Scheduled structures which would affect the choice of option.

Potential effects on cultural heritage relate to the minor effect on the orchard (Option 7A) and a potential effect on the use of the meadows for local community events (Option 7B). If the increase in flooding under Option 7B were enough to interfere with the use of the meadows, it would inevitably also have an unacceptable effect on the ecology of the site, sufficient to cause Natural England to object to the scheme. Therefore, this effect is scored under ecology rather than in this section, to avoid double-counting.

Ecological impacts

Iffley Meadows SSSI is the most important ecological site in the scheme area (discounting Port Meadows, which is north of Area 1 and not expected to be affected). It is essential that any effect on the SSSI is net beneficial, or at least neutral. BBOWT have indicated that ideally they would prefer the meadows, especially the southern part, to be drier than they currently are. The population of Snakes Head Fritillary (larger than the population in Area 2) is towards the south of the site.

Option 7A has negative effects due to loss of trees, including some from the orchard. However, since it does not directly affect the SSSI, it is BBOWT's preferred option.

Option 7C involves direct land-take from the SSSI. As currently drawn it would be unlikely to be acceptable, however if it were re-aligned to follow an old ditch channel and were to incorporate drainage improvements in the south of the SSSI to compensate for the past effects of the building of the southern bypass, it may be possible to make this option acceptable.

Option 7B may turn out to be unacceptable, depending on the results of the modelling. The key question is whether it increases the duration of the typical winter flood (specifically, if it causes flooding to last longer into spring). If the river will normally drop below the lowered bank level before the end of the flood season (i.e. the floods remain on the site due to slow drainage at the southern end), it may be possible to make this option viable by including some drainage improvements in the south. However, if modelling shows that flooding will extend later into spring, due to water entering the site later than it currently does, both BBOWT and Natural England will oppose this.

The overall effect of Option 7B is hard to assess until the modelling is available. It has currently been scored on the assumption that there will be a minor increase in spring flooding.

Scoring on environmental objectives at Area 7

Refer to Appendix A.4 for the scoring of all Sub-Objectives at Area 4.

Appendix B.04 – First-Phase Evaluation Data for Institutional Objectives

Evaluation of Institutional objectives at Area 2

Provides Benefits and Minimises Impact on Interested Parties at Area 2

Residents / Landowners / Tenants

There are no residents directly affected by the proposed options in Area 2. Feedback from the residents of North Hinksey is incorporated under the 'Public' Parameter.

The landowner for the meadow section of Area 2 has major reservations regarding the impacts on the meadow from all of the options and has significant concerns over the impact on the setting and condition of the meadow. It was noted that Option 2B could be linked into the section of channel in the area which is currently a wetland section. Concern was raised over public access in this area and they would like to see the footprint of any works made as small as possible. Oxford City Council own the section of Area 2 adjacent to Botley Road and have noted that the impact on the Seacourt Nature Park will be significant for all options other than Option 2C. The landowner also raised the opportunity for improving the visual aspect of Willow Walk with the proposed new clear-span bridge over the existing culverts and headwalls.

The tenant farmer for the meadow in Area 2 currently uses the field for grazing cattle and cutting hay. This is an important part of the management regime used over the years to maintain the meadow in its current state including its ecological value. All of the options will impact on the farming regime in the meadow. The ground water is high in this area and any proposed excavations will create wetter areas which may then create difficulties with cutting hay and have a wider impact on the viability of grazing in the meadow for longer periods of the year than the current situation. Option 2B severs the field in two with the new channel and will create difficulties with cutting hay on the second-stage channel and additional access to each area will be required.

Local Authorities

Oxfordshire County Council also raised the opportunity to improve the visual aspect of Willow Walk and the opportunity for enhancements to Willow Walk to reduce flood risk to this important pedestrian and cycle route to the city centre.

There was also concern if Option 2C or Option 2D were implemented there would be a significant loss of trees along the left bank of the Seacourt Stream. If Option 2B is carried out and the existing Seacourt Stream becomes a backwater there would be impacts on local drainage network which would need to be managed.

Public

Overall feedback from the public was that Option 2B would be the preferred option. Although at the Abingdon public consultation event, Option 2C was the preferred choice. However, at the West Oxford public consultation event, Option 2A was preferred and this was the second most popular option overall across all public events.

Concern was raised over the loss of trees on the left bank of the Seacourt Stream in Options 2C and 2D and possible impacts on the existing stone bridge over the stream on Willow Walk with these options. Overall Option 2D was by far the least preferred option.

Other interested local organisations and businesses

Other organisations consulted as part of this process has similar comments to those highlighted in the previous sections. Particular in relation to the loss of trees, impacts on the status of the meadow and recreational activities along with the visual appearance of the existing culverts at Willow Walk. Other than impacts of trees no specific preferences were put forward at this stage.

Impact of the farming business is covered in the previous sections, no other businesses will be directly affected by the works. No feedback from any of the businesses along Botley Road has been received.

Evaluating potential policy/legislative conflict and planning outcomes at Area 2

Links to River Basin Management Plan

None of the options in this area are in conflict with the overall aims and objectives of the River Basin Management Plan. Specific details of ecological status of channels and other issues covered by the plan are included in the Environmental Objectives of this review.

Impacts on Navigation in the Oxford Area

None of the options in this area will have impacts on river based navigational operations in the Oxford area. Options for creating an easily navigable watercourse in this area is also severely limited.

Links to Existing Planning Policy

There are a number of Oxford City Planning Policies which could affect the scheme. These include Policy CS11 – Flooding and Policy NE11 – Land Drainage and River Engineering Works. The proposed works are in line with these policies although all proposed options will directly impact on the flora and fauna of the meadow in Area 2.

Planning Policy CS4 – Green Belt will require all of the proposed options to justify the need for the scheme to achieve planning consent. Policy NE20 – Wildlife Corridors requires wildlife corridors to be maintained, Options 2C and 2D will impact on the existing wildlife corridor along the Seacourt Stream. All options will help to improve pedestrian and cycle routes under Policy TR5. However Option 2B will restrict pedestrian access routes east – west across the meadow.

Evaluating opportunities for partnering/funding at Area 2

Stakeholder requirements and objectives

In addition to flood risk reduction to residential properties there will also be a benefit to reduced flood risk along Botley Road. This will also benefit the commercial and retail businesses in the area. However all options provide a similar level of fluvial flood risk reduction benefit and there is no direct differentiation between the options in relation to wider stakeholder objectives in this area.

Opportunities for development, both public and private

The proposed works are expected to reduce flood risk to residential and commercial properties along Botley Road and in the Osney area along with a reduction in risk to Botley Road transport route. There may be some small benefit to the Osney Mead Trading Estate. It is understood that options are being investigated by the Oxford University to redevelop this area. However there is no direct differentiation between the options in this area.

Opportunities for public and private sector funding

As noted above all options have similar flood risk benefits in the area, approaches are being made to Oxford University in relation to funding opportunities or partnership working in relation to Osney Mead Trading Estate redevelopment and in relation to longer term education opportunities with the university. Approaches to benefiting businesses along Botley Road may yield some funding. All options provide a similar level of fluvial flood risk reduction benefit. However, Option 2B may help to

reduce groundwater impacts to some of the businesses along Botley Road, and Option 2A will have potentially less benefits otherwise there is no direct differentiation between the options in this area.

Scoring on Institutional objectives at Area 2

Refer to Appendix C.2 of the main report for the scoring of all Sub-Objectives at Area 2.

Evaluation of Institutional objectives at Area 3

Provides Benefits and Minimises Impact on Interested Parties at Area 3

Residents / Landowners / Tenants

There are no residents directly affected by the proposed options in Area 3. Feedback from the residents of South Hinksey is incorporated under the 'Public' Parameter.

The landowner for the paddock section of Area 3 immediately to the south of Willow Walk again has major reservations regarding the impacts on the meadow from all of the proposed options and has significant concerns over the impact on the setting and biodiversity opportunities of the paddocks with all the options. Concern was raised over public access in this area as it is currently used for horse paddock and the public is currently excluded. There would be issues around allowing free public access if the area continues to be used as horse paddocks, this view was reiterated by the tenant at these paddocks.

Other landowners in the area raised concerns about extracting gravels as part of the works, however this is a wider issue and sits outside of this options review process. Refer to the scheme's Material Management Plan for the discussions relating to gravel extraction.

The tenant farmer for the various horse paddocks in the northern section of Area 3 noted that the grazing areas would be significantly reduced as a result of the scheme. To maintain horse grazing the water courses need to be fenced to avoid animals wandering off. This will create difficulties with all options where the second-stage channel needs to be kept clear of obstructions. This tenant also raised concerns over the impacts to his riding school business due to a reduction in grazing available and any restrictions which may impact on his clients hacking around the local area.

The tenant on the meadows to the south of this area currently uses the field for grazing sheep, cattle and cutting hay. It was noted that parts of this area are usually very wet throughout most of the year and the works will make the area around the channel even wetter. All of the options will impact on the farming regime in the meadows through which the channel runs in terms of hay cutting and animal grazing. Parts of the area will be wetter in the future, to make the area viable two cuts of hay per year are required this may be difficult to achieve in some areas of the second stage of the new channel. Dry access for sheep to use across the channel will be required at a location in this area, however this is common to all options.

None of the tenants using the land were in favour of the lake options due to the additional land take for these options.

Local Authorities

Limited specific comments were received for Area 3 from Local Authorities which are not covered elsewhere in the environmental and landscape aspects of this assessment. Therefore all Options are scored neutrally in this section to avoid double counting in the overall assessment process.

Public

Feedback from the public on Options in Area 3 indicated that Option 3A was the preferred, opinion was then relatively evenly split across the remaining options. At three of the five drop in sessions, Option 3A was the preferred option, these were the three drop in meetings closest to Area 3 and therefore indicate the local opinion. Positive responses to other options are also divided by location of events. The Kennington and Abingdon events preferred the lake options generally. As opinion is

relative to the areas of respondents it is difficult to directly assign preferences other than taking the overall scores across all the public drop in events. The least preferred options was 3B although from the comments it is not clear why this is the case.

Other interested local organisations and businesses

Other organisations consulted as part of this process have similar comments to those highlighted in the previous sections. Particular in relation to the loss of trees and hedgerows along with the impacts to existing watercourses. Overall feedback indicated that Option 3D is preferred due to the wider range of environmental opportunities.

Impact of the farming and agricultural businesses, including the riding stables in the area is covered in the previous sections, no other businesses will be directly affected by the works.

Evaluating potential policy/legislative conflict and planning outcomes at Area 3

Links to River Basin Management Plan

All options maintain and maximise the use of the existing floodplain in this area. Option 3C will potentially have an impact on the geomorphology of the new system as the on-line lake will tend to act as a silt trap and will require an additional weir to retain levels, this option is also likely to have the lowest water quality for the new body of water created by the lake. There may be some potential impacts on the status of existing watercourse at the northern end of this area and this will require careful design to ensure they are enhanced wherever possible.

Impacts on Navigation in the Oxford Area

None of the options in this area will have impacts on river based navigational operations in the Oxford area. All options impact on the Bulstake Stream and care will be needed at the junction with this stream to ensure navigation depths in the River Thames are not impacted during low flow periods. Options for creating an easily navigable watercourse in this area is also severely limited.

Links to Existing Planning Policy

There are a number of Oxford City Planning Policies which could affect the scheme. These include Policy CS11 – Flooding and Policy NE11 – Land Drainage and River Engineering Works. The proposed works are in line with these policies. Sections of Area 3 route pass through local wildlife sites for wildlife conservation where Policy C12 – Biodiversity applies, however all options have equal impacts and will require mitigation works.

Planning Policy CS4 – Green Belt will require all of the options to justify the need for the scheme to achieve planning consent. If Options 3B or 3C were to go ahead and a lake implanted for recreational purposes, then any facilities associated with recreation and rowing at the lake could be in contravention of CS11. All options will help to improve pedestrian and cycle routes under Policy TR5.

Evaluating opportunities for partnering/funding at Area 3

Stakeholder requirements and objectives

Option 3D is likely to create a greater range of environmental habitats which could further increase the environmental opportunities in the area which links in with the wider aims and objectives of all the key stakeholder and interested parties. The lake opportunities in Options 3B and 3C will enhance the recreation facilities but generally at the expense of environmental benefits and maintaining the existing type of landscape character of the area. All options provide equal opportunities for meeting other key requirements and objectives.

Opportunities for development, both public and private

The proposed works in this area optimise the use of the existing flood plain and do not reduce flood risk in areas which could be suitable for development under current planning policy. Similar to the

proposals at Area 2, there may be some small benefit to the Osney Mead Trading Estate. However there is no direct differentiation between the options in this area at this stage.

Opportunities for public and private sector funding

As noted above, all options have similar flood risk benefits in the area. There are no direct beneficiaries in this area other than the residents of South Hinksey. As before there may be some flood risk benefit to the Osney Mead Trading Estate which may assist with redevelopment opportunities which could help bring in some funding from this development. However all options create this opportunity. As noted before there are ongoing discussions regarding this area with Oxford University with respect the educational opportunities and Option 3D is likely to create the largest range of habitats which could benefit education programmes with the university.

Whilst there is significant service infrastructure in this area, the operators have indicated their plant is already sufficiently resilient with respect to flood risk. Options 2B and 2C could potentially draw in funding for the creation of the lake of recreational purposes. However, a commercially viable recreational lake is not likely to be compatible with the overall landscape and environmental aims of the project. Also, the facilities required for a recreational lake could create planning issues in the flood plain.

Scoring on Institutional objectives at Area 3

Refer to Appendix C.3 of the main report for the scoring of all Sub-Objectives at Area 3.

Evaluation of Institutional objectives at Area 4

Provides Benefits and Minimises Impact on Interested Parties at Area 4

Residents / Landowners / Tenants

There are no residents to the north of Old Abingdon Road directly affected by the proposed options in Area 4. Feedback from the residents of South Hinksey is incorporated under the 'Public' Parameter. There are a small number of private residential properties at the northern end of Kennington Road which will have gardens affected by all of the options to enhance flows through Munday's Bridge. The residents have all voiced concerns over these works due to the loss of garden and disruption. They have recently suffered disruption in relation to a Thames Water scheme in the same location. Option 4C will have the greatest impact in terms of land take from the gardens.

Option 4C will heavily impact on the frontage of the Said Business School at Egrove Park on Kennington Road and they have expressed concern over the visual impact of the enlarged channel through this area.

No specific comments from the other landowners in this area expressed any preferences for any of the options which are not covered by other aspects of this appraisal.

The tenant farmer for fields to the north of Old Abingdon Road has expressed concern over the impacts of lowering the second stage on the grazing areas which would be wetter for longer periods of the years. Option 4B minimises this and the impact on the areas available for grazing and hay making.

All options will impact on the landowners on the left bank of the Hinksey Stream which is required to enhance the capacity of the channel, however the impacts are neutral in relation to the options selection process.

The options in this area will also potentially impact on the horse riding school business In North Hinksey due to a reduction in access for their clients hacking around the local area. Option 4A would minimise these impacts.

Local Authorities

Limited specific comments were received for Area 4 from Local Authorities which are not covered elsewhere in the environmental and landscape aspects of this assessment. Therefore all options are scored neutrally in this section to avoid double counting in the overall assessment process.

Public

Feedback from the public on options in Area 4 are relatively evenly split across the options. Overall, Option 4B scored higher than the others. Option 4A and 4C were closely rated. However at two of the five drop in sessions, Option 4C was the preferred option, these were the southernmost drop-in sessions but over Option 4C was also the least preferred option.

Other interested local organisations and businesses

Other organisations consulted as part of this process didn't have any significant comments. However the Freshwater Habitats Trust noted that they generally preferred Option 4C as this avoided impacts on the Kennington Pond to the south of the A423 bypass.

Impact of the farming and agricultural businesses, including the riding stables in North Hinksey is covered in the previous sections, no other businesses will be directly affected by the works.

Evaluating potential policy/legislative conflict and planning outcomes at Area 4

Links to River Basin Management Plan

None of the options in this area are in conflict with the overall aims and objectives of the River Basin Management Plan. All options maintain and maximise the use of the existing flood plain. Option 4A will potentially have the biggest change to the existing floodplain as the smaller channel will need to be heavily engineered and artificially increase velocities in this area. There are opportunities to improve the status of some of the existing watercourses in the area.

Impacts on Navigation in the Oxford Area

None of the options in this area will have impacts on river based navigational operations in the Oxford area. Options for creating an easily navigable new watercourse in this area is also severely limited. The proposed works to Hinksey Stream will help to improve the possibility of navigation for small craft and kayaks in this area for all options.

Links to Existing Planning Policy

There are a number of Oxford City Planning Policies which could affect the scheme. These include Policy CS11 – Flooding and Policy NE11 – Land Drainage and River Engineering Works. The proposed works are in line with these policies, although Options 4B and 4C would create a more natural appearing river channel.

Planning Policy CS4 – Green Belt will require all of the options to justify the need for the scheme to achieve planning consent. Parts of the works on the Hinksey Stream are close to the protected transit route for guided buses or local rail set out in Policy TR8, however all options would have similar impacts. All options will help to improve pedestrian and cycle routes under Policy TR5.

Evaluating opportunities for partnering/funding at Area 4

Stakeholder requirements and objectives

Option 4A utilises an engineered channel and limits the range of environmental habitats which could benefit the area. All options provide equal opportunities for meeting other key requirements and objectives.

Opportunities for development, both public and private

The proposed works in this area optimise the use of the existing floodplain and do not reduce flood risk in areas which could be suitable for development under current planning policy. The areas of

South Hinksey which are protected by the raised embankment are already developed with no opportunities for additional future development within the village.

Opportunities for public and private sector funding

As noted above, all options have similar flood risk benefits in the area. There are no direct beneficiaries in this area other than the residents of South Hinksey.

Whilst there is significant service infrastructure in this area, the operators have indicated their plant is already sufficiently resilient with respect to flood risk. Therefore the opportunities for additional funding in this area are limited.

Scoring on Institutional objectives at Area 4

Refer to Appendix C.4 of the main report for the scoring of all Sub-Objectives at Area 4.

Evaluation of Institutional objectives at Areas 5&6

Provides Benefits and Minimises Impact on Interested Parties at Areas 5&6

Residents / Landowners / Tenants

There are no residents in this area who would be directly affected by the proposed options in Areas 5&6.

The landowner for the fields affected by the proposed works has major reservations regarding the impacts on the land use of the meadows from all of the options. There are also significant concerns over the impact on the setting and condition of the meadow if any of the options are taken forward. Public access for walking activities will be reduced by Option 5B&6B. The landowner also expressed concern over Option 5A&6A due to the change in setting and profile for the Thames Path.

The tenant farmer for the fields has indicated concerns over the impacts of all options, lowering the second stage on the grazing areas would create wetter for longer periods of the year and would reduce the viability of grazing. Option 5B&6B will sever the fields and create difficulties with crossings for both animals and vehicles. It was noted that if this option was taken forward this could be reduced by following the course of an existing ditch closer to the railway than the route indicated on the current option plans.

Local Authorities

Limited specific comments were received for Areas 5&6 from Local Authorities which are not covered elsewhere in the environmental and landscape aspects of this assessment. Generally Options 5B&6B and 6C were preferred to minimise impact on the River Thames and on the setting of Sandford Lane.

Public

Feedback from the public on for these areas indicated that overall Option 5B&6B was preferred. Option 5A&6A was the second choice and Option 6C was least preferred. However the feedback from the Kennington drop-in meeting, which is closest to the works, indicated that whilst Option 5A&6A was the first choice option, Option 6C was preferred over Option 5B&6B. For consistency the overall public ratings have been used for the purposes of this appraisal.

Other interested local organisations and businesses

Other organisations consulted as part of this process didn't have any significant comments other than potential environmental impacts which are covered in other parts of this assessment process.

Evaluating potential policy conflict and planning outcomes at Areas 5&6

Links to River Basin Management Plan

None of the options in this area are in direct conflict with the overall aims and objectives of the River Basin Management Plan. All options maintain and maximise the use of the existing flood plain. Option 5A&6A will impact on the setting of the River Thames through this reach and also on the Thames Path.

Impacts on Navigation in the Oxford Area

Option 5A&6A would potentially impact on navigation along this reach by creating a shelf as part of the second stage along the main river. This could create a hazard to navigation at certain flows and levels. Other options will not impact on navigation activities.

Links to Existing Planning Policy

There are a number of Planning Policies which could affect the scheme in this location, however the proposed works are in line with flood risk planning guidance.

All options will potentially be in conflict with the Green Belt planning policy in force in the area. The impacts on the Thames Path by Option 5A&6A may be also be contrary to guidance on helping to improve pedestrian and cycle routes.

Evaluating opportunities for partnering/funding at Areas 5&6

Stakeholder requirements and objectives

All options have an impact of on the MG4 status grassland in this area. Option 5A&6A impacts on the Thames Path, however the other options also restrict public access in and east–west direction and additional footbridges would be required at strategic locations in the area to maintain these routes.

Opportunities for development, both public and private

The proposed works in this area optimise the use of the existing floodplain and do not reduce flood risk to any areas locally. Other forms of development in the area covered by this scheme would be contrary to planning guidance.

Opportunities for public and private sector funding

As noted all options have similar flood risk benefits in the area. There are no direct beneficiaries in this area.

National Grid and SSSE have significant service infrastructure in this area but they have indicated their plant is already sufficiently resilient with respect to flood risk. Therefore, the opportunities for additional funding from direct beneficiaries in this area are very limited.

Access to the site from Kennington Road via Sandford Lane is restrictive and there may be an opportunity to work with the industrial estate owner in the area to facilitate an upgrade to this road, however this applies to all options and is not a differentiator between the options.

Scoring on Institutional objectives at Areas 5&6

Refer to Appendix C.5&6 of the main report for the scoring of all Sub-Objectives at Areas 5&6.

Evaluation of Institutional objectives at Area 7

Provides Benefits and Minimises Impact on Interested Parties at Area 7

Residents / Landowners / Tenants

There are twenty five residential house boats which would be directly impacted by the works proposed in Option 7A. These residences would be impacted both during the construction phase as they would need to be temporarily relocated. In the permanent situation, it is possible one of the residential moorings would be lost and the setting of the mooring area would be impacted. All residents affected by the works proposed under Option 7A and the landowner for this area have indicated their objection to this option.

Options 7B and 7C have minimal impacts on local residents.

The landowner on the right bank of the Weirs Mill Stream downstream of the residential area will also be impacted by Option 7A and has voiced objections to the scheme. Other landowners in the area are concerned about the impacts of Options 7B and 7C on the Site of Special Scientific Interest between Weirs Mill Stream and the River Thames.

Local Authorities

Limited specific comments were received for Area 7 from Local Authorities. The specific comments received are covered elsewhere in this appraisal so all options have been score neutrally in this section to avoid double counting.

Public

Feedback from the public on Options in Area 7 tend to match the views of the local residents with Option 7C being rated as the most favoured. Option 7B was the next favoured, and Option 7A the least favoured. However Option 7A was the preferred option at only two of the five drop-in sessions. Other two drop-in sessions identified Option 7C being the preferred option. The overall least preferred option was 7A.

Other interested local organisations and businesses

Other organisations consulted as part of this process indicated that Option 7B is likely to be the least favoured options. This is mainly due to the fact most of the other interested organisations tend to be orientated toward environmental considerations.

There are no businesses that will be directly affected by the works.

Evaluating potential policy/legislative conflict and planning outcomes at Area 7

Links to River Basin Management Plan

Some options in this area will have some element of conflict with the overall aims and objectives of the River Basin Management Plan. These are related to potential impacts on designated sites for Options 7B and 7C. These options will need careful design and monitoring if they are chosen for implementation.

Impacts on Navigation in the Oxford Area

None of the options in this area will have direct impacts on river based navigational operations in the Oxford area. However, Option 7C could help to create a circular navigation route for small craft and kayaks by connecting Weirs Mill Stream to the River Thames although a portage may be required at the confluence with the Thames.

Links to Existing Planning Policy

Oxford City Council Planning Policy CS11 – Flooding and Policy NE11 – Land Drainage and River Engineering Works apply to these options. The proposed works are in line with these policies in terms of reducing flood risk.

Planning Policy CS4 – Green Belt will require all of the options to justify the need for the scheme to achieve planning consent. Policy CS12 - Biodiversity applies to Options 7B and 7C which could contradict the aims of this policy due to some impacts on the designated meadows in this area.

Evaluating opportunities for partnering/funding at Area 7

Stakeholder requirements and objectives

Option 7A impacts on residential boat moorings which are in short supply in the Oxford area. All options are designed to provide a level of enhanced flood risk protection to Abingdon Road to ensure it is kept open longer during flood events.

Opportunities for development, both public and private

The proposed works in this area for Options 7A and 7C are designed to lower water levels in residential areas, this will have the benefit of helping to reduce flood risk to any vacant sites within these residential areas which could create local small scale development opportunities. Option 7B does not lower water levels in the area but provides raised protection, this will have a more limited wider benefit outside of the directly protected areas.

Opportunities for public and private sector funding

There is limited opportunity of seeking significant funding from direct beneficiaries in this area although some local businesses along Abingdon Road may contribute.

Option 7C may attract some funding if recreational benefits associated with kayaking or rowing can be demonstrated.

Scoring on Institutional objectives at Area 7

Refer to Appendix C.7 of the main report for the scoring of all Sub-Objectives at Area 7.

Appendix C - Score Matrices for First-Phase Appraisal

C.1 *First-Phase Scoring Matrix for Area 1 (placeholder)*

C.2 *First-Phase Scoring Matrix for Area 2*

C.3 *First-Phase Scoring Matrix for Area 3*

C.4 *First-Phase Scoring Matrix for Area 4*

C.5&6 *First-Phase Scoring Matrix for Areas 5&6*

C.7 *First-Phase Scoring Matrix for Area 7*

Appendix D - Preliminary Service Clash Review at First-Phase

Introduction

The data used to produce this analysis is based on a preliminary C2 asset search conducted by Zetica Limited in July 2015. C2 returns from asset owners are known to have a low level of accuracy. In order to increase confidence, and reduce the possibility of unknown clashes occurring during the construction phase, more detailed survey would be recommended. This would include a full GPR survey of the site, with trial pits to validate the GPR survey. Further trial pits would be recommended in areas with a high density of services.

As part of the Oxford Flood Alleviation Scheme many options have been proposed. In order to further this to outline design stage, a services analysis has been conducted to identify those areas where a clash occurs between existing services and the proposed design. The extent of this project is fairly large and so has been split into numerous areas for ease of understanding.

For each proposed option to obtain a service clash a 5 metre 'buffer' was formed around the perimeter of the option and every intersection within the buffered area was noted.

Summary of preliminary service review at Area 2

For this area, there are four proposed options; 2A, 2B, 2C and 2D. The service clashes in this area consisted of National Grid – Electricity and High Voltage Electricity, with one surface water sewer clash with Options 2C and 2D. The total number of clashes for each option were as follows:

- Option 2A – 10 clashes
- Option 2B – 10 clashes
- Option 2C – 7 clashes
- Option 2D – 9 clashes

Many of the encounters were running parallel with the edge of the option boundary, with few running through the field area.

Summary of preliminary service review at Area 3

This area also has four proposed solutions: 3A, 3B, 3C and 3D. The service clashes in this area consisted of High Voltage Electricity, with a few National Grid – Electricity and one gas and surface water pipe (intersecting through all options). The total number of clashes were as follows:

- Option 3A – 11 clashes
- Option 3B – 11 clashes
- Option 3C – 10 clashes
- Option 3D – 10 clashes

This area had many services running through the field and all recorded clashes tend to go through all proposed options.

Summary of preliminary service review at Area 4

This area has three proposed solutions: 4A, 4B and 4C. This area encounters numerous existing services and is located nearby a railway line and a few pylons. Towards the Northern end of this site, there are a few clashes with services which are all High Voltage cables or National Grid – Electricity. Towards the centre and Southern side of the site there are multiple other services running including: clean water pipes, gas pipes, communication lines and water sewers.

There is a high density of services at both proposed crossings at Old Abingdon Road. A number of trial pits investigations will likely be required at these locations.

The total number of clashes were as follows:

- Option 4A – 25 Clashes
- Option 4B – 23 Clashes
- Option 4C – 28 Clashes

Summary of preliminary service review at Areas 5&6

These areas have been combined and three options have been proposed: 5A&6A, 5B&6B and 6C. The clashes in this area mainly consisted of the National grid electricity, with a few HV Electricity lines. The total number of clashes per option was as follows:

- Option 5/6A – 7 Clashes
- Option 5/6B – 11 Clashes
- Option 6C – 13 Clashes

This area had services running in multiple directions running both parallel and across the site.

Summary of preliminary service review at Area 7

This area also has four proposed solutions: 7A, 7B and 7C. The clashes in this area were from a variety of services, including High and Low voltage electricity, National Grid electricity, water pipes, gas pipes, communication lines and others. The total number of clashes per option were as follows:

- Option 7A – 14 Clashes
- Option 7B – 10 Clashes
- Option 7C – 6 Clashes

Appendix E - Proposed New Hinksey Defence

This document is entitled 'IMSE500177-HGL-02-04-RE-C-000112-Proposed_New_Hinksey_Defence'

Appendix F - Sketches for the Proposed Channels Modifications at the A423 Railway Bridge

Appendix G - Score Matrix for Second-Phase Appraisal