

Appendix C Strategic level HRA Stage 1 and Stage 2 reports

Appendix C1 Strategic level HRA Stage 1 report

Stage 1 Habitats Regulations Assessment

Environment Agency record of screening for likely significant effects

This is a record of the screening for likely significant effects required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended), undertaken by the Environment Agency in respect of the Sowy/King's Sedgemoor Drain Enhanced Capacity Project

Revision	Date	Description	Author	Checked	Reviewed	Approved
P01.1	20/09/19	Review draft	J Halls	M Olivier	L Rudd	I Ball
3	16/10/19	Minor update following review by W Maclennan	J Halls	M Olivier	L Rudd	I Ball

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1. Permission, plan or project (PPP) details

Type of PPP:	Flood Risk Management Scheme (phased delivery)
Environment Agency reference no:	ENVRESW001353
National grid reference:	ST40932760 (Monksleaze Clyce) to ST35173774 (Parchey Bridge)
Site/project name or reference:	Sowy/King's Sedgemoor Drain (KSD) Enhanced Capacity Project

2. Description of proposal

Introduction

This Stage 1 Habitats Regulations Assessment (HRA) is for a scheme to improve the options available for flood risk management in part of the Somerset Levels. The proposals form part of the 20-year *Somerset Levels and Moors Flood Action Plan* which was published by the Somerset Rivers Authority (SRA) in spring 2014 in response to the extreme and prolonged flooding that the area suffered the previous winter. The primary objective of the scheme is to reduce the risk, depth and duration of such flood events that threaten property and infrastructure. This will be achieved through increasing the capacity of the Sowy River (Sowy) and parts of the King's Sedgemoor Drain (KSD), which operate as a flood relief channel for the River Parrett and its tributaries. The proposals follow-on from a scheme to increase channel capacity of a short length of the Sowy and Langacre Rhyne under the A372 Beer Wall, which was completed in 2016 (EA reference SW0057).

A HRA is required because the scheme is:

- likely to have a significant effect on one or more European sites (either alone or in combination with other plans or projects), and
- is not directly connected with or necessary to the management of the site for its European nature conservation interest.

Although not part of the European site network (sites designated to fulfil obligations under the Habitats Directive and Birds Directive), it is Government policy that Ramsar sites (wetlands of international importance) are also included in an HRA.

Due to the scale of the scheme it will be necessary to undertake the works in several phases. This HRA considers the overall 'Strategic' long-term aim of delivering an increased flow capacity within the flood relief channel of up to 24m³/s. Therefore, here we refer to this document as the 'Strategic' HRA.

Separate project level HRAs will be produced at the time that detailed designs are being developed and once there is confirmation of funding and known timescales.

This 'Strategic' HRA will focus on screening the potential operational effects of the scheme and the mitigation measures required to ensure that the overall scheme objectives are compliant with the Habitats Regulations 2017. Separate project-level HRAs will be produced for each phase of scheme and consider the construction and operational impacts related to the relevant phase of the scheme. It is not envisaged that the flood relief channel and associated water level management structures would be totally decommissioned so this stage has not been assessed. Any proposed decommissioning, future modifications or change in operating procedures would be subject to a separate assessment at the time.

Location

The scheme is located within the Somerset Levels, to the south-east of Bridgwater, along the whole length of the Sowy corridor and part of the KSD corridor (Figure 1, Appendix A). These artificial watercourses act as flood relief channels when the River Parrett overtops and/or when water is deliberately re-routed via an inlet control structure at Monksleaze Clyce. The working

corridor will run from Monksleaze Clyce, along the Sowy through to the KSD and as far downstream as Parchey Bridge. The KSD continues from here for a further 5.5 km before reaching the gravity outfall sluice into the River Parrett at Dunball, downstream of Bridgwater.

Part of the working corridor passes either through or close to several component Sites of Special Scientific Interest (SSSIs) that make up the Somerset Levels and Moors SPA and Ramsar sites (Figure 1).

Scheme description

Design

In order to achieve the enhanced capacity targets there is a need to increase the height of existing informal flood banks located along the left and right banks of the Soway and KSD between Parchey Bridge and Monksleaze Clyce, which will mostly be achieved through the infilling of low spots rather than wholesale raising. It is anticipated that the material to raise the embankments will be obtained from reprofiling the existing spoil heaps and informal flood embankments and widening the adjoining lengths of watercourse (which will also increase capacity).

Programme

There will be a phased approach to the delivery of the scheme, depending on the availability of funding. It is currently not known how many phases will be needed or what the final completion date will be.

Operation and maintenance

The increase in channel capacity will give EA operating staff more flexibility and control when managing anticipated and actual flood events. When the River Parrett is at capacity it is not possible to operate the various pumping stations that are crucial to evacuating excess floodwater at times of extreme major flood events (i.e. of threat to people, property and infrastructure). The opportunity to divert additional flow down the Soway will not prevent the Parrett from flooding the moors, but it will mean that the duration and depth of any flooding can be reduced. The two engineered spillways on the right-hand bank of the R. Parrett (Aller Moor and Beasley's) will continue to operate during flood events (when the river reaches 7.9 m AOD and 7.5 m AOD) in tandem with the opening / closing of Monksleaze Clyce i.e. a maximum agreed volume of water entering the Soway can be achieved by incrementally opening or closing the clyce.

Maintenance activities will be required in the form of weed cutting and clearance from the channel and topping up of the embankments if there is excessive settlement. The banks will also be cut annually (where not grazed) to prevent establishment of rank grass, scrub and trees. Periodic condition surveys will be undertaken, especially after any overtopping events that could damage the embankments or control structures.

Mitigation measures

During the initial development of the full Soway/KSD Enhanced Capacity Project in 2015-2016, concern was raised about the potential impacts on designated sites, including:

- a reduction in the frequency and duration of small-scale flood events through King's Sedgemoor, which provide valuable feeding and roosting conditions for many of the non-breeding bird features;
- the increased capacity and ability to divert water along the Soway in advance of a flood event could mean that some of the moors along the River Parrett would no longer flood; and
- for larger events where land along the River Parrett was flooded then the ability to reduce river levels quicker, through sending more water down the Soway, would mean that the pumps could operate earlier and thereby remove standing flood water.

To address these concerns and potential impacts it was agreed to investigate the likely changes in extent and duration of flooding during 'typical' events compared to what currently happens. It was concluded that there would be a reduction in extent and frequency of shallow flooding, so mitigation measures would be required. Proposals have now been made to undertake improvements to a range of water control structures in the area, which will help with retention and management of areas of shallow flood throughout the appropriate seasons.

Operational procedures have also been devised to confirm under what circumstances the flood relief channel is used and how Monksleaze Clyce operates. It provides details of the current procedure based on an assumed channel capacity of 17m³/s plus the small revisions that will be

required following the proposed incremental increase to 24m³/s. It takes account of the influence and relationship of all pumping stations and spillways in the Parrett valley.

Incorporated mitigation

Following the judgement of *People over Wind, Peter Sweetman v Coillte Teoranta* and the subsequent publication of an advice note by the Planning Inspectorate (PINS 05/2018), mitigation measures required specifically to avoid or reduce potential harmful effects on European site features can no longer be considered during the Stage 1 assessment of likely significant effect. Consequently, the mitigation measures described above cannot be used, but have been included to demonstrate that they form an integral part of the scheme when it comes to the Stage 2 Appropriate Assessment.

It should be noted that where 'standard' measures for protecting the environment are included as a matter of good practice and/or because of other statutory, legal or health and safety requirements then these can be treated as essential features or characteristics of a plan or project and therefore can be considered at Stage 1. This is because they have been included irrespective of whether a European site might be affected i.e. although they may incidentally provide some benefit to a European site, their inclusion and purpose is not to avoid or reduce harmful effects on the site (Tyldesley and Chapman, 2013). For this scheme the incorporation of pollution prevention and biosecurity measures during construction and maintenance activities are standard good practice.

3. Figure showing project location and European sites

See Appendix A.

4. European sites requiring assessment

Initial screening

The following sites were considered during initial screening due to the potential risk of direct and/or indirect effects as a consequence of scheme construction, operation or maintenance activities:

Somerset Levels and Moors Special Protection Area (SPA) - **screened in** due to potential direct and indirect effects. Construction will partly be within the King's Sedgemoor and Southlake Moor component SSSIs as well as non-designated land that may represent supporting, functional habitat.

Somerset Levels and Moors Ramsar site - **screened in** due to potential direct and indirect effects. Construction will partly be within the King's Sedgemoor and Southlake Moor component SSSIs as well as non-designated land, which represents supporting, functional habitat.

Severn Estuary Special Area of Conservation (SAC) - **screened out** due to: no pathways or mechanisms for direct impacts on SAC habitats during construction or maintenance; migratory fish features do not use the KSD or Sowey; and no clear pathways for indirect impacts on features (no significant changes in quantity or quality of water discharging at Dunball into the lower R. Parrett and Bridgwater Bay).

Severn Estuary SPA - **screened in** due to potential effects on non-breeding bird features that utilise both the estuary and the Somerset Levels and Moors depending on prevailing weather, tidal and other conditions. This is a very large site, extending to 24,700 ha along both the English and Welsh sides of the estuary. For this HRA it is assumed that the likely interchange of birds will be with the Bridgwater Bay SSSI component.

Severn Estuary Ramsar site - **screened in** due to the potential effects on non-breeding birds that utilise both the estuary and the Somerset Levels and Moors and eels, which migrate through the KSD and beyond via Dunball. Features where there is considered to be no risk of any likely significant effect whatsoever are the other listed migratory fish species as (unlike eels) they do not pass through Dunball (Andy Baines, EA Technical Specialist, Fisheries, Biodiversity &

Geomorphology pers. comm.); extreme tidal range; presence of four Habitats Directive Annex 1 habitats (see SAC above) and unusual estuarine communities. There are no pathways for either direct or indirect impacts on these features including no significant changes in quantity or quality of water discharging at Dunball into the lower R. Parrett and Bridgwater Bay.

European site name	Qualifying features likely to be sensitive to the scheme (EA habitat/species group code)
Somerset Levels and Moors SPA	Bewick's Swan <i>Cygnus columbianus bewickii</i> (3.4, 3.6, 3.7)
	Golden Plover <i>Pluvialis apricaria</i> (3.4, 3.7)
	Lapwing <i>Vanellus vanellus</i> (3.4)
	Teal <i>Anas crecca</i> (3.4, 3.6)
	Waterbird assemblage (3.4, 3.6, 3.7)
Somerset Levels and Moors Ramsar	Bewick's Swan (3.4, 3.6, 3.7)
	Lapwing (3.4)
	Teal (3.4, 3.6)
	Waterbird assemblage (3.4, 3.6, 3.7)
	17 Red Data Book invertebrate species
Severn Estuary SPA	Bewick's Swan (3.4, 3.6, 3.7)
	Dunlin <i>Calidris alpina alpina</i> (3.4)
	Redshank <i>Tringa totanus</i> (3.4, 3.7)
	Gadwall <i>Anas strepera</i> (3.6)
	Shelduck <i>Tadorna tadorna</i> (3.6)
	Greater White-fronted Goose <i>Anser albifrons albifrons</i>
	Waterbird assemblage (3.4, 3.6, 3.7)
Severn Estuary Ramsar	Bewick's Swan (3.4, 3.6, 3.7)
	Dunlin (3.4)
	Redshank (3.4, 3.7)
	Gadwall (3.6)
	Shelduck (3.6)
	Greater White-fronted Goose (3.4, 3.6)
	Waterbird assemblage (3.4, 3.6, 3.7)
	European eel <i>Anguilla anguilla</i>

The habitat group numbers relate to groups of birds, which, because of the type of habitat that supports them, have similar sensitivities to Environment Agency permissions, plan or projects.

The habitat groups are:

- 3.1 Birds of uplands
- 3.2 Birds of woodland and scrub
- 3.3 Birds of lowland heaths and brecks
- 3.4 Birds of lowland wet grasslands**
- 3.5 Birds of lowland dry grassland
- 3.6 Birds of lowland freshwaters and their margins**
- 3.7 Birds of farmland (for this scheme any cropped areas)**
- 3.8 Birds of coastal habitats
- 3.9 Birds of estuarine habitats
- 3.10 Birds of open sea and offshore rocks

Those highlighted habitat groups are relevant to the habitats that have the potential to be directly or indirectly impacted by the scheme.

5. Conservation objectives¹

The assessment of likely significant effects will consider the implications of the proposal in view of the site's conservation objectives.

Generic conservation objectives for SACs

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:

For qualifying habitats

- The extent and distribution of qualifying habitats
- The structure and function (including typical species) of qualifying habitats, and
- The supporting processes on which qualifying habitats rely.

For qualifying species

- The extent and distribution of habitats of qualifying species
- The structure and function of habitats of qualifying species
- The supporting processes on which habitats of qualifying species rely
- The populations of qualifying species, and
- The distribution of qualifying species within the site.

In addition, Natural England has recently published supplementary advice on the Conservation Objectives for the Somerset Levels and Moors SPA (Natural England, 2019). The Severn Estuary SPA is part of a European Marine Site (EMS) so has a published Regulation 35 conservation advice package from 2009 (Natural England 2009). These provide site-specific attributes and associated targets for each of the qualifying features, which are primarily used for condition monitoring in relation to maintenance or restoration, but which are also relevant when undertaking a HRA.

6. Risks relevant to the type of PPP being assessed

The risks relevant to the scheme and assessed within this HRA screening are:

- Change in flow or velocity regime
- Changed water chemistry
- Changes in physical regime
- Changes in surface water flooding
- Competition from non-native species
- Disturbance
- Habitat loss
- Habitat/community simplification
- Physical damage
- Turbidity

Where one or more of these risks could directly or indirectly have any effect on a qualifying feature then they have been considered in the screening table below. The table does not include construction impacts and risks as they will be covered by the individual project HRAs. Construction risks are considered to be low and can be avoided or reduced through standard mitigation measures.

¹ Generic conservation objectives are based on 'Natural England (2014) Conservation Objectives for European Sites in England Strategic Standard 01/02/2014 V1.0'

7. HRA Stage 1 screening table

At the screening stage, given the narrow range of habitats involved and the inability to consider scheme specific mitigation, all the bird features have been grouped together.

EA habitat/species group	Risk	Likely significant effect alone?	?	Likely significant effect in combination?	?
Somerset Levels and Moors SPA and Ramsar					
Severn Estuary SPA and Ramsar					
3.4 Birds of lowland wet grasslands 3.6 Birds of lowland freshwaters and their margins 3.7 Birds of farmland (for this scheme any cropped areas or grassland areas which do not function as wet grassland at any time of year)	Change in flow or velocity regime	This risk will only be relevant when the increased capacity allows more water to be directed down the relief channel and when there is overtopping of the R. Parrett spillways. Changes in velocity will not be significant but out of bank flow and associated volume changes will alter the extent and duration of shallow flooding used by birds. Likely significant effect.	Yes	As there is a likely effect alone there is no need to consider the risk of in combination effects at Stage 1. These will be considered as part of the Stage 2 assessment if relevant.	N/A
	Changed water chemistry	Increasing the capacity of the flood relief channel and changes in operational procedures could have an effect on water chemistry and quality within habitats used by bird features. The scale, duration and impact of any changes are uncertain without undertaking a thorough assessment. Risk of likely significant effect due to changes in operational procedures is uncertain. Weed cutting, desilting and other maintenance activities could also have an effect on water	?	As there is uncertainty over a likely effect alone, this risk will be carried forward to the Stage 2 assessment and any in combination effects considered there.	N/A

EA habitat/species group	Risk	Likely significant effect alone?	?	Likely significant effect in combination?	?
		<p>chemistry and quality. However, standard pollution prevention measures (including timing of activities and emergency response procedures) will be incorporated into the method statements to minimise the risk of this occurring and reducing any effect to a temporary and negligible one.</p> <p>No risk of likely significant effect due to maintenance activities.</p>			
	Changes in physical regime	<p>Changing flow patterns due to the increased channel capacity and different cross-sectional profiles have the potential to alter erosion and sedimentation patterns within the flood relief channels (which are used by some of the bird features). Additionally, during uncontrolled flooding there is potential for erosion on the spillways and other land over which flood water runs until it reaches the moors. These changes could affect habitats used by SPA species.</p> <p>Weed cutting and de-silting could result in short-term, temporary impacts within the channel. The significance of these impacts is uncertain without undertaking a thorough assessment.</p> <p>The scale and duration of any changes in physical regime is unknown, so there is</p>	?	As there is uncertainty over a likely effect alone, this risk will be carried forward to the Stage 2 assessment and any in combination effects considered there.	N/A

EA habitat/species group	Risk	Likely significant effect alone?	?	Likely significant effect in combination?	?
		uncertainty as to whether or not there would be a likely significant effect.			
	Changes in surface water flooding	<p>The scheme's principal aim is to provide additional capacity within the Sowy-KSD so that at times of anticipated and actual flood events a greater volume of water can be diverted out of the River Parrett and into the relief channel, up to the height of the embankments. There will be no change during normal or low flow condition.</p> <p>There is the potential for the frequency of out-of-bank flows to be reduced and also affect the extent, depth and duration of flooding.</p> <p>There will be a reduction in the volume of uncontrolled flooding onto the moors when Aller and/or Beasley's spillways from the R. Parrett run and the capacity of the Sowy and Langacre are exceeded. This is likely to be noticeable for shorter duration events where they currently run for less than 24 hours. This has implications for the King's Sedgemoor SSSI component of the SPA as well as non-designated land in the floodplain that represents functional habitat. Furthermore, the potential for changes in associated water levels in the River Parrett requires investigation in</p>	Yes	As there is a likely effect alone there is no need to consider the risk of in combination effects at Stage 1.	N/A

EA habitat/species group	Risk	Likely significant effect alone?	?	Likely significant effect in combination?	?
		relation to spillways that impact other component SSSIs. Likely significant effect alone.			
	Competition from non-native species	<p>There will be no increased risk of the spread or introduction of non-native species, which could impact bird habitats, as a result of the increased capacity and revised operating procedures.</p> <p>There is a risk of the spread or introduction of non-native species during maintenance activities. However, this will be managed through the use of biosecurity best practice measures for working in and close to watercourses. The approach will be based on 'Check, Clean, Dry'. If there were to be an accidental introduction then it is likely that non-native species would be confined to the flood relief channel and measures could be taken to control and eradicate. There would be no threat to the overall site conservation objectives.</p> <p>No likely significant effect alone.</p>	No	<p>Not applicable to the increased capacity and operating procedures as there are no predicted effects, so no prospect of in-combination effects.</p> <p>Even with the use of biosecurity measures there is a small risk that non-native species could be inadvertently introduced during maintenance. However, this would be at a localised, small-scale and competition from non-native species is not identified as a current threat to the site (Natural England, 2015). Consequently, there is no risk of in-combination effects that could compromise the conservation objectives.</p>	<p>N/A</p> <p>No</p>
	Disturbance	There is a risk of disturbance to bird features during maintenance activities. The actual impact would depend on the nature of the activity, specific location, time of year and	No	No prospect of any significant in-combination effects as the effects of the works alone would be inconsequential.	

Appendix C2 Strategic level HRA Stage 2 report

Stage 2 Habitats Regulations Assessment



Environment Agency record of appropriate assessment

This is a record of the appropriate assessment required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (SI 2017/1012 – as amended), undertaken by the Environment Agency in respect of the plan detailed below.

Revision	Date	Description	Author	Checked	Reviewed	Approved
P01.1	05/02/20	Review draft	J Halls	M Olivier	L Rudd	I Ball
P01.2	12/03/20	Minor revision following review	J Halls	M Olivier	M Olivier	I Ball
P01.3	05/08/20	Revision to reflect updated mitigation proposals	A Davies	I Pearson	I. Pearson	I Ball

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Permission, plan or project (PPP) details

This is a record of the Appropriate Assessment required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended), undertaken by the Environment Agency in respect of the River Sowy and King's Sedgemoor Drain Enhancements Scheme. Due to the scale of the scheme it will be necessary to undertake the works in several phases. However, this **strategic level Stage 2 HRA** considers the full River Sowy and King's Sedgemoor Drain Enhancements Scheme.

Type of PPP:	Flood Risk Management Scheme (phased delivery)
Environment Agency reference no:	ENVRESW001353
National grid reference:	ST40932760 (Monk's Leaze Clyce) to ST35173774 (Parchey Bridge)
Site reference:	River Sowy and King's Sedgemoor Drain Enhancements Scheme

Description of proposal

Introduction

This Stage 2 Habitats Regulations Assessment (HRA) is for a Scheme to improve the options available for flood risk management in part of the Somerset Levels. The proposals form part of the 20-year *Somerset Levels and Moors Flood Action Plan*¹ (referred to as the 'Flood Action Plan') which was published by the Somerset Rivers Authority (SRA) in spring 2014 in response to the extreme and prolonged flooding that the area suffered the previous winter. The primary objective of the Scheme is to reduce the risk, depth and duration of such flood events that threaten property and infrastructure. This will be achieved through increasing the capacity of the Sowy River (Sowy) and parts of the King's Sedgemoor Drain (KSD), which operate as a flood relief channel for the River Parrett and its tributaries. The proposals follow-on from a Scheme to increase channel capacity of a short length of the Sowy and Langacre Rhyne under the A372 Beer Wall, which was completed in 2016.

An HRA is required because the Scheme is:

- is not directly connected with or necessary to the management of the site for its European nature conservation interest, and
- likely to have a significant effect on one or more European sites (either alone or in combination with other plans or projects).

Due to the scale of the Scheme it will be necessary to undertake the works over several phases. This document represents the Stage 2 appropriate assessment of the overall 'Strategic' long-term aim of delivering an increased flow capacity within the flood relief channel of up to 27m³/s (KSD) and 24m³/s (Sowy). The 'Strategic' HRA will focus on examining the potential operational effects and what mitigation measures will be required to ensure that the overall Scheme objectives are compliant with the Habitats Regulations.

Project level HRAs for each individual stage of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme will be produced at the time that detailed designs are being developed and once there is confirmation of funding and known timescales. Phase 1 is being developed concurrently with this Strategic assessment. These Project level HRAs will focus on the construction impacts relevant to the particular proposals for each phase of the full Scheme.

Subject to the outcome of the project-level HRAs concluding either no likely significant effect or no adverse effect on site integrity, the projects will be undertaken under the Environment

¹ <https://www.somersetiversauthority.org.uk/flood-risk-work/somerset-20-year-flood-action-plan/>

Agency's permitted development powers. However, each Scheme will still be subject to an appraisal of all environmental effects under the Environmental Impact Assessment (Land Drainage Improvement Works) (Amendment) Regulations 2017. The Environment Agency is therefore both proponent (with the SRA) and determining authority for the Scheme. It is also, therefore, a competent authority with respect to the Habitats Regulations. However, because the Schemes are being progressed through permitted development, prior approval must also be sought from the local planning authority where any likely significant effects have been identified (Regulations 75-78).

Location

The Scheme is located within the Somerset Levels, to the south-east of Bridgwater, along the whole length of the Sowy corridor and part of the KSD corridor (Figure 1, Appendix 1). These artificial watercourses act as flood relief channels at times when the River Parrett overtops and/or when water is deliberately re-routed via an inlet control structure at Monk's Leaze Clyce. The working corridor will run from Monk's Leaze Clyce, along the Sowy through to the KSD and as far downstream as Parchey Bridge. The KSD continues from here for a further 5.5 km before reaching the gravity outfall sluice into the River Parrett at Dunball, downstream of Bridgwater.

Part of the working corridor passes either through or close to several component SSSIs of the Somerset Levels and Moors SPA and Ramsar sites (Figure 1, Appendix 1).

Scheme description

Design

In order to achieve the enhanced capacity targets there is a need to increase the height of the existing informal flood embankments. It is anticipated that a proportion of the material required would be obtained from widening adjoining lengths of watercourse and/or providing channel features such as embayments, two-stage channels and backwaters, which will also increase channel capacity. The detailed design will propose environmental enhancements such as two-stage channels and embayments, which have been located as to minimise impacts on habitats and reduce the risk of encountering buried archaeological features.

Programme

There will be a phased approach to the delivery of the Scheme, depending on the availability of funding. It is currently not known how many phases will be needed or what the final completion date will be. However, construction of Phase 1 of the River Sowy and King's Sedgemoor Drain Enhancements Scheme is planned to start in 2020 and be completed by March 2021, subject to the receipt of the necessary consents.

Operation and maintenance

The increase in channel capacity will give EA operating staff more flexibility and control when managing anticipated and actual flood events. When the River Parrett is at capacity it is not possible to operate the various pumping stations that are crucial to evacuating excess floodwater at times of extreme major flood events (i.e. of threat to people, property and infrastructure). The opportunity to divert additional flow down the Sowy won't prevent the Parrett from flooding the moors, but it will mean that the duration and depth of any flooding can be reduced. The two engineered spillways on the right-hand bank of the River Parrett (Aller Moor and Beazley's spillways) will continue to operate during flood events (when the river reaches 7.9 m AOD and 7.5 m AOD) in tandem with the opening / closing of Monk's Leaze Clyce i.e. a maximum agreed volume of water entering the Sowy can be achieved by incrementally opening or closing the clyce.

Maintenance activities will be required in the form of weed cutting and clearance from the channel and topping up of the embankments if there is excessive settlement. The banks will also be cut annually (where not grazed) to prevent establishment of rank grass, scrub and trees. Periodic condition surveys will be undertaken, especially after any overtopping events that could damage the embankments or control structures.

Water level impacts and incorporated mitigation measures

During the initial development of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme in 2015-2016, concern was raised about the potential impacts on designated sites, including:

- a reduction in the frequency and duration of small-scale flood events through the moors adjacent to the flood relief channel (including those within the SPA and Ramsar), which provide valuable feeding and roosting conditions for many of the non-breeding bird features;
- the increased capacity and ability to divert water along the Sowy in advance of a flood event could mean that some of the moors along the River Parrett would no longer flood; and
- for larger events where land along the River Parrett was flooded then the ability to reduce river levels quicker, through sending more water down the Sowy, would mean that the pumps could operate earlier and thereby remove standing flood water.

In addition to increasing the capacity of the flood relief channels, another key component of the Flood Action Plan is to undertake selective dredging within the River Parrett in order to improve flow conveyance and allow pumps to operate earlier at times of extreme flood events. Dredging and any associated operational changes in pumping has the potential alone, and in-combination with the River Sowy and King's Sedgemoor Drain Enhancements Scheme, to have an effect on the frequency, depth and duration of flooding in the Parrett and Tone valleys. Proposed dredging along a 2.2km length of the River Parrett between Stathe and Burrowbridge (adjacent to Southlake Moor SSSI) has been subject to an Environmental Impact Assessment under the EIA (Land Drainage Improvement Works) (Amendment) Regulations 2017 (Johns Associates, 2019)². This included modelling water level effects of the dredging alone, as well as in combination with the full implementation of the River Sowy and King's Sedgemoor Drain Enhancements Scheme.

To address these concerns and potential impacts it was agreed to investigate the likely changes in extent and duration of flooding during against the January 2016 flood event which, at the time was believed to be of a scale of flood that typically would happen each year. When investigated it was seen to be an above-average flood and one that would probably occur once every two to three years. Nevertheless, it was considered to be representative of the type of event that provides additional beneficial flooding equivalent to an expected 'typical' event compared to what currently happens. The spatial extents of flooding under the January 2016 flood event was checked against the extent of the SPA, including land outside the site boundary, but which nevertheless provides functional, supporting habitat. It was concluded that there would be a reduction in extent and frequency of shallow flooding, so mitigation measures would be required. A Mitigation Action Plan (MAP) has now been developed, which includes proposal to undertake improvements to a range of water control structures in the area, which will help with retention and management of areas of shallow flood throughout the appropriate seasons and mitigate any potential adverse effects due to any reduction in extent and frequency of flooding (Appendices 2 and 3).

Operational procedures have also been devised to confirm under what circumstances the flood relief channel is used and how Monk's Leaze Clyce operates. They provide details of the current operation based on an assumed channel capacity of 17m³/s plus the small revisions that will be required following the proposed incremental increase to 27m³/s (KSD) and 24 m³/s (Sowy) (Appendix 3). These procedures take account of the influence and relationship of all pumping stations and spillways in the Parrett valley.

Due to recent case law, it is no longer possible to consider mitigation measures that are required specifically to avoid effects on European site features during the Stage 1 screening for likely significant effect. However, they can be considered as part of the Stage 2 appropriate assessment when considering whether or not there will be an adverse effect on site integrity.

² https://somersetdrainageboards.gov.uk/media/Volume_2_Environmental_Statement1.pdf

Map(s) showing PPP location and European site(s)

See Appendix 1.

Summary of Stage 1 (likely significant effect) conclusion

At Stage 1 it was not possible to rule out the likelihood of significant effects, and those effects requiring appropriate assessment are summarised below in Table 1.

Table 1. Stage 1 likely significant effect risk summary based on EA bird group

EA bird group	Risk	Likely significant effect alone	Likely significant effect in combination [#]
Somerset Levels and Moors SPA and Ramsar			
Severn Estuary SPA and Ramsar			
3.4 Birds of lowland wet grassland	Change in flow or velocity regime during operation	Yes	No
3.6 Birds of lowland freshwaters and their margins	Changed water chemistry during operation and maintenance	Uncertain	No
	Changes in physical regime within the flood relief channels	Uncertain	No
3.7 Birds of farmland (for this Scheme any cropped or grassland areas which do not function as wet grassland at any time of year)	Changes in surface water flooding	Yes	No
	Habitat loss	Uncertain	No
	Habitat/community simplification	Yes	No

[#] Where a likely significant effect alone is identified at the screening there is no need to consider in combination effects at that stage. If the appropriate assessment concludes no adverse effect alone on site integrity, then the potential for in combination effects will be considered.

The relevant species and which EA bird groups they fall into, based on the types of habitat that could be affected, are shown in Table 2 below EA species and habitat groups are used to consider species with similar habitat requirements and sensitivities as a whole and are particularly useful at the screening stage. As can be seen from Table 2, each species can belong to more than one bird group.

Table 2. Qualifying features and bird groups

Site and qualifying feature	Bird group		
	3.4	3.6	3.7
Somerset Levels and Moors SPA and Ramsar			
Bewick's Swan	Y	Y	Y
Golden Plover	Y		Y
Lapwing	Y		Y
Teal	Y	Y	
Waterfowl assemblage	Y	Y	Y
Severn Estuary SPA and Ramsar			
Bewick's Swan	Y	Y	Y
Dunlin	Y		

Site and qualifying feature	Bird group		
Redshank	Y	Y	
Gadwall		Y	
Shelduck		Y	
Greater White-fronted Goose	Y		
Waterfowl assemblage	Y	Y	Y

Table 3 lists the 'main component' species of the waterfowl assemblage of the designated sites i.e. those that fall in one or more of the following categories:

- i) migratory species present in internationally important numbers ($\geq 1\%$ biogeographic population);
- ii) those species comprising $\geq 2,000$ individuals (i.e. $\geq 10\%$ of minimum total to qualify for an internationally-important assemblage);
- iii) 'named components' otherwise listed on the SPA citation.

Other important component species that don't fall in the above categories but need to be considered by the assessment are 'red-listed' Birds of Conservation Concern and/or those included on Section 41 of the Natural Environment and Rural Communities Act 2016.

Table 3. Components of waterfowl assemblage apart from named qualifying features

Site / species	Peak mean to 2017/18 ³	Named component species	Red List	Section 41
Somerset Levels and Moors SPA				
Mute Swan	1,097	-	-	-
Gadwall	688	-	-	-
Shoveler	1,333	-	-	-
Wigeon	21,835	-	-	-
Pintail	780	-	-	-
Pochard	216	-	Y	-
Bittern	11	-	-	Y
Little Egret	117	-	-	-
Whimbrel	0	Y	-	-
Curlew	16	-	Y	Y
Black-tailed Godwit	205	-	Y	Y
Ruff	8	-	Y	-
Snipe [#]	829	Y	-	-
Green Sandpiper	8	-	-	-
Severn Estuary SPA and Ramsar*				
Mute Swan	420	-	-	-
Shoveler	487	-	-	-
Wigeon	7,751	Y	-	-
Teal	5,374	Y	-	-
Pintail	745	Y	-	-

³ Wetland Bird Survey (WeBS) data from Waterbirds in the UK 2017/18 © copyright and database right 2019. WeBS is a partnership jointly funded by the BTO, RSPB and JNCC, in association with WWT, with fieldwork conducted by volunteers

Site / species	Peak mean to 2017/18 ³	Named component species	Red List	Section 41
Pochard	291	Y	Y	-
Tufted duck	812	Y	-	-
Little Egret	198	-	-	-
Curlew	3,571	Y	Y	Y
Whimbrel	221	Y	-	-
Black-tailed Godwit	765	-	Y	Y
Ruff	35	-	-	-
<i>Peak mean above that of importance at the international (biogeographic) level</i>				
<i>Peak mean above that of importance at the GB level</i>				

Non-breeding snipe are notoriously difficult to census by the count method. Although numbers do not reach the threshold of GB importance this is still the highest peak mean of all WeBS sites.

* Excludes species that don't utilise the Somerset Levels or are only likely to be found very infrequently and in small numbers, so there is no risk of likely significant effects on the SPA population (e.g. Grey Plover).

The only component species of the Severn Estuary SPA and Ramsar that isn't a component of the Somerset Levels and Moors (SLM) SPA is tufted duck. Relatively small numbers occur on the SLM, with a peak mean of 205 birds to 2017/8 compared to the GB threshold of 1,100.

Conservation objectives⁴

The appropriate assessment will consider the implications of the proposal in view of the site's conservation objectives. The conservation objectives for the sites requiring appropriate assessment are below:

Table 4 Conservation Objectives for the Special Protection Areas

Somerset Levels and Moors SPA (UK9010031) (Natural England 2020a)⁵
With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified and subject to natural change:
Ensure that the integrity of the site is maintained or restored as appropriate, and to ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:
<ul style="list-style-type: none"> - the extent and distribution of the habitats of the qualifying features - the structure and function of the habitats of the qualifying features - the supporting processes on which the habitats of the qualifying features rely - the populations of the qualifying features, and - the distribution of the qualifying features within the site.
Severn Estuary SPA (UK9015022) (Natural England 2020b)⁶
With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified and subject to natural change:
Ensure that the integrity of the site is maintained or restored as appropriate, and to ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:
<ul style="list-style-type: none"> - the extent and distribution of the habitats of the qualifying features - the structure and function of the habitats of the qualifying features - the supporting processes on which the habitats of the qualifying features rely

⁴ Generic conservation objectives are based on 'Natural England (2014) Conservation Objectives for European Sites in England Strategic Standard 01/02/2014 V1.0'

⁵ <http://publications.naturalengland.org.uk/publication/4598158654963712>

⁶ <http://publications.naturalengland.org.uk/publication/5601088380076032>

- the populations of the qualifying features, and
- the distribution of the qualifying features within the site.

There are currently no conservation objectives for any Ramsar sites. However, given that it is only the Ramsar non-breeding bird features that are being considered they are adequately covered by the SPA objectives.

The individual species that are qualifying features of the sites are listed in Table 2 above, with additional notable species within the waterfowl assemblage shown in Table 3.

Supplementary Advice

In addition to the generic SPA objectives, Natural England has recently published supplementary advice on the Conservation Objectives for the Somerset Levels and Moors SPA (Natural England, 2019b). These provide site-specific attributes and associated targets for each of the qualifying features, which are primarily used for condition monitoring in relation to maintenance or restoration, but which are also relevant when undertaking a HRA. A summary of the ones relevant to this assessment are shown in Table 5.

Table 5. Summary of attributes and targets for qualifying features of the SLM SPA

Attribute	Target
Population abundance	<p><i>Bewick's Swan</i>: restore size to a level at or above that at the time of classification (310 birds).</p> <p><i>Golden Plover</i>: maintain at a level above that at the time of classification.</p> <p><i>Teal</i>: maintain at a level above that at the time of classification.</p> <p><i>Lapwing</i>: restore size to a level at or above that at the time of classification.</p>
Assemblage abundance	Maintain the overall abundance of the non-breeding assemblage at a level above 20,000 individual wintering wetland birds. There were 58,093 individuals (5-year peak mean) at the time of classification and the current figure is 93,946.
Diversity of species that make up the assemblage	Maintain the species diversity of the waterfowl assemblage. The species composition and numbers of individuals of all species within the assemblage will clearly change over time. However, the focus of the target is maintenance and restoration of populations of the 'main component' assemblage species (Table 1 above).
Extent and distribution of supporting non-breeding habitat	Maintain the extent and distribution of suitable habitat within and outside the SPA boundary, which supports the qualifying features for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding).
	Within the SPA boundary maintain 6,394.18ha of habitat, including grazing marsh, fen, reedbeds, neutral grassland, open water, rivers, artificial drainage channels and ditches
	Outside the SPA boundary: an unquantified area of land of functional importance for qualifying features. Such land includes arable, species-poor and species-rich grassland and a variety of high-quality wetland sites as nature reserves such as RSPB Greylake.

Attribute	Target
Supporting habitat (within and outside the SPA): water quantity	<p>Maintain the supply of water to a standard, which provides the necessary conditions to support the qualifying features of the SPA.</p> <p>In winter the flood regime must provide a mixture of splash, shallow and deep flooded areas (target depths and area of flooding is provided in the <i>Supplementary Advice</i>).</p> <p>The provision of suitable conditions depends on an integrated approach to water level and flood risk management. The use of Raised Water Level Areas (RWLAs) within the SSSIs contributes to this.</p>
Supporting habitat (within and outside the SPA): water quality	<p>The SPA qualifying features are relatively insensitive to organic and nutrient pollution. The current water quality of the Somerset Levels and Moors is likely to be adequate to support the SPA qualifying features.</p> <p>However, it should be noted that some of the component SSSIs are currently listed as <i>unfavourable – declining</i> due to elevated phosphorous levels that are having an adverse effect on aquatic plant and invertebrate communities.</p>
Supporting habitat (within and outside the SPA): conservation measures	<p>Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to maintain the structure, function and/or the supporting processes associated with the feature and its supporting habitats.</p> <p>For non-breeding birds the key measures are sward management (grazing and cutting), water level management and maintenance of watercourses and associated structures.</p>
Supporting habitat (within and outside the SPA): air quality	<p>Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).</p>
Supporting habitat (within and outside the SPA): minimising disturbance caused by human activity	<p>Reduce the frequency, duration and/or intensity of disturbance within close proximity of affecting roosting, foraging, feeding, moulting and/or loafing birds so that the qualifying features are not significantly disturbed.</p>
Supporting habitat (within and outside the SPA): landscape structure	<p>Maintain open and unobstructed terrain within and around roosting and feeding areas with no overall decrease in field sizes.</p>
Supporting habitat (within and outside the SPA): connectivity with supporting habitats	<p>Maintain the safe passage of birds moving between roosting and feeding areas within and outside the component SSSIs and between the Somerset Levels and Moors and Severn Estuary SPAs.</p> <p>The advice notes that research into the role of the flyway between the estuary and inland moors and the extent and importance of functionally-linked land outside the SPA boundary is required.</p>
Supporting habitat (within and outside the SPA):	<i>Bewick's Swan</i>

Attribute	Target
Food availability within supporting habitat	<p>Maintain the availability of cereal grains, rape, potatoes and sugar beet, where these sources are locally important to feeding flocks.</p> <p><i>Golden Plover and Lapwing</i></p> <p>Maintain the availability of key invertebrate prey species (e.g. earthworms and beetles) of preferred prey sizes.</p> <p><i>Teal</i></p> <p>Maintain the cover/abundance of preferred food plants (e.g. <i>Polygonum, Eleocharis, Rumex, Ranunculus, and Juncus</i>).</p> <p><i>Assemblage</i></p> <p>Maintain the cover/abundance of preferred food plants and availability of key invertebrate prey species.</p>

For population abundance it should be noted that where the current 5-year peak mean (see Table 5 below) is in excess of the figure at the time of classification there is a requirement to maintain and avoid deterioration from the current level. For lapwing and Bewick's swan, where current levels are below that at the time of classification then there is a need to restore the size of the populations to the original baseline.

For the Severn Estuary SPA, advice formerly given under Regulation 33 of the Conservation (Natural Habitats & c.) Regulations was published in 2009 (Natural England and Countryside Council for Wales, 2009). Although this identifies some hazards and vulnerabilities of the SPA features these all relate to saltmarsh and other intertidal habitats within the estuary (despite the fact that the boundary includes some coastal grazing marsh on the landward side of the sea walls), so is not relevant to this assessment.

Site Improvement Plans for the Somerset Levels (Natural England 2015a) and Severn Estuary (Natural England 2015b) provide a high-level overview of the issues (both current and predicted at the time of publication) affecting site condition and outline the priority measures required to improve the condition of the features. They include actions relevant to water level management, including dealing with summer flooding and prolonged, deep winter flooding.

Site condition and conservation status of qualifying features

Somerset Levels and Moors SPA and Ramsar sites

The SPA and Ramsar have 12 component SSSIs, with five located in the Brue valley and seven on the floodplains of the Rivers Parrett and Tone. The Scheme has the potential to affect, directly or indirectly, the seven sites in the Parrett and Tone floodplains so it is those that will be included in this assessment. Table 6 summarises the site condition of each SSSI based on information published on Natural England's Designated Sites View webpages (Natural England 2019a).

Table 6. Site condition of component SSSI of the Somerset Levels and Moors SPA and Ramsar in the Parrett and Tone floodplains

SSSI	Condition
Curry and Hay Moors	<p><u>Overall</u>: All but one of the 24 units in Unfavourable - recovering, mainly due to high phosphate levels, the presence of Nuttall's waterweed and a poor range of ditch succession.</p> <p><u>Non-breeding birds</u>: Relatively few birds noted as using the site due to lack of suitable splash conditions.</p>

SSSI	Condition
King's Sedgemoor	<p><u>Overall</u>: All 21 units are listed as <i>Unfavourable - Declining</i> following site checks made in 2017. The stated reason is elevated levels of phosphorous in the ditch network, resulting in algal dominance and loss of vascular plant diversity since the previous assessment. Most other site features, including birds, are in favourable condition.</p> <p><u>Non-breeding birds</u>: The site supports relatively high numbers of waders and wintering waterfowl, the key locations being the RWLAs where they can feed and roost without suffering any significant disturbance.</p>
Moorlinch	<p><u>Overall</u>: 10 of the units <i>Unfavourable - recovering</i> and the other one (droves) <i>Favourable</i>.</p> <p><u>Non-breeding birds</u>: No recent figures or condition quoted - favourable based on data up to 2011-12.</p>
Southlake Moor	<p><u>Overall</u>: All 3 units are listed as <i>Unfavourable - Declining</i> due to elevated levels of phosphorous in the ditch network, resulting in algal dominance and loss of vascular plant diversity since the previous assessment. Most other site features, including birds, are in favourable condition.</p> <p><u>Non-breeding birds</u>: The site consistently supports large numbers of birds due to the provision of both shallow and deep-water conditions between December and February. This is partly achieved through taking water directly from the Sowy and the ability to discharge it back when required.</p>
West Moor	<p><u>Overall</u>: All 10 units <i>Unfavourable - declining</i> due to water quality issues plus lack of full range of ditch succession stages in most units.</p> <p><u>Non-breeding birds</u>: No specific reference though appropriate splash conditions noted in 5 of the 10 units.</p>
West Sedgemoor	<p><u>Overall</u>: All 7 units are listed as <i>Unfavourable - Declining</i> following site checks in 2016. Elevated levels of phosphorous in the ditch network, resulting in algal dominance, are having a negative effect on plant communities. Most other site features, including birds, are in favourable condition.</p> <p><u>Non-breeding birds</u>: West Sedgemoor supports considerable numbers of waterfowl due to the provision of extensive areas of shallow flood where birds can safely roost and feed.</p>
Wet Moor	<p><u>Overall</u>: Of the 20 units, 12 are listed as <i>Unfavourable - recovering</i>; 7 as <i>Favourable</i> and 1 (the River Yeo) as <i>Unfavourable - no change</i>.</p> <p><u>Non-breeding birds</u>: Considered to be favourable in terms of numbers of birds and the presence of suitable splash conditions in those units where these features are mentioned.</p>

The SSSI condition status gives an indication of the health of each SPA component site, though in the case of non-breeding birds it should be noted that some sites are more important to these features than others. Raised Water Level Areas (RWLA) within some of the sites are managed

between December and February to provide suitable conditions for waterbirds, ranging from ‘splash’ to shallow water through to deeper water.

Furthermore, many of the qualifying species will also utilise areas of functional / supporting habitat outside of the SSSIs. Unless specifically managed as part of an agri-environment scheme, functional habitat tends to only be of value when there is standing water present and that is often the result of pluvial and/or fluvial flooding. The exception is for species such as lapwing, golden plover, Bewick’s swan and mute swan that regularly utilise cropped fields and non-flooded grassland for feeding.

Wetland Bird Survey

Wetland Bird Survey (WeBS) data provides useful figures and information about non-breeding bird populations at the SPA level as well as the ability to query and compare individual species data across sites. The WeBS Report Online (Frost et al 2019) details the latest published peak mean counts together with ‘Alerts’. The latter analyses trends in abundance of waterbird features on designated sites and highlights those where there is a >25% decline (Amber Alert) or more than 50% decline (Red Alert) over the short (5 years), medium (10 years) and long-term (up to 25 years) periods. The latest WeBS Alerts were published in 2019 utilising data up to 2017/18 (Woodward et al 2019).

Table 7. Somerset Levels and Moors SPA and Ramsar features, 5-year peak mean numbers⁷

Feature	Peak mean at classification	Peak mean to 2017/18	Peak mean to 2016/17	Peak mean to 2015/16	Peak mean to 2014/15	Peak mean to 2013/14
Bewick’s swan	310	4	5	4	16	22
Golden Plover	3,110	12,881	12,578	12,778	10,370	9,638
Teal	7,476	17,906	21,908	21,816	25,707	23,328
Lapwing	36,565	33,779	32,662	31,651	39,783	37,041
Waterfowl assemblage	58,093	93,946	90,183	94,737	107,391	101,751

Annex 1 species (Article 4.1)

The large drop in numbers of **Bewick’s swan** is reflected in both national and regional (south-west) trends since the mid-1990s. However, reductions on the Somerset Levels pre-dated the national declines so there are likely to be some site-specific drivers of decline.

The increase in **golden plover** numbers is reflected in national and international trends. They are far less dependent upon areas of shallow flood and spend most of their time feeding (daytime, but more particularly at night) on permanent pasture and ploughed fields. They will roost on the latter but may also move to coastal areas (Brown and Grice 2005).

Migratory / non-breeding species (Article 4.2)

Increases in **teal** are also a reflection of national and regional trends over the last 30 years. The current **lapwing** peak is lower than at the time of classification, but they still represent the most numerous single species and SLM is the most important site for them in the whole of Britain.

Waterfowl assemblage (Article 4.2)

At the time of classification, in addition to the Annex 1 and migratory species referenced above, the following assemblage species occurred in nationally important numbers: gadwall, wigeon,

⁷ Contains Wetland Bird Survey (WeBS) data from Waterbirds in the UK 2017/18 © copyright and database right 2019. WeBS is a partnership jointly funded by the BTO, RSPB and JNCC, in association with WWT, with fieldwork conducted by volunteers

shoveler, pintail, snipe and curlew. The current status of these and additional species which now occur in nationally or internationally important numbers are shown in Table 3 above.

Severn Estuary SPA and Ramsar sites

The site comprises 12 component SSSIs extending to 24,488 ha, of which approximately 10% is grazing marsh and other habitats landward of the sea defences. For the purpose of this assessment, the Bridgwater Bay SSSI has been considered as the site from where there is most likely to be an interchange of birds within the Somerset Levels.

Bridgwater Bay SSSI is divided into 30 units of which 14 are listed as 'neutral grassland (lowland)', so are assumed to be grazing marsh or similar. The condition of 12 of the neutral grassland units is *Unfavourable - recovering* and the other two as *Favourable*. Two of the units have RWLAs.

Qualifying species

Data on the qualifying species has been obtained from WeBS online⁸ and the SPA and Ramsar citations.

Table 8. Severn Estuary SPA features that may use the Somerset Levels and Moors

Feature	Peak mean at classification	Peak mean to 2017/18	Peak mean on SLM 2017/18
<i>Article 4.1</i>			
Bewick's swan	289	150	4
<i>Article 4.2</i>			
Shelduck	2,892	4,450	68
Gadwall	330	190	688
Redshank	2,013	5,720	6
Dunlin	41,683	29,189	777
Greater white-fronted goose	3,002	125	0
<i>Waterfowl assemblage</i>	68,026	88,178	93,946
Mute swan	n/a	420	1,097
Shoveler	n/a	487	1,333
Wigeon	3,977	7,751	21,835
Teal	1,998	5,374	17,906
Pintail	523	745	780
Pochard	1,686	291	216
Tufted duck	913	812	475
Little egret	n/a	198	117
Curlew	3,096	3,571	16
Whimbrel	246	221	0
Spotted redshank	3	8	0

Bewick's swan: This is the only Annex 1 qualifying feature. As with the Somerset Levels and Moors SPA, numbers of this species have declined since the site was classified in 1993, with a peak mean

⁸ Frost et al 2019 <https://app.bto.org/webs-reporting/>

of 289 birds (1988/89-1992/93), to 122 for the period 2017/18. These birds are all probably concentrated around the Slimbridge Wetland Centre and unlikely to use the Somerset Levels over the wintering period or on migration.

Shelduck: Primarily associated with estuaries and other coastal habitats throughout the year although some birds will use freshwater wetlands, though typically never that far inland. The large numbers that use the Severn Estuary are partly a reflection of the post-breeding moult gathering in Bridgwater Bay.

Gadwall: Most birds will be associated with coastal grazing marsh, but the overall numbers are much lower than within the SLM, though there is likely to be a movement of birds from the estuary inland at the time of harsh winter weather conditions on the coast.

Redshank: Primarily an estuarine species, but birds will nest inland in freshwater environments, as they do in the SLM. Very few birds are recorded in the SLM during WeBS counts and the peak numbers are often recorded in March, which is likely to represent bird returning from elsewhere to breed.

Dunlin: Primarily a coastal species but birds will use inland sites whilst on migration and during harsh weather. The SLM peak mean is currently 777 birds and it is highly likely that some of these will be using Bridgwater Bay and/or the wider Severn estuary. They will feed on bare, muddy margins.

Greater white-fronted goose: The number of geese has declined markedly since classification, in line with national trends. Most of the birds that currently use the Severn estuary will be in and around Slimbridge. The current peak mean for SLM is 0 although there is suitable habitat present and they used to occur regularly.

Appropriate assessment: assessing the impacts alone

Scoping of qualifying features

Rather than undertake the assessment based on 'bird groups' (Table 1 above), each of the qualifying species of the designated sites that are listed in Tables 2 and 3 have been considered. Initially this has involved scoping out species where there is either considered to be no likelihood of any effect whatsoever (in the absence of the incorporated mitigation measures), or that if there was the prospect of any effects then they would be so small or inconsequential that they would neither be significant alone, nor could they combine with other plans and projects to result in a significant effect.

Table 9. Bird features that have been scoped out of the assessment

Feature	SLM	Severn Estuary	Reason for scoping out
Bewick's swan <i>Annex 1</i>	Y	Y	A reduction in the extent, frequency and duration of shallow flood events would not have any effects on the few birds that currently occur, nor would it compromise the ability to restore the relatively small numbers of birds that there were at the time of the SLM classification (310). The birds favour permanent bodies of deeper water for roosting and a variety of agricultural land for feeding and daytime loafing. Suitable deep-water roost sites exist at Southlake and West Sedgemoor in the Parrett valley as well as at the complex of flooded peat workings in the Brue valley. Although Bewick's swan will utilise areas of shallow flood in cultivated fields and pasture they are not dependent upon it and will feed on sites with no standing water whatsoever. Sufficient habitat would therefore remain throughout the SPA even if there were a reduction in the extent of shallow water.
Golden plover <i>Annex 1</i>	Y	-	This species tends to roost on coastal flats and feed (daytime and night-time) on ploughed fields and permanent pasture. The presence of areas of shallow flood within the SLM is not critical to either feeding or roosting. Furthermore, the current peak mean is four times that at the time of classification (and rising), suggesting that overall environmental conditions are favourable.
Shelduck	-	Y	Numbers of birds on the Severn Estuary SPA have remained stable long-term, and there are no Alerts over any of the three time periods. The figures include the long-established post-breeding moult gathering in Bridgwater Bay. The peak mean count for the SLM is just 68 (cf 4,450 for the Severn) and birds are more likely to be found on permanent deeper waterbodies where they do occur inland. Suitable deep waterbodies can be found during the winter months at Southlake and West Sedgemoor in the Parrett valley as well as at the complex of flooded peat workings in the Brue valley.
Greater white-fronted goose	-	Y	Numbers have been declining in the Severn Estuary SPA and nationally for many years. The majority of birds use Slimbridge, and whilst the SLM has plenty of suitable habitat they are rarely recorded here and would be unlikely to be dependent upon this area even if numbers in the Severn recovered to the peak at the time of classification (3,002).

Feature	SLM	Severn Estuary	Reason for scoping out
Bittern	Y	-	This species is not dependent upon areas of splash or shallow flood.
Gadwall	Y	Y	The current peak mean for SLM is 688 and the Severn Estuary 190. Although the former exceeds the threshold for a site of international importance, the vast majority of birds using the larger, permanent waterbodies in the Brue valley with very few recorded in the Parrett and Sowey/KSD corridors (including the RSPB reserves of West Sedgemoor and Greylake which are used by large numbers of other duck such as teal and shoveler).
Pochard	Y	Y	A diving duck that tends to be found on permanent, deeper waterbodies and will not be reliant on RWLAs or other areas of shallow flood.
Tufted duck	-	Y	As pochard.
Curlew	Y	Y	The current peak mean is 16, which is highest that it has been since 1991/92 when it was 33. Whilst a Red List and section 41 species, there is no prospect of there being any significant adverse effect. The ability to reduce the extent and duration of flooding in late spring and summer represents a small beneficial effect on the breeding population.
Whimbrel	Y	Y	Although a component of the waterfowl assemblage on the SLM classification, the current peak mean is 0 so there is no prospect of any significant effect.
Redshank	-	Y	The current peak mean is eight and the highest that it has been historically back to 1991/92 is 52 so, there is no prospect of there being any significant adverse effect. The ability to reduce the extent and duration of flooding in late spring and summer represents a small beneficial effect on the breeding population.
Spotted redshank	-	Y	There are no recent records from the WeBS counts for SLM and the current peak mean for the Severn is only eight birds.
Green sandpiper	Y	-	Although numbers exceed those of importance at the GB level, the peak mean is just eight birds so there is no prospect of any significant effect.
Ruff	Y	-	Although numbers exceed those of importance at the GB level, the peak mean is just eight birds so there is no prospect of any significant effect.

This leaves the following species that are considered to be highly dependent upon the existence of temporary areas of splash and shallow flood in the SLM during the core winter period (December to February inclusive):

- Mute swan
- Dabbling ducks – shoveler, teal, pintail, wigeon (mostly grazing but always in close proximity to water)
- Little egret
- Waders – lapwing, dunlin, snipe and black-tailed godwit

The waterfowl assemblage calculation for the SLM incorporates all species, however the majority of the peak mean total (currently 93,946) is accounted for by lapwing, wigeon, teal, golden plover, shoveler and mute swan (total 87,831 for species contributing at least 1,000 birds). Of these species, golden plover (12,881) is the only one that has been scoped out of the assessment.

Change in flow or velocity regime during operation

The Sowy channel is within Unit 106 of the King's Sedgemoor SSSI component of the SLM SPA and Ramsar. The unit is currently listed as *Unfavourable - declining* due to water quality issues, which are reflected across the whole site, though it is noted that it supports relatively high numbers of waders and waterfowl on areas of shallow flood and within the RWLA. The Sowy itself will be used by species such as mute swan and other components of the waterfowl assemblage. The whole of the relief channel is likely to be of particular value at times of prolonged freezing conditions when most of the RWLAs and other shallow water areas are not available.

The increased operational capacity of the Sowy and KSD will allow greater volumes and flows (from approximately 17m³/s to a maximum of 27m³/s (KSD) or 24m³/s (Sowy)) to pass along the channel when water is either deliberately diverted via Monk's Leaze Clyce and/or by entering from the River Parrett spillways. Increased velocity and volume of water has the potential to result in scour, with associated loss of in-channel vegetation and adverse impacts on invertebrates and fish, all of which are potential sources of food to one or more of the bird features.

During operational conditions when extra water is being diverted into the flood relief channel, or flowing into it via the spillways, the channel is unlikely to be used by birds. The channel will already be subject to high levels of turbidity and scour when operating under flood conditions at the current capacity and an increase, as proposed, will not result in greater levels of scour that would have a noticeable effect on water quality or food sources. The widening of some sections of channel will provide habitat improvements in terms of an increase in shallow margins and berms where aquatic and emergent plants will establish. This vegetation will give cover for birds, be a direct food resource as well as improve the habitat for prey items such as invertebrates and fish.

The Scheme will not result in any changes in flow or velocity regime that would compromise the Conservation Objectives and therefore there will be no adverse effect on the integrity of the designated sites. No mitigation measures are required to reach this conclusion.

Changed water chemistry during operation and maintenance

The Sowy part of the SSSI is already subject to annual maintenance in the form of weed cutting and removal of material. De-silting (dredging) is also undertaken periodically. These activities have the potential to alter water chemistry through disturbance of sediment, changes in dissolved oxygen levels and pollution from equipment being used. Standard control measures will be employed during maintenance activities to minimise these risks, to include appropriate programming, pollution control and the monitoring water temperature and dissolved oxygen levels. During operation there won't be any change to the risk of water chemistry being altered by potential pollutants being diverted into the flood relief channel from the River Parrett just because there is the ability to increase volumes and flows.

Based on the latest SSSI assessment, the Sowy and other waterbodies within King's Sedgemoor are suffering from elevated phosphate levels and these are having an effect on plant and invertebrate communities. However, the *Conservation Objectives Supplementary Advice (COSA)* (Natural England, 2019b) states that the SPA qualifying features are relatively insensitive to organic and nutrient pollution and the current water quality of the site is likely to be adequate to support the features.

The Scheme will not result in any changes in flow or velocity regime that would compromise the Conservation Objectives and therefore there will be no adverse effect on the integrity of the designated sites. No mitigation measures are required to reach this conclusion.

Changes in physical regime within the flood relief channels

The increased capacity will mainly be achieved through raising sections of existing low-level informal flood embankments that are set-back from the edge of the flood relief channel. There will be some widening of the channel for material sourcing or provision of enhancement features such as embayments, two-stage channels and backwaters. None of these activities will have a significant effect on the physical regime of the channel that could alter the habitat features that are currently present.

The Sowy and KSD have some value for relatively small numbers of waterbirds during normal operating and weather conditions. Nevertheless, these will contribute to the waterfowl assemblage totals and, more importantly, the channel will often provide an ice-free refuge at times of prolonged freezing conditions. The implementation of the Scheme will not alter the physical regime and therefore there is no risk of the beneficial effects of the channel for waterbirds being compromised.

The Scheme will not result in any changes in physical regime within the Sowy/KSD that would compromise the Conservation Objectives. Consequently, there will be no adverse effect on the integrity of the designated sites from this risk. No mitigation measures are required to reach this conclusion.

Changes in surface water flooding

The non-breeding bird features are dependent upon areas of open water and/or muddy margins. These can vary from areas of 'splash', to shallow water to deeper permanent bodies of water. Due to the importance of such features, the use of RWLAs is a key part of site management from December to February inclusive. Although most of the in-field water is supplied directly from the rhynes and flood relief channel (e.g. the warping at Southlake), as well as water falling directly on the land, the contribution made by periodic flood events is also important. Increasing the channel capacity to accommodate flows of 27m³/s in the KSD and 24m³/s in the Sowy, compared to the current capacity of up to 17m³/s will result in a number of potential impacts that could compromise the Conservation Objectives of the SLM:

- a reduction in the frequency and duration of small-scale flood events through King's Sedgemoor, which provide valuable feeding and roosting conditions for many of the non-breeding bird features;
- the increased capacity and ability to divert water along the Sowy in advance of a flood event could mean that some of the moors along the River Parrett would no longer flood; and
- for larger events where land along the River Parrett was flooded then the ability to reduce river levels quicker, through sending more water down the Sowy, would mean that the pumps could operate earlier and thereby remove standing flood water.

These impacts could affect all the species scoped into the assessment but especially the large numbers of dabbling ducks, mute swan and lapwing that rely on the additional areas of temporary flooded grassland outside of SSSIs, for at least part of the time. Depending on the presence and extent of additional flooding outside of RWLAs, most birds will usually spend the daytime loafing

and roosting at undisturbed sites with extensive areas of open water, such as the RSPB reserves at West Sedgemoor and Greylake. They will then fly out to feed over a more extensive area at night-time, so these additional areas of flood are important for their survival over the winter period (Chown, 2003). Changes in surface water flooding are therefore the highest risk hazard to maintaining the integrity of the designated sites.

In addition to increasing the capacity of the flood relief channels, another key component of the Flood Action Plan is to undertake selective dredging within the River Parrett in order to improve flow conveyance and allow pumps to operate earlier at times of extreme flood events. Dredging and any associated operational changes in pumping has the potential alone, and in-combination with the River Sowy and King's Sedgemoor Drain Enhancements Scheme, to have an effect on frequency, depth and duration of flooding. Proposed dredging along a 2.2km length of the River Parrett between Stathe and Burrowbridge (adjacent to Southlake Moor SSSI) has been subject to an Environmental Impact Assessment under the EIA (Land Drainage Improvement Works) Regulations (Amendment) Regulations 2017 (Johns Associates, 2019). This included modelling water level effects of the dredging alone, as well as in combination with the full implementation of the Sowy-KSD Scheme.

To address these concerns and potential impacts it was agreed to investigate the likely changes in extent and duration of flooding during against the January 2016 flood event which, at the time was believed to be of a scale of flood that typically would happen each year. When investigated it was seen to be an above-average flood and one that would probably occur once every two to three years. Nevertheless, it was considered to be representative of the type of event that provides additional beneficial flooding equivalent to an expected 'typical' event, compared to what currently happens. The extent of flooding under the January 2016 event was checked against the extent of the SPA, including land outside the site boundary, but which nevertheless provides functional, supporting habitat. The results showed that for the dredging alone (an increase in capacity of 7m³/s) the flood extent would decrease by approximately 300ha out of a total extent of 3,500 ha across all Parrett and Tone moors. Of the 300ha total, 100ha was within SSSIs and 70ha within RWLA. When the combined effects of the dredging with the increase in capacity of the KSD to 27m³/s and Sowy to 24m³/s were subject to the model run the reduced extent increased to 600 ha with 100 ha within SSSIs and 90 ha within RWLA.

Mitigation

The potential impacts and associated significant effects of reduced flooding, both short and long-term, on the designated site features will be mitigated by:

1. The advanced (autumn 2020) repair and upgrade of key structures that control levels in the RWLAs at Moorlinch, West Moor and King's Sedgemoor (Othery rhyne).
2. The production of a Mitigation Action Plan (MAP) which has been designed to ensure there will be no deterioration in SPA habitat availability or quality, including functionally linked land, through a range of general and site specific measures This includes additional measures (structural and operational) required to sustain medium to long-term provision of suitable habitat in the face of uncertainty over climate change, availability of agri-environment payments and other external factors.

The primary purpose of the MAP is to ensure that there will be no deterioration in SPA habitat availability or quality as a result of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme. The MAP contains a range of general and site-specific mitigation measures to achieve this. These measures include:

- Ensuring water level management meets the operational requirements (target water levels) of the agreed WLMPs.
- Maintaining and updating WLMPs and extending them to Functionally Linked Land (FLL) where necessary.

- Sustaining the existing RWLAs.
- Maintaining and improving the water management infrastructure required to achieve the conservation objectives of protected sites and FLL.
- Ensuring channel maintenance is sympathetic to nature conservation.
- Mitigating for the changes in small winter flooding within SSSIs through such actions as:
 - the replacement of failing water control structures or the provision of new structures to effect ‘no change’ to existing winter surface water conditions (Moorlinch, West Moor and King’s Sedgemoor as identified above)
 - adjustments to operational protocols to effect ‘no change’ to existing winter surface water conditions; a review of WLMPs with partner organisations by 2022
 - maintaining a minimum 300mm water depth in ditches through the winter within and outside designated sites (where this would not increase flood risk)
 - and the creation of in-field wet features such as shallow water scrapes and wet field gutters.

Further details regarding the proposed refurbishment works are provided in Appendix 2 and the MAP is provided in Appendix 3.

In addition, operational procedures confirm under what circumstances the flood relief channel is used and how Monk’s Leaze Clyce operates. They provide details of the current operation based on an assumed channel capacity of 17m³/s plus the small revisions that will be required following the proposed incremental increase to 27m³/s in the KSD and 24m³/s in the Sowy (Appendix 4). It takes account of the influence and relationship of all pumping stations and spillways in the Parrett valley.

It should be noted that:

- The enhanced capacity of 27m³/s in the KSD and 24m³/s in the Sowy will be contained between the banks more or less up to crest height, i.e. there will be no significant freeboard along the full length of the banks. This means that when flows exceed this figure due to over-topping from the Parrett spillways water will flood onto the moors during these higher level events.
- The Scheme will deliver more control and capacity to deal with the adverse effects of prolonged, deep winter floods and the increased likelihood of summer floods (which will impact some of the bird features during the breeding period).

The increase in capacity to accommodate flows of 27m³/s and 24m³/s in the KSD and Sowy respectively, subject to the implementation of the incorporated mitigation measures, will not have an adverse effect the integrity of the designated sites.

Habitat loss

At the strategic level there are not considered to be any adverse effects as a consequence of direct habitat change (net reduction in area of grassland with a gain of emergent and open water) given the nature of habitats within the corridor and the relatively small area that will be affected. The open water provides some benefit to wildfowl, but there will be a net increase in area. The actual amount and type of habitat that will be directly affected by the construction works will be quantified and included in the individual project level HRAs produced as each stage of the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme is completed.

Any loss of grassland habitat within the working corridor and changes in the extent of open water within the flood relief channel will not compromise the Conservation Objectives. Consequently, there will be no adverse effect on the integrity of the designated sites. No mitigation measures are required to reach this conclusion.

Habitat /community simplification

There are no predicted changes from the operation of the increased capacity that would simplify supporting habitat through the Sowey/KSD corridor. The existing in-channel and adjoining habitats have established based on the watercourses functioning as a flood relief channel with variable flows throughout the year. The widening of parts of the channel would create localised additional diversity.

The increased capacity and future operation of the flood relief channel will not alter the type or quality of the existing habitats along the corridor. Consequently, there will be no adverse effects on the integrity of the designated sites. No mitigation measures are required to reach this conclusion.

Appropriate assessment: conclusion alone

The implementation of the full Scheme to increase the carrying capacity of the Sowey/KSD flood relief channel will reduce the duration and extent of flooding from low level events that result in excess water from the River Parrett and flood relief channel from spilling onto the adjoining floodplain. Hydraulic modelling has confirmed that there would be reductions in the extent and duration of flooding, albeit the majority of the areas affected would be outside of the designated sites and RWLAs. Nevertheless, for the purpose of the HRA all land within the floodplain has been assumed to represent supporting habitat.

The potential adverse impacts and associated significant effects of reduced flooding, both short and long-term, on the designated sites will be cancelled by the delivery of the incorporated mitigation measures described above and in Appendices 2 to 4.

The increased capacity of the Sowey/KSD and associated increased flexibility to manage flood flows, especially those that have the highest risk of causing damage to property, infrastructure and land use, also represents a beneficial effect for the designated site features. Prolonged and/or deep flooding on the moors can result in damage to vegetation, other supporting features and water level management control structures.

The other risks considered will not result in any adverse effect on designated site integrity.

Appropriate assessment: assessing the impacts in combination

The assessment of impacts alone has concluded that, with the proposed mitigation measures, there will be no adverse effects on the integrity of the designated sites. The mitigation package has been designed and agreed with Natural England to take account of the combined effects (which would be additive) of the Scheme with recently completed and planned dredging on the River Parrett.

Other routine maintenance works along the Sowey-KSD, including small-scale dredging around bridges and other structures, would not result in additional effects that in combination could result in an adverse effect on site integrity.

Appropriate assessment: conclusion in combination

The Scheme, when incorporating of the proposed mitigation measures, will not result in any adverse effects to the integrity of the designated sites, either alone or in-combination with other plans or projects, or impede the ability of the sites to achieve their conservation objectives.

Stage 2 Habitats Regulations Assessment conclusion

Qualifying Feature	Predicted Risk	Potential Impact on Conservation Objective	Will scale of impact lead to adverse effect on integrity of the site alone?	Will scale of impact lead to adverse effect on integrity of the site in combination?	Can adverse effects be avoided or mitigated?
All species from the SLM and Severn Estuary SPA and Ramsar sites scoped into the assessment: <i>Mute swan</i> <i>Shoveler,</i> <i>Teal,</i> <i>Pintail,</i> <i>Wigeon</i> <i>Little egret</i> <i>Lapwing</i> <i>Snipe</i> <i>Dunlin</i> <i>Black-tailed godwit</i>	Change in flow or velocity regime	Increased scour during high flows when Sowy/KSD in operation could affect food resources available to birds	No. This is an infrequent, temporary impact that only relates to a relatively small part of the designated site	No.	N/A
	Changed water chemistry during operation and maintenance.	Temporary loss of habitat and food used by birds.	No. This is considered to be a very low, temporary risk that would not have an adverse effect due to the availability of large areas of alternative feeding habitat were there to be an incident that reduced food supply in the flood relief channel.	No	N/A
	Changes in physical regime within the flood relief channels	Loss of in-channel vegetation, which represents a direct food source and cover for prey species (fish and invertebrates).	No. The raising of banks and localised widening of sections of channel will not fundamentally change the existing regime.	No	N/A

Qualifying Feature	Predicted Risk	Potential Impact on Conservation Objective	Will scale of impact lead to adverse effect on integrity of the site alone?	Will scale of impact lead to adverse effect on integrity of the site in combination?	Can adverse effects be avoided or mitigated?
	Changes in surface water flooding	Reduction in frequency, duration and extent of beneficial flooding from over-topping of the Sowy-KSD into the King's Sedgemoor SSSI and supporting habitat within the corridor	Yes, supported by modelling data and any reduction in extent of beneficial flooding would compromise the Conservation Objectives	Yes, the impact would be greater in combination with the completed and planned dredging programme (capital and maintenance) for the River Parrett.	Yes, the effects of the Scheme alone and in combination with the dredging can be cancelled. Implementation of a Mitigation Action Plan to incorporate all aspects of water level and land use management into the medium to long-term (see Appendix 3), including the upgrade and refurbishment of water level control structures at selected RWLAs (see Appendix 2 for further detail)
		Reduction in duration of flooding on other SPA and supporting habitat within the pumped system due to the ability to evacuate flood water into the	Yes, supported by modelling data and any reduction in extent of beneficial flooding would compromise the Conservation Objectives	Yes, the impact would be greater in combination with the completed and planned dredging programme (capital and maintenance) for the River Parrett.	Yes, the effects of the Scheme alone and in combination can be avoided by compliance with the Operational Management Plan (Appendix 4) and ensuring that the

Qualifying Feature	Predicted Risk	Potential Impact on Conservation Objective	Will scale of impact lead to adverse effect on integrity of the site alone?	Will scale of impact lead to adverse effect on integrity of the site in combination?	Can adverse effects be avoided or mitigated?
		Parrett earlier than was previously possible.			approach (including any relevant triggers) are incorporated into the updated WLMPs in accordance with the MAP (see Appendix 3)
	Habitat loss	There will be some small-scale changes in the relative amounts of grassland and open water along the Sowy-KSD channel. Any reduction in important habitat could compromise Conservation Objectives.	No. The nature and extent of habitat changes (to be quantified once detailed design are available for each phase) is considered to be insignificant given the location and scale of impact.	No.	N/A
	Habitat/community simplification	Reduction of in-channel and terrestrial vegetation diversity could affect food sources used by birds.	No. The watercourse already functions as a flood relief channel and the increased capacity will not alter the geomorphology or vegetation that the corridor currently supports.	No.	N/A

Stage 2 Habitats Regulations Assessment summary

Somerset Levels and Moors SPA

Somerset Levels and Moor Ramsar

Severn Estuary SPA

Severn Estuary Ramsar

The plan as proposed can be shown to have no adverse effect on the integrity of any of these sites. The proposed mitigation measures identified at this strategic level, combined with the fact that each phase of the construction works will be subject to a separate project level HRA, which will consider construction impacts, will cancel the effects of a reduction in the frequency and volume of uncontrolled over-topping that contributes to the maintenance of suitable splash and shallow flood conditions along the Sowy/KSD corridor. In addition, the use of operational procedures in relation to the timing and duration of pumping from moors subject to water level management controlled by pumps will not compromise the provision of areas of shallow flood within RWLA and elsewhere. No additional conditions or restrictions on the way that the plan is implemented are required.

Advice

Environment Agency internal advice and consultation

N/A

Natural England advice

Natural England officers have been involved in discussions throughout Scheme development, including providing advice on potential impacts and the formulation of suitable mitigation measures. Natural England will be the owners of the Mitigation Action Plan (MAP), which will be accepted and delivered by all partner organisations involved in water level management, to ensure mitigation for the Scheme is in place for the longer term.

Third party advice

None specifically on the HRA.

Somerset Drainage Board Consortium (incorporating the Parrett IDB) have been involved in discussions on the potential in-combination effects of dredging in the River Parrett and the mitigation measures required to counter these. They undertook the hydraulic modelling analysis to identify the potential changes in extent and duration of flooding following an increase in the capacity of the River Parrett and the Sowy-KSD.

The RSPB have also contributed local land management experience and advice on the mitigation measures.

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⁹ Contains Wetland Bird Survey (WeBS) data from *Waterbirds in the UK 2017/18* © copyright and database right 2019. WeBS is a partnership jointly funded by the BTO, RSPB and JNCC, in association with WWT, with fieldwork conducted by volunteers

Decision

The Environment Agency has completed the appropriate assessment and the draft conclusion is that the plan would not have an adverse effect on the integrity of the following sites, either alone or in combination with other plans and projects:

- Somerset levels and Moors SPA
- Somerset Levels and Moors Ramsar
- Severn Estuary SPA
- Severn Estuary Ramsar

Name of Environment Agency officer:	Will Maclennan
Job title:	Senior Environmental Project Manager, NEAS
Date:	TBC

This appropriate assessment has been sent to Natural England for consultation

Date sent to Natural England:	06/04/2020
Date response received from Natural England:	TBC

Natural England comments:

Natural England advise:

Delete as appropriate

- that the operation can go ahead
- against the issuing of the PPP

Please ensure that Natural England's response is attached to this Formal Notice.

Name of Natural England officer:	
Job title:	
Date:	

Final appropriate assessment record

This is a record of the appropriate assessment required by Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (SI 2017/1012), undertaken by the Environment Agency.

The Stage 1 assessment concluded that the PPP would be likely to have a significant effect on the following site(s):

- Somerset levels and Moors SPA
- Somerset Levels and Moors Ramsar
- Severn Estuary SPA
- Severn Estuary Ramsar

An appropriate assessment has been undertaken of the implications of the proposal in view of the relevant site conservation objectives.

The Environment Agency has concluded that the plan would not have an adverse effect on the integrity of the following sites, either alone or in combination with other plans and projects:

- Somerset levels and Moors SPA
- Somerset Levels and Moors Ramsar
- Severn Estuary SPA
- Severn Estuary Ramsar

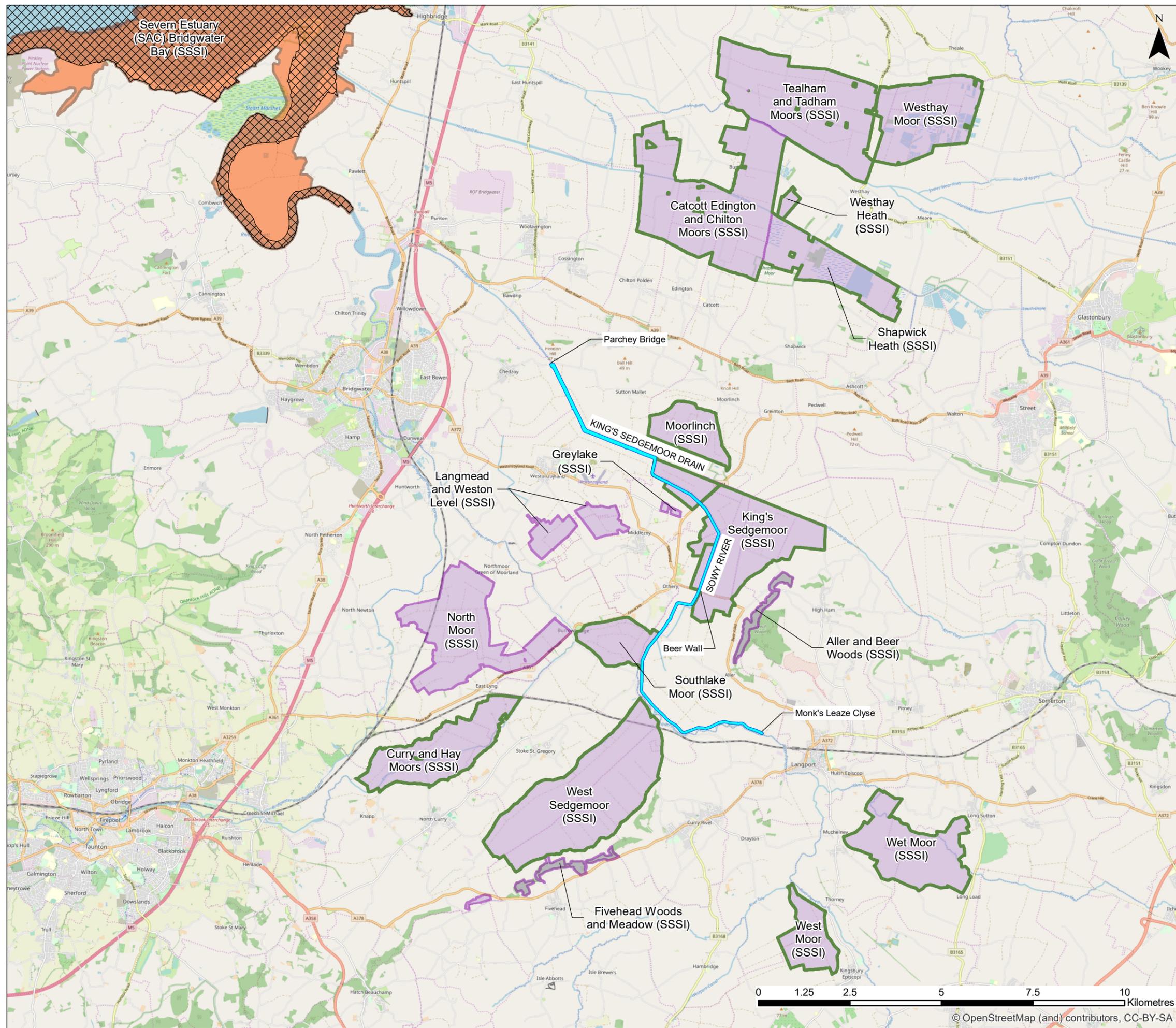
Natural England were consulted on the appropriate assessment and the Environment Agency's conclusions on **TBC** and their representations, to which the Environment Agency has had regard, are attached in Annex 1. The conclusions of this appropriate assessment are in accordance with the advice and recommendations of Natural England.

Name of Environment Agency officer:	Will Maclennan
Job title:	Senior Environmental Project Manager, NEAS
Date:	TBC

Appendix 1

FIGURE 1

- Legend**
- Main works area
 - Somerset Levels and Moors Ramsar and Special Protection Area (SPA)
 - Severn Estuary Special Protection Area (SPA) and Ramsar site (Bridgwater Bay SSSI component)
 - Severn Estuary Special Area of Conservation (SAC)
 - Site of Special Scientific Interest (SSSI)



P00	24/09/2019	First issue	FL	JH	LR	IB
Rev.	Date	Description of revision	Drawn	Check'd	Rev'd	Appr'd



Client: Environment Agency

Project: River Sowy and King's Sedgemoor Drain Enhancements Scheme

Drawing Title: Scheme location in relation to designated sites

ENVRESW001353-CH2-XX-400-DR-EN-1055

Scale @ A3	1:100,000	DO NOT SCALE
Jacobs No.	B2368000	



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Appendix 2

Refurbishment of water controls structures at King's Sedgemoor, Moorlinch and West Moor RWLAs

Background

The proposed works focus on refurbishing or replacing water control structures within three of the component SSSIs (see Figure 1, Annex A to Appendix 2). The selection of these structures is based on the potential impacts identified by hydraulic modelling. It has been agreed with Natural England and other SRA delivery partners to reduce the previous design life for the structures from 25 years down to a shorter 5-10 year life expectancy. This reduction is to make the mitigation proportionate to the Scheme and reflect the uncertainty surrounding the future of the agri-environment schemes in these areas (all current Schemes will end within the next 5 years).

Sites and locations

King's Sedgemoor RWLA - Egypt's Clyce - NGR ST 40392 34154

The RWLA adjacent to Egypt's Clyce (see Figure 2, Annex A to Appendix 2) is in favourable condition but relies on the clyce being able to effectively pen the Othery Rhyne upstream. The control mechanism is a penstock structure, positioned on a concrete headwall. The penstock allows water from Othery Rhyne to be discharged into the Kings Sedgemoor Drain (KSD), through a 1.5m diameter field access culvert.

To maintain effective penning of water upstream and ensuring condition status of the designated site is maintained, certain elements of the structure need replacing. Specifically, timber pin piling was temporarily installed to address leakage around the concrete headwall. These pin piles have a limited life and so will be replaced with steel sheet piling to provide longevity of effective penning.

The field access culvert that lies between the clyce and the KSD, and which facilitates discharge into the KSD, is a steel Armco 1.5m diameter pipe. The pipe has deteriorated at the outfall, which has been heavily poached and eroded. Furthermore, the ground over the culvert that forms the field access has subsided, which has likely collapsed the culvert. A new culvert and ancillary elements (headwall and outfall) will be replaced to ensure the Othery Rhyne can continue to discharge into the KSD.

Moorlinch RWLA - NGR ST 38958 35998 (centralised) (see Figure 2, Annex A to Appendix 2)

Modelling shows reduced wetting in the Moorlinch SSSI area. If the RWLA was to fail, the conditions on the moor would no longer be maintained by artificially penning, and would be subject to reduced flooding (for the modelled scenario) following implementation of the Scheme.

A short term refurbishment of the Moorlinch RWLA (i.e. to last a further 5 -10 years) has been agreed with Natural England. Maintenance of the RWLA is considered sufficient for mitigating the modelled impacts from the Scheme on the Moorlinch SSSI component of the SPA in the short term.

Short term work will comprise refurbishment and/or replacement of 53 of the existing structures that are integral in maintaining the Moorlinch RWLA. To ensure the Moorlinch RWLA functions effectively for the next 5 years, the following works will be undertaken:

- Cofferdam and dewatering of the upstream section of 13 trench sheet dams and earth bunds, to inspect and refurbish (as required) the associated non return valves;

- Overhaul of 2 tilting weir units;
- Formally close 2 penstock structures;
- Undertake vegetation clearance to facilitate the works and access to all 53 structures; and
- remove and reinstate safety fencing and guarding.

Works will be completed in 2020.

West Moor RWLA – NGR ST 42041 22342 (centralised) (see Figure 3, Annex A to Appendix 2)

Modelling shows a reduction of flood extent and duration within the West Moor SSSI component of the SPA, with 15.26ha identified within the RWLA. It is assumed that the area within the RWLA will not be affected as water will be held by structures to maintain high water levels. This assumption is based on the RWLA working effectively. However, the main RWLA was constructed in 1994 and is at risk of failing.

Like Moorlinch RWLA, it has been agreed with Natural England that a short to medium term refurbishment of the West Moor RWLA will be sufficient to temporarily mitigate the modelled impacts from the Scheme on this component SSSI.

Short term work will comprise refurbishment and/or replacement of 94 of the existing structures that are integral in maintaining the RWLA. To ensure the RWLA functions effectively for the next five years, the following works will be undertaken:

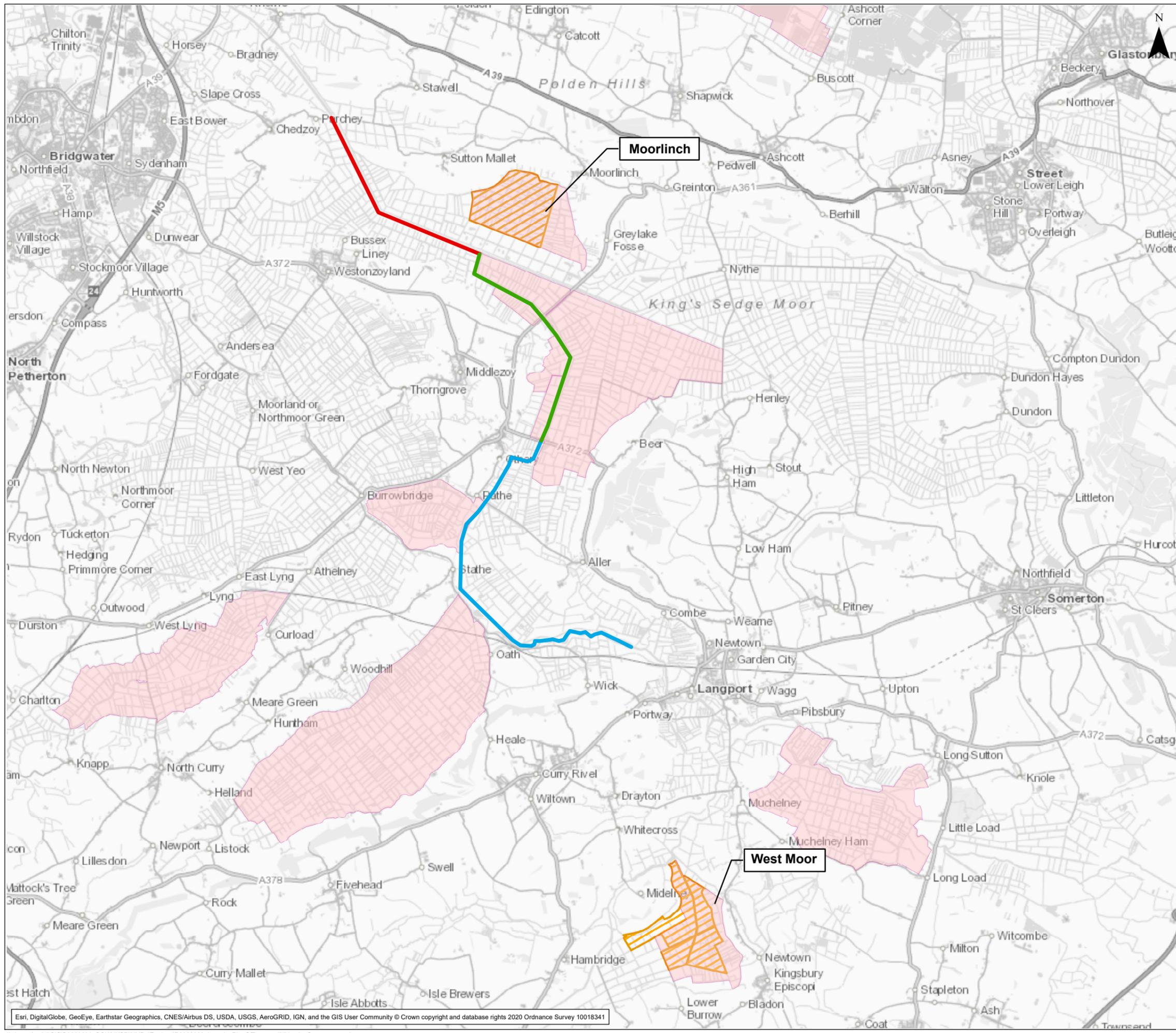
- Refurbishment of four penstock structures that control flow into the RWLA, that will include supplying and fitting of galvanised walkways and associated steel hand rails
- Replacement of three stop log trench sheet dams and two basic trench sheet dams that maintain water levels within the various blocks of the RWLA
- Removal of three further stop log trench sheet dams that have been identified as no longer required.
- Refurbishment of the four tilting weirs that controls the overall water levels in the RWLA
- Refurbishment of two syphons that allows connection under the two main drains that intersect the RWLA.
- Undertake vegetation clearance to facilitate the works and access to all 94 structures; and remove and reinstate safety fencing and guarding.

The refurbishment/replacement of the control structures will largely be like-for-like to the original design, with some upgrading of the sheet pile material and protective coating.

Works will be completed in 2020.

Annex A

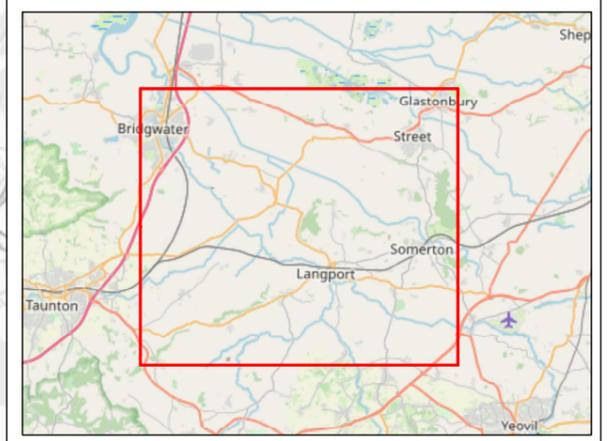
FIGURE 1



Legend

Proposed Scheme

- KSD
- Lower Sowy
- Upper Sowy
- Somerset Levels and Moors SPA and Ramsar sites
- Moorlinch and West Moor Raised Water - Level Areas



PO1	02/04/2020	First issue	JM	JH	MO	IB
Rev.	Date	Description of revision	Drawn	Check'd	Rev'd	Appr'd

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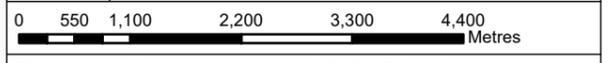
Drawing Title

Location Plan of Proposed Mitigation Structures

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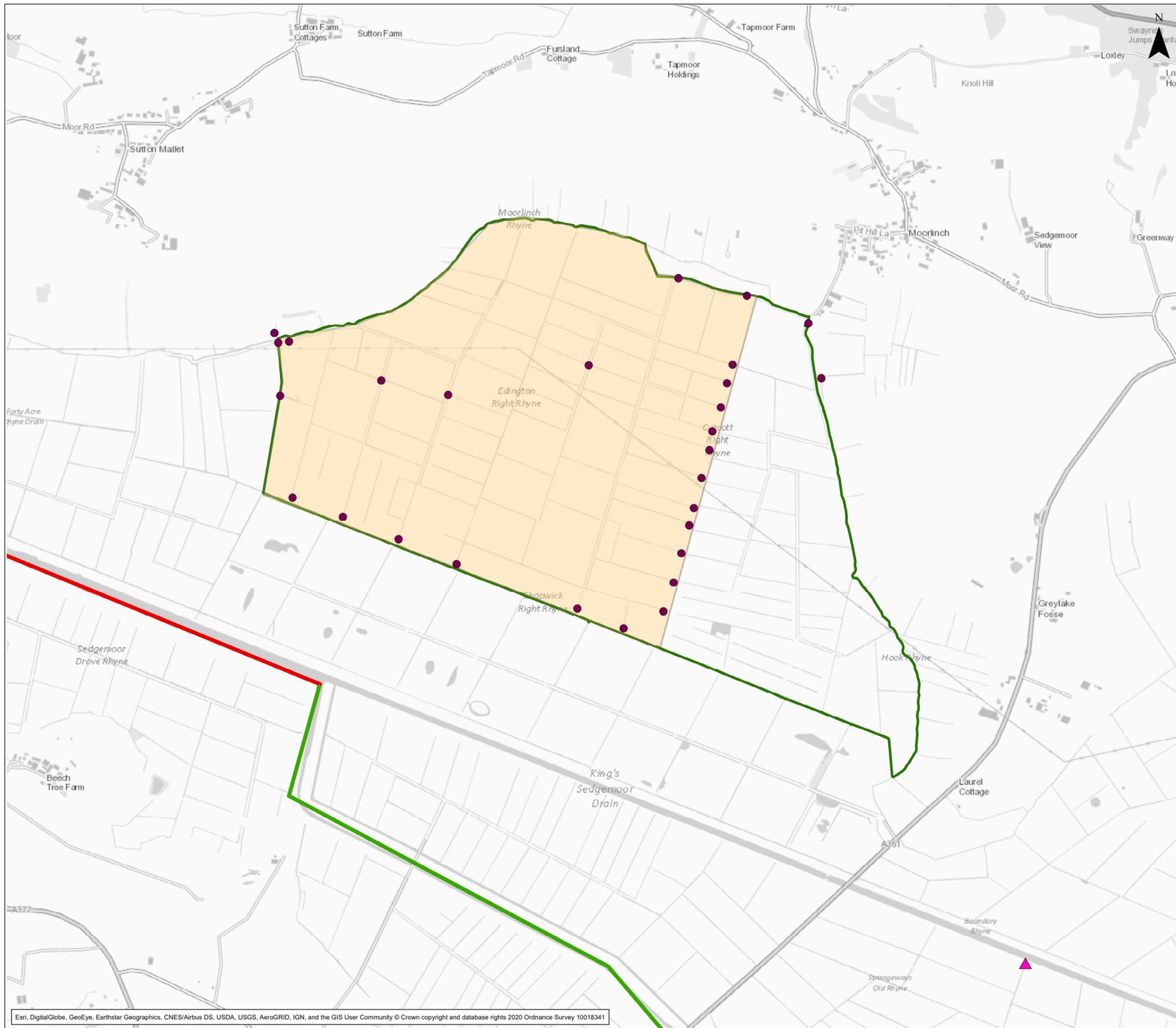
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FIGURE 2



Legend

- Egypt's Clyce
- Proposed Scheme**
- KSD
- Lower Sowy
- Moorlinch Structures
- Moorlinch Raised Water Level Area
- Moorlinch SSSI



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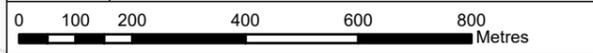
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Moorlinch SSSI and RWLA Mitigation Structures

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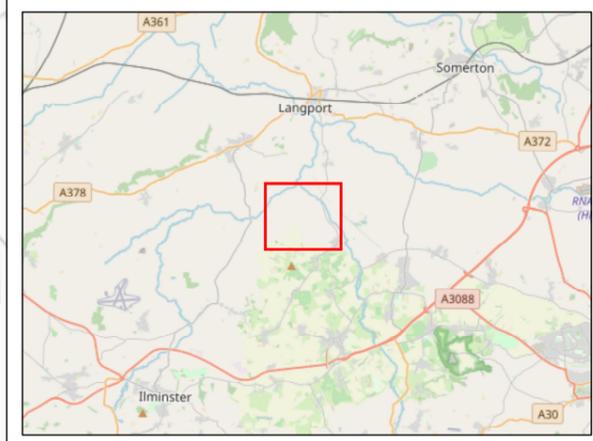
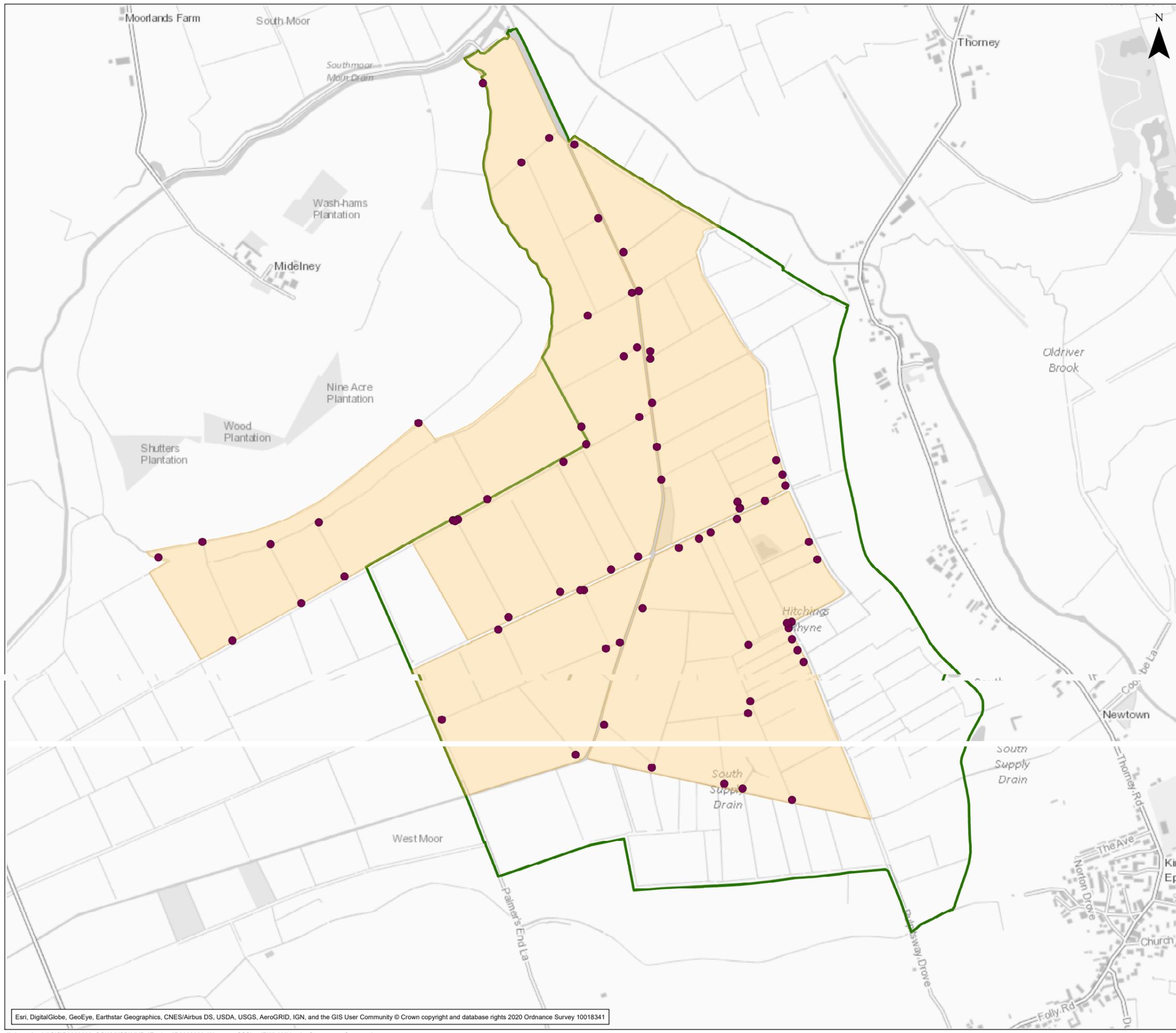
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FIGURE 3

- Legend**
- West Moor Structures
 - West Moor Raised Water Level Areas
 - West Moor SSSI



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Rev.	Date	Description of revision	Drawn	Check'd	Re'v'd	Appr'd



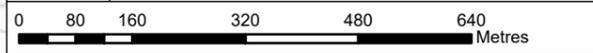
Client **Environment Agency**

Project **River Sowy and King's Sedgemoor Drain Enhancements Scheme**

Drawing Title **West Moor SSSI and RWLA Mitigation Structures**

ENVRESW001353-CH2-ZZ-400-DR-EN-1067

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Appendix 3 Parrett Dredging and River Sowey and King's Sedgemoor Drain Enhancements Scheme Mitigation Plan

River Sowy and King's Sedgemoor Drain Enhancements Scheme

Parrett Dredging and River Sowy and King's Sedgemoor Drain Enhancements Scheme Mitigation Plan

Version 5: update to IDB Mitigation Plan for Parrett Dredge (Version 3: published in IDB Environmental Statement) to also include River Sowy and King's Sedgemoor Drain Enhancements Scheme (hereon referred to as Sowy projects for ease) effects (Table B & Maps 3 & 4) and incorporate an Implementation plan (Table 3) for mitigation actions for both projects. Version 4 used for comment to update in version 3

Tables 3 & 4 and Maps 3 & 4 are included in Annex 1.

<p><i>Version 1- 4</i> <i>10/6/2020</i> <i>Philip Brewin</i> <i>Parrett IDB</i></p>	<p><i>Version 5</i> <i>22/06/2020</i> <i>John Rowlands</i> <i>Environment Agency</i></p>
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1. Introduction

The Somerset Levels and Moors provides exceptional wetland habitat for 10,000s of over-wintering wildfowl and waders (waterbirds). The availability and quality of this habitat depends on effective water level management. The conservation requirements for water level management include maintenance of extensive wet grasslands with wet ditches and large areas of splash flooding in the winter months of December, January and February. For the Parrett Dredging and Sowy projects to be legally compliant, the work must not cause a deterioration in these conditions.

The primary purpose of this mitigation plan is to ensure no deterioration in SPA habitat availability or quality, as a consequence of the Dredging and Sowy projects. It is important to highlight that this plan covers the effects of a full River Sowy and KSD Enhancements scheme (increasing capacity up to 24 cubic metres of water - cumecs) and an IDB dredge project which was planned to increase conveyance by 8 cumecs. The impact of both these projects will initially be less than shown by the modelling outputs within this plan. The Phase 1 Sowy projects will deliver a 17 cumec capacity and the dredge a 3- 4 cumec increase. This plan will allow any future phases of work to have agreed mitigation in place and therefore be legally compliant. It was agreed by all partners that this strategic and phased plan would be the best approach to take in delivering such a large project.

This change will be most apparent for the Langport Moors and the Sowy/KSD corridor. Small winter floods, resulting from minor overtopping of spillways or simply from rainfall and runoff overwhelming watercourses on the Moors, are beneficial to waterbirds. Especially important is their dynamic nature and the consequential fluctuations in water levels that result in the short-term wetting up of low-lying meadows. Another important

aspect is how the projects affect areas of suitable habitat beyond the boundaries of the protected sites. These areas provide supporting habitat (functionally linked land) and are typically wet grassland meadows with few trees that provide feeding opportunities (areas of splash flooding) in wet conditions and are important refuges during larger floods, when waterbirds are displaced from the lower, wetter, sites by deep floods. Hydraulic modelling indicates the projects will, in effect, reduce the magnitude, and therefore the frequency, of small winter floods.

2. Mitigation Objectives

Over the last 30 years, an extensive network of Raised Water Level Areas (RWLA) has been developed and operated across many of the moors. Water levels are maintained close to ground level in these wetland schemes to create surface water conditions in winter months, which are used by waterbirds as night-time feeding sites or daytime safe roost sites. RWLAs are the primary mechanism for achieving the conservation objectives of the SPA. The total area of land under RWLA management in the Parrett catchment is 2,000ha. These areas help mitigate the effects of flood and water management, which generally reduce the wetness of the low-lying meadows in winter and therefore prevent the habitat requirements of the SPA from being met. RWLAs will also act to protect the SPA from the potential impacts of the Dredging and Sowy projects on small winter floods. It is essential that this mitigation plan supports the ongoing maintenance and operation of the existing RWLA network.

This mitigation plan proposes to sustain the existing area of RWLA, recognising that investment will be required for renewal, operation and maintenance of these schemes. If the total area was to fall below current levels, then the mitigation plan will seek to replace the lost area with an equivalent area elsewhere. This is a basic requirement for ensuring that there is no deterioration in SPA habitat availability or quality, and that the SPA retains its favourable status.

The existing Water Level Management Plans (WLMPs) will be complied with and the WLMPs will be reviewed and updated to take account of infrastructure improvements and operational changes and ensure favourable conditions are sustained.

This mitigation plan also includes actions for each Moor to ensure no change to the impact of the Dredging and Sowy projects on the extent, duration and frequency of small winter floods outside of RLWAs. As hydraulic modelling indicates the majority of change will occur outside of protected areas, these actions should focus on the functionally linked land (outside designated areas). Mitigation actions include changing target water levels in winter, to ensure ditches remain wet and surface water features are created during wet conditions.

Alternative options for mitigation have also been identified, including the potential to develop new RWLAs, on functionally linked land. Similar mitigation actions can also be undertaken within designated sites, where there is potential to

extend/consolidate existing wetland schemes or generally improve water level management. Mitigation actions will take into account the broader conservation objectives for each area, including condition status and any remedial actions required to achieve favourable condition.

3. Impacts

The impacts of the Dredging and Sowy projects on the duration and extent of small, environmentally beneficial, winter floods have been identified through hydraulic modelling and mapping. This is summarised in Figures D3.1 and D3.2, which were included in the HRA Appropriate Assessments (see text box below). Table D3.1 further summarises the model output for each area.

Extract from HRA Appropriate Assessment: Summary of hydraulic modelling of the potential impact of the Dredging and Sowy projects on the duration and extent of small, environmentally beneficial, winter floods.

A hydrological modelling study compiled by SDBC has been used to inform this HRA (Appendix 1). The EA hydraulic flood model for the lower Parrett and Tone was used to assess the potential effects of conveyance improvements. Light Detecting and Ranging (LiDAR) land level data were used to calculate the area of land which the model indicated would have at least 50 mm depth of water (splash conditions) at the peak flood level of model runs for the 2012 summer floods. The 2012 summer floods are considered to be a suitable reference event for winter floods that have an estimated probability in occurrence (i.e. a 1 in 3 year to a 1 in 5 year flood event).

The modeling includes the following caveats and assumptions:

The model is calibrated to analyse large flood flows and not changes in more frequent small flood events which are the focus of the study to inform the HRA;

The model uses reference flow events, rather than flows of known probability;

The model does not include the ditch networks or water level management infrastructure; and

Modelling includes the length of the River Parrett from Oath to Burrowbridge which is approximately 50% more than the actual length of proposed dredging from Stathe to Burrowbridge, therefore the actual increase in conveyance will be less.

The model has used the full Sowy scheme outputs (24 cumecs) but with a phase 1 scheme (17 cumecs) being promoted, the impacts will be less than modelled and shown here.

The model has predicted changes to the level and duration of winter surface splash flooding in the following areas outlined in Table D3.1 as a result of the dredging of the River Parrett. The results of the hydrological modelling are also presented in Figures D3.1 and D3.2.

Using the 2012 summer floods as a proxy for a small winter flood, hydraulic modelling of current baseline conditions indicates a total flood area across all Parrett Moors of nearly 3,500 ha. This reduces by nearly 300 ha as a result of the Parrett dredging in the model. Across all moors there is an approximate 7% reduction in flood area. Changes in flood extent are greatest (70%) outside the areas of SSSI (200 ha) and 80% is outside of Raised Water Level Areas (RWLAs) (230 ha). It must be noted that the reductions will in fact be smaller initially for the proposed project dredging and Sowy projects, as the dredging is approximately 50% of the modelled scheme and the improved conveyance for the Phase 1 Sowy projects is less than the full scheme improvements.

Langport Moors, West Sedgemoor, Aller Moor, King's Sedgemoor and Chedzoy experience the greatest change in flood extent and have a predicted minimum 10% reduction in flooding. Reductions in flood duration are relatively small: typically, a 12-hour to a 2-day reduction in flooding due to increased flood flow conveyance of the River Parrett.

RWLAs considerably contribute to achieving and sustaining wetland condition of the SPA and maintain the required conditions during December to February. It is possible to compare RWLA to the effect of dredging in terms of area and duration: ha/days (the length time flooded multiplied by area). Assuming 50% the area within RWLAs achieves the required winter conditions, RWLAs contribute 167,300 ha/days, which compares with a reduction of 1500 ha/days for a typical winter flood as a consequence of the proposed Parrett Dredge. This represents a 1% reduction in SPA winter flood conditions due to dredging, when compared to the combined contribution of RWLAs. The potential effect associated with water level management upon the Somerset Levels and Moors SPA and Ramsar site is predicted to be minor adverse.

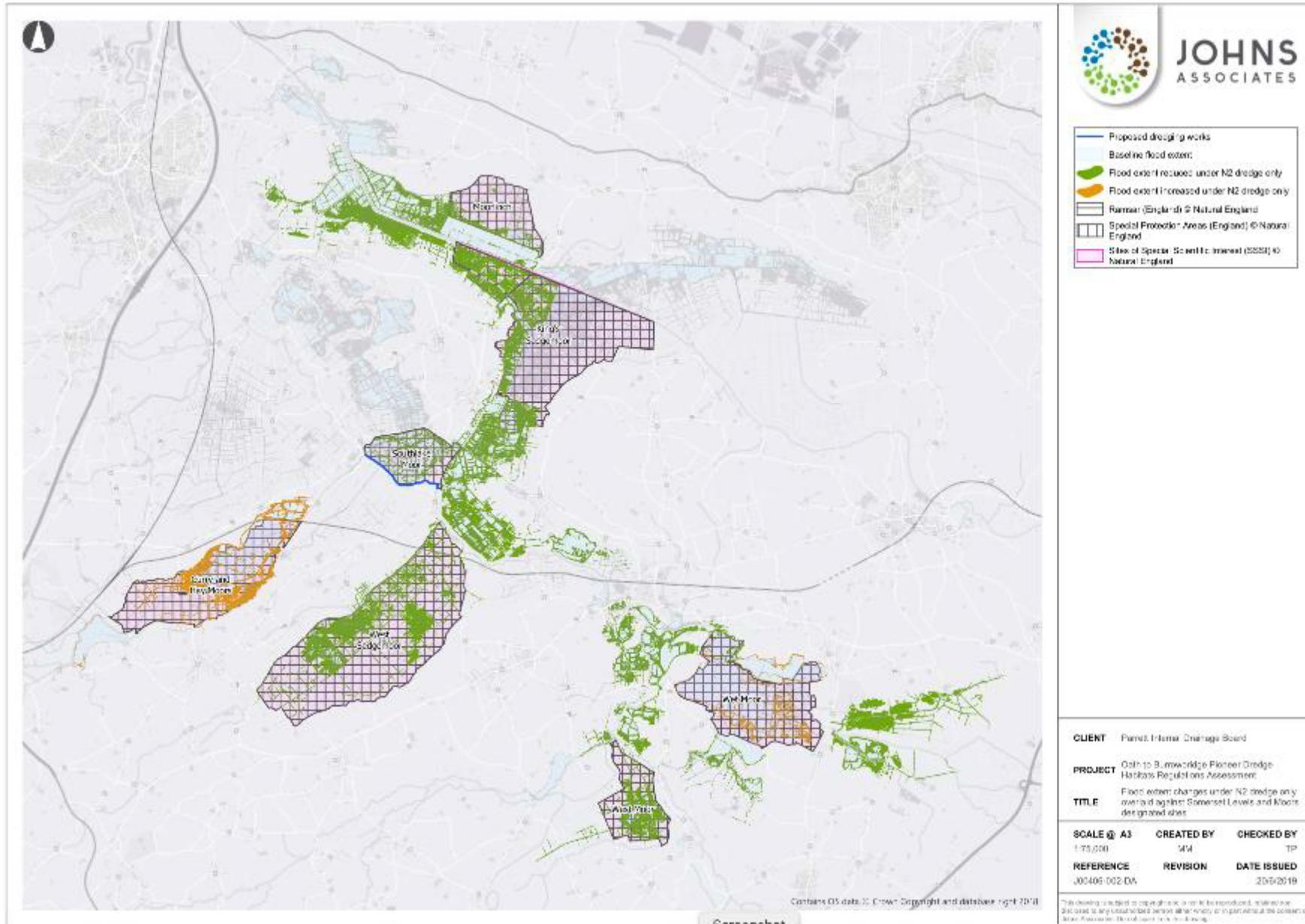


Figure D3.1 (from HRA and Appropriate Assessment): Analysis of Indicative Changes in Flood Extent for the Parrett Dredge

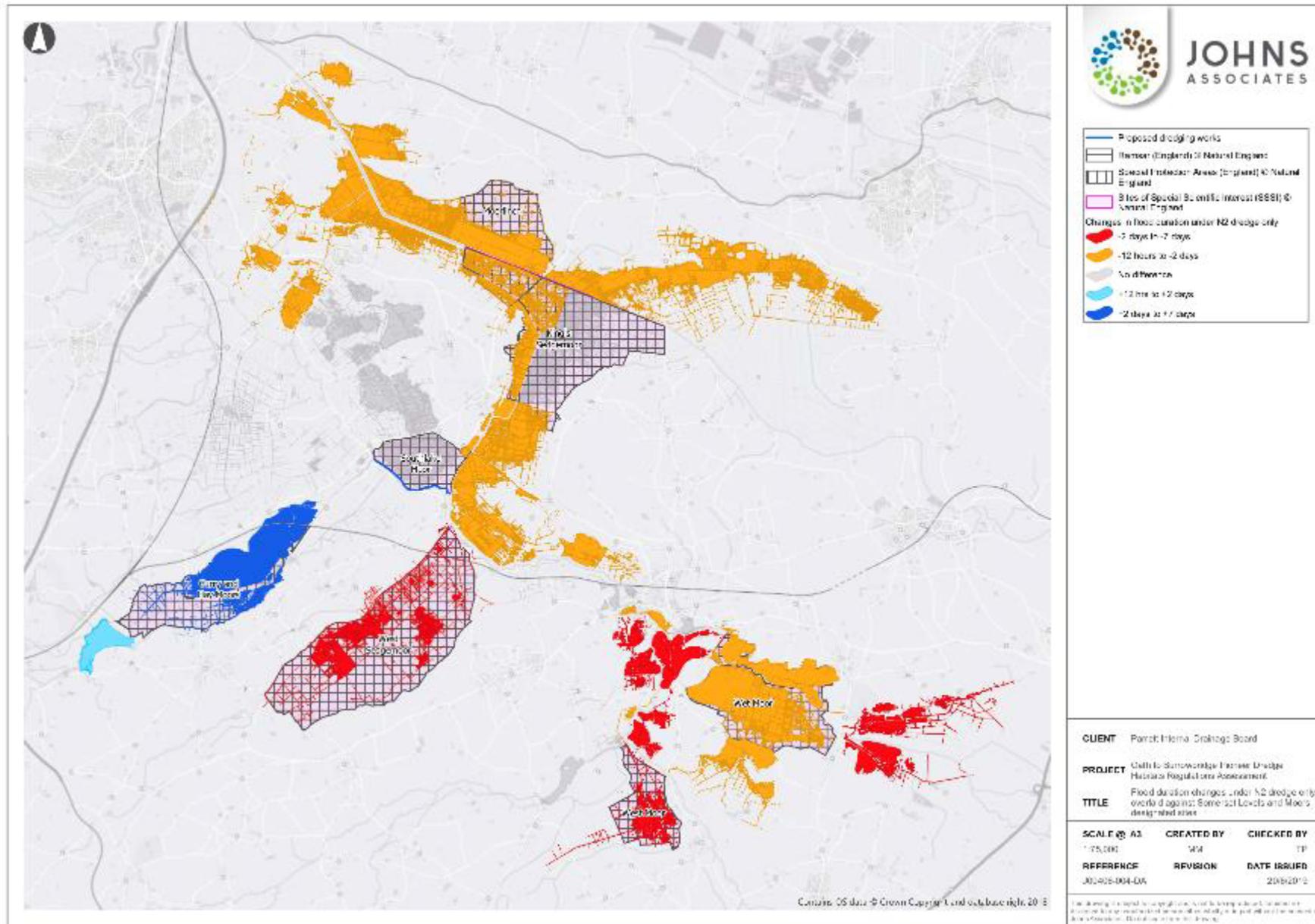


Figure D3.2 (from HRA and Appropriate Assessment): Analysis of Indicative Changes in Flood Duration for the Parrett Dredge

Table D3.1 - Indicative change in flood extent and duration for the Parrett Dredge

Hydraulic modelling was used to identify potential changes in the level and duration of flooding, for a small winter flood, as a consequence of the Parrett Dredge. Table D3.1.

Area	Change (ha)	Change within SSSI	Change outside SSSI	Change within RWLAs	Change outside RWLAs	Change in flood duration
Long Load	-69.4	0	-69.4	0	-69.4	-2 days to -7 days
Wet Moor	-29.7	0.3	-30	1.21	-31.09	6 Areas: -12 hrs to -2 days
						4 Areas: -2 days to -7 days
West Moor	-22	-21.8	-0.2	-12.78	-9.22	-2 days to -7 days
South Moor	-2.2	0	-2.2	0	-2.2	1 Area -2 days to -7 days
						1 Area: -12 hrs to -2 days
						3 Areas: No difference
Huish Level	-4.9	0	-4.9	0	-4.9	-2 days to -7 days
Langport Moors	-0.9	0	-0.9	0	-0.9	1 Area: -12 hrs to -2 days
						1 Area: No difference
West Sedgemoor	-58.5	-57.7	-0.8	-36.42	-22.08	2 Areas: No difference
						1 Area: -2 days to -7 days
Stanmoor	0	0	0	0	0	No difference
Currymoor	59	43.5	15.5	2.41	56.59	1 Area +12 hrs to +2 days
						2 Areas: +2 days to +7 days
Northmoor	0	0	0	0	0	No difference
Aller Moor	-65.2	-6.1	-59.1	-6.24	-58.96	7 Areas: -12 hrs to -2 days
						1 Area: No difference
King's Sedgemoor (SSSI)	-39.3	-35.9	-3.4	-1.05	-38.25	4 Areas: -12 hrs to -2 days
						1 Area: No difference
King's Sedgemoor (Butleigh & Walton)	0	0	0	0	0	No difference
Moorlinch	-7	-2	-5	-3.65	-3.35	-12 hrs to -2 days
Southlake	-1.8	-1.7	-0.1	-1.78	-0.02	No difference
Earlake	0	0	0	0	0	No difference
Langmead & Weston	0	0	0	0	0	No difference
Chedzoy	-47.2	0	-47.2	0	-47.2	-12 hrs to -2 days
Bawdrip & Bradney	0	0	0	0	0	No difference
TOTAL	-289	-81	-208	-58	-231	

4. Mitigation Action Plan

Based on the impacts identified from the modelling, mitigation options have been attributed to each area and developed into actions, through consultation with EA, NE and PIDB.

The following Table 1 “General Water Management Mitigation Measures” identifies mitigation actions that are applicable to all areas. Site specific and detailed actions are included in section 5 and Table 2 “Site Specific Water Management Mitigation Measures”

Following implementation of the mitigation measures identified in Table 2, the proposed Dredging and Sowy projects are unlikely to have a significant effect on the Somerset Levels and Moors SPA.

Table 1. General Water Level Management Mitigation Measures: These actions apply to all areas. Site specific actions are identified in Table 2 below.

General actions	Description	Type	Responsible Body	When	Actions
All areas	Ensure water level management (especially in winter) meets the operational requirements (target water levels) of the agreed WLMPs. Report annually on status of WLMP implementation.	WLMP compliance	IDB/EA	ongoing	All WLMPs for the Parrett area are nearly 10 years old and need updating to take account of investments and operational changes since the plans were last produced. WLMPs will be the primary documents for ensuring protected sites achieve and sustain favourable condition status and to implement mitigation actions for Parrett Dredging and the Sowy.
All areas	Maintain and update WLMPs, extend WLMPs to include Functionally Linked Land (FLL) here necessary. Report annually on status of WLMP development outside of SSSIs.	WLMP update	IDB	Autumn 2020	Areas impacted by Dredging and Sowy projects, where current WLMPs do not include winter penning levels for nature conservation including: Aller Moor, Chedzoy and Kings Sedgemoor.
All areas	Sustain existing RWLA network. Maintain existing schemes, seek opportunities to improve the operation, or extend existing schemes. Implement new areas if existing schemes fall out of operation. Report annually on status of RWLA network.	RWLAs	IDB/EA	Ongoing	Significant investment has been made in recent years to improve RWLA management. Existing RWLAs that are currently failing to meet this requirement include West Moor and Moorlinch.
All areas	Maintain and improve existing water management infrastructure required to achieve the conservation objectives of the protected sites and the wider area (FLL). Report annually on status of water management infrastructure.	Water management infrastructure	IDB/EA	Ongoing	Significant investment has been made in recent years to improve water management infrastructure. Notable areas, where further investment is required, include: King's Sedgemoor and West Moor.
All areas	Channel maintenance. Ensure channel maintenance is sympathetic to nature conservation. In particular, ensure maintenance is undertaken at the most appropriate time of year and in accordance with agreed specifications. Report annually on maintenance programme.	Operations (channel maintenance)	IDB/EA/farmers (supported by agri-environment funding)	Spring 2020	Parrett IDB will review maintenance programmes before the end of 2019 and will agree maintenance specifications and timings with NE.

General actions	Description	Type	Responsible Body	When	Actions
<p>Within SSSIs</p> <p>See Table 2 (below) for details</p>	<p>Mitigate for the predicted changes in small winter floods as a consequence of Dredging and the Sowy projects. Modelling indicates that the combined impact of these schemes across all Parrett wetland SSSIs is 100ha less of splash flooding, with duration of flooding typically reduced, by 2 days, to one week for a flood of the same magnitude as the summer 2012 flood. No assessment of the impacts on flood frequency could be made, but it can be assumed that Dredging and the Sowy projects will reduce the frequency of small floods in winter. Report annually on this requirement.</p>	<p>Strategic planning and operational delivery. Structures and operations (water levels).</p>	<p>IDB/EA</p>	<p>Spring 2020</p>	<p>See site specific actions (Table 2) for a list of potential measures that can, in combination, meet this requirement. Not all actions identified in Table 2 will be practical and achievable. Given potential uncertainties over the achievability of some actions, more actions have been identified than will be required for mitigation. The minimum requirement is to mitigate for reduced winter flooding on 100ha SSSI land.</p>
<p>Outside SSSIs</p> <p>See Table 2 (below) for details</p>	<p>Mitigate for the predicted changes in small winter floods as a consequence of Dredging and the Sowy projects. Modelling indicates that the combined impact of these schemes across all non-designated areas of the Parrett is 500ha less of splash flooding, with duration of flooding typically reduced, by 2 days, to one week for a flood of the same magnitude as the summer 2012 flood. No assessment of the impacts on flood frequency could be made, but it can be assumed that Dredging and the Sowy projects will reduce the frequency of small floods in winter. Report annually on this requirement.</p>	<p>Strategic planning and operational delivery. Structures and operations (water levels).</p>	<p>IDB/EA</p>	<p>Spring 2020</p>	<p>See site specific actions (Table 2) for a list of potential measures that can, in combination, meet this requirement. Not all actions identified in Table 2 will be practical and achievable. Given potential uncertainties over the achievability of some actions, more actions have been identified than will be required for mitigation. The minimum requirement is to mitigate for reduced winter flooding on 500ha of non-designated land.</p>

5. Site Specific Mitigation Actions

5.1. Monitoring of effects

5.1.1. Ecological monitoring – The primary source of ecological data, relating to the SPA, is bird count data from the British Trust for Ornithology (BTO). BTO data will be collected by Natural England and analysed once a year to identify any changes in the number of birds using the SPA. This data will help identify ecological change that may require mitigation.

5.1.2. Water level monitoring – Where detrimental change is likely as a consequence of the Dredging or Sowy projects, continuous water level data will be collected by the Environment Agency at key locations for each moor and analysed once a year for any discernible trends that might be attributed to the Dredging or Sowy projects. Historical water level records will be used to identify trends in data collected after the Dredging and Sowy projects have been implemented. If necessary, new telemetry will be installed to monitor conditions in specific locations. Data analysis will focus on identifying changes in the frequency and duration of small winter floods. If detrimental trends in water levels are detected, further meteorological and climate data such as rainfall and temperature will be analysed in order to better understand the causes of those trends.

5.2. Mitigation measures including Water Level Management Mitigation Measures

Where detrimental change, as a consequence of the Dredging or Sowy projects, has been identified and confirmed by monitoring, appropriate mitigation measures will be deployed. Mitigation measures will be agreed with the partners (Natural England, IDB and EA) prior to implementation.

5.2.1. Replacement or new water control structures – Replace failing structures, or build new structures, that are necessary to effect 'no change' to existing surface water conditions during winter months (December to February) and ensure no detrimental change in SPA condition as a consequence of the Dredging and Sowy projects.

5.2.2. Operational protocols – Where monitoring indicates it is necessary, and it is agreed that other measures are less suitable, existing water level control structures such as pumping stations and sluices can be operated to effect 'no change' to existing conditions during winter months (December to February) and ensure no detrimental change as a consequence of the Dredging and Sowy projects. This could be achieved by evacuating excess flood water in accordance with existing protocols but suspending evacuation for a short period of time once an agreed level is achieved to safeguard the 'splash conditions' that would otherwise be lost. If required, these changes will only be implemented during

small winter floods that pose no increased flood risk to homes, businesses and infrastructure (e.g. local roads). And the operational risk for each location will need to be carefully considered and the agreed protocols incorporated into the Water Level Management Plan for each area.

- 5.2.3. Water Level Management Plan (WLMP)** – Water Level Management Plans will be reviewed with partner organisations by 2022. Changes to water control structures and water levels, agreed in the intervening period, will be incorporated in WLMPs.
- 5.2.4. Maintain a depth of water (minimum of 300mm) in ditches through the winter period** – This will include the ditch network within and outside the designated sites where ditches have sufficient depth to achieve this without increasing flood risk.
- 5.2.5. Creation of in-field wet features** – To maintain surface water conditions for waterbirds in winter, such as creation of shallow water scrapes and wet field gutters.

Table 2. Site specific Water Level Management Mitigation Measures: the current condition status of Parrett SSSIs, and existing remedial actions required for each site to achieve favourable condition status, have been used to inform selection of mitigation measures required to effect 'no change' to existing surface water conditions during winter months (December to February) and ensure no detrimental change in SPA condition as a consequence of the Dredging and Sowey projects. Refer to Table D3.1 (above): for potential size and probably location of effect.

Area	Description	Mitigation type	Responsible Body	When	Actions
Aller Moor	Monitor surface water conditions in winter, new telemetry required for Aller Moor, upstream of Aller Drove.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Remedial Work at Beer Wall to prevent water bypassing structure during high flows.	Rebuild structures	EA	Completed 2019	Part of Sowey project, but not mitigation, due to defect causing unanticipated changes in surface water conditions on Aller Moor in winter.
	Implement changes in the operation of Langacre and Beer Wall or IDB structures on Aller Moor	Operational Protocols	EA/IDB	Winter 2020/21	Implement operational changes to effect 'no change' in winter months. Informed by monitoring. Use EA structures Church Drove, Oxleaze Drove and IDB structure Stathe Drove to pen winter level. Operate IDB weirs Lucas Rhyne, Black Withies and Leazeway to maintain water levels in winter.
King Sedgemoor (Non SSSI) Butleigh and Walton Moor, 18 ft rhyne	Monitor surface water conditions in winter, new telemetry required for Butleigh and Walton Moor, 18 ft rhyne.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.
	Land purchase to create new RWLA.	New structures	IDB/NE	2025	Potential to mitigate changes in surface water conditions in winter.

Area	Description	Mitigation type	Responsible Body	When	Actions
	Monitor water levels using telemetry at Greylake and Nythe structure.	Monitoring	IDB	2020 – 2022	Operate to effect 'no change' in winter months. Informed by monitoring.
	Implement changes in the operation of Greylake sluice, or other alternative.	Operating protocols	IDB	2022	If required and feasible, as informed by monitoring.
West Sedgemoor	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.
Long Load	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Area has low SPA potential due to disturbance and flood risk management constraints.
	Implement changes in the operation of Long Load pumping station and syphon.	Operational protocols	EA	2021	Operate to effect 'no change' in winter months. Only if effect seen through monitoring?
	Prepare WLMP (no existing WLMP for this area).	WLMP	IDB	2025	To agree and formalise target water levels and operational protocols. Area has low SPA potential due to land use and disturbance constraints.
Wet Moor SSSI	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Implement changes in the operation of North barrier Sluice to sustain surface water conditions in winter.	Operational protocols	EA	2021	Operate to effect 'no change' in winter months. Informed by monitoring.
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.

Area	Description	Mitigation type	Responsible Body	When	Actions
West Moor	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Rebuild and maintain existing RWLA including syphons, bunds and flap valves.	Refurbishment / Rebuild structures	EA construction IDB maintenance and operation	2020/21	Refurbish 68 structures in total (works varying from replacing fences to replacement of trench sheet dams) Possibility to extend the RWLA, re resilient wet grassland project.
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.
Huish Level	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Area has low SPA potential due to disturbance and flood risk management constraints.
	Prepare WLMP (no existing WLMP for this area).	WLMP	IDB	2025	To agree and formalise target water levels and operational protocols. Area has low SPA potential due to disturbance and flood risk management constraints.
Moorlinch	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Rebuild and maintain existing RWLA, including bunds and flap valves, and consider extension to the east.	Refurbishment / Rebuild structures and operational changes	EA construction IDB maintenance and operation	2020/21	Refurbish 28 structures in total (works varying from replacing fences to refurbishment of existing structures) Restoration of neglected ditch habitats (low water depth and very poor water circulation through SSSI ditches) is impacting habitat quality and water level management.
	Implement changes in the operation of IDB weirs to extend existing RWLA to the east.	Operational changes	IDB	2021	Operate to effect 'no change' in winter months. Informed by monitoring.

Area	Description	Mitigation type	Responsible Body	When	Actions
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.
King Sedgemoor (SSSI)	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Rebuild Egypt Clyse.	Rebuild structures	Rebuild structures	2020/21	Refurbishment of upstream headwall and discharge culvert. Maintain current operational practices (closed in winter).
	Maintain existing RWLA.	Rebuild structures	IDB	2020	Extreme high silt levels in SSSI ditches and rhynes have compromised the summer feed to KSM and is impacting SSSI condition. Bunds and fencing need repair and maintenance.
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.
Currymoor	Monitor surface water conditions in winter.	Monitoring	EA	Continuation of existing EA mitigation programme	Monitor surface water conditions in winter
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.
Southlake Moor	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.
Chedzoy	Monitor surface water conditions in winter.	Monitoring	IDB/EA	Report annually	Implement operational changes to effect 'no change' in winter months. Informed by monitoring.

Area	Description	Mitigation type	Responsible Body	When	Actions
	Update WLMP.	WLMP	IDB	2022	To agree and formalise target water levels and operational protocols.

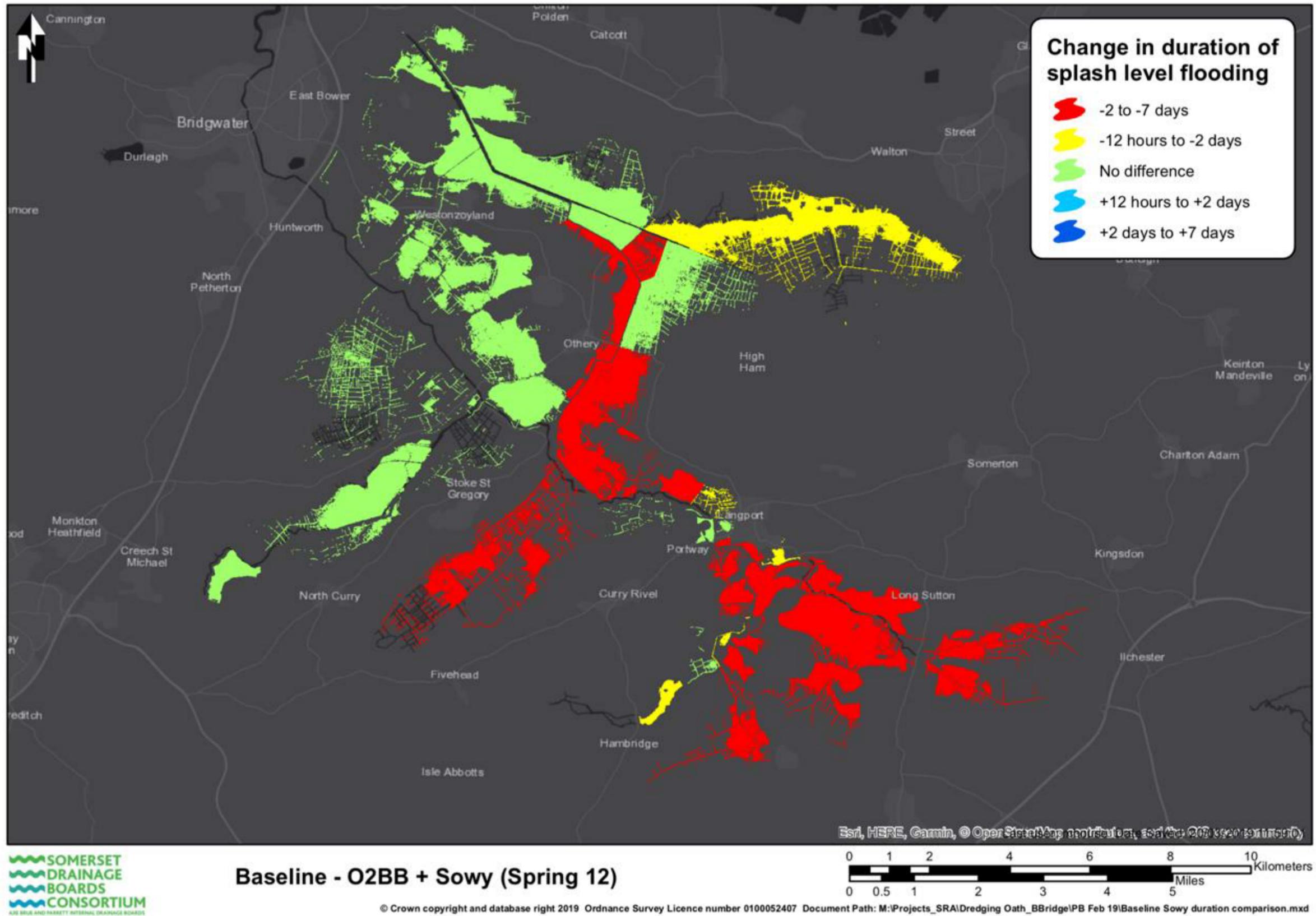
ANNEX 1

Table 3: Indicative change in flood extent and duration for the Parrett Dredge and Sowy Project combined

Hydraulic modelling was used to identify potential changes in the level and duration of flooding, for a small winter flood, as a consequence of the combined Parrett Dredge and River Sowy and King's Sedgemoor Drain Enhancement Scheme.

Area	Change (ha)	Change within SSSI	Change outside SSSI	Change within RWLAs	Change outside RWLAs	Change in flood duration
Long Load	-84.1	0	-84.1	0	-84.1	-2 days to -7 days
Wet Moor	-63.4	-1.3	-62.1	0.94	-64.48	-2 days to -7 days
West Moor	-26.1	-25.8	-0.3	-15.26	-10.84	-2 days to -7 days
South Moor	-3.9	0	-3.9	0	-3.9	1 Area -2 days to -7 days
						2 Areas: -12 hrs to -2 days
						2 Areas: No difference
Huish Level	-21.7	0	-21.7	0	-21.7	-2 days to -7 days
Langport Moors	-5.8	0	-5.8	0	-5.8	1 Area -2 days to -7 days
						1 Area: -12 hrs to -2 days
West Sedgemoor	-88.9	-87.7	-1.2	-54.49	-34.41	2 Areas: No difference
						1 Area: -2 days to -7 days
Stanmoor	0	0	0	0	0	No difference
Currymoor	11.8	8.5	3.3	0.8	11	No difference
Northmoor	0	0	0	0	0	No difference
Aller Moor	-205.4	-33.7	-171.7	-15.61	-189.79	6 Areas: -2 days to -7 days
						1 Area: -12 hrs to -2 days
						1 Area: No difference
King's Sedgemoor (SSSI)	47.3	45.4	1.9	-1.1	48.4	3 Areas: -2 days to -7 days
						2 Areas: No difference
King's Sedgemoor (Butleigh & Walton)	-188.8	0	-188.8	-5.81	-182.99	No flood duration model output available
Moorlinch	7.4	-0.5	7.9	-0.84	8.24	No difference
Southlake	-3.8	-3.8	0	-3.8	0	No difference

Area	Change (ha)	Change within SSSI	Change outside SSSI	Change within RWLAs	Change outside RWLAs	Change in flood duration
Earlake	0	0	0	0	0	No difference
Langmead & Weston	0	0	0	0	0	No difference
Chedzoy	21.7	0	21.7	0	21.7	No difference
Bawdrip & Bradney	0	0	0	0	0	No difference
TOTAL	-604	-99	-505	-95	-509	



Map 4. Indicative change in flood duration for a typical annual winter flood determined from hydraulic modelling of the Parrett Dredging and Sowy projects.

Table 4. Implementation of operational protocols: the current condition status of Parrett SSSIs, and existing remedial actions required for each site to achieve favourable condition status, has been used to inform the selection of mitigation measures. These are required to effect 'no change' to existing surface water conditions during winter months (December to February) and ensure no detrimental change in SPA condition as a consequence of the Parrett Dredging and Sowey projects. Indicative change in flood extent and duration for a typical annual winter flood determined from hydraulic modelling (see Table 3 and maps 3 and 4). Abbreviations: WLMP – Water Level Management Plan, RWLA – Raised Water Level Area.

Early warning monitoring – Where there is a high degree of certainty that there will be no adverse effect. Monitoring could provide early warning of any adverse effects.

Validation monitoring – A monitoring plan put in place to validate predicted effects after implantation of required mitigation.

Area	Projected indicative change extent and duration for a typical annual winter flood	Potential mechanism off change (typical winter flood)	Mitigation type	Mitigation objective	Short-term infrastructure improvements	Required mitigation operational protocols	Responsible Body	WLMP update (to incorporate mitigation protocols)	Strategic mitigation options
Long Load	Reduced flood duration (2 to 7 days) and reduced extent (25-100ha).	Increased conveyance in Sowey and Parrett.	Validation monitoring and operational protocols.	Manage water levels to effect 'no change' in winter months. Confirm with monitoring.	None proposed.	Adjust winter operation of Long Load pumps and syphon to maintain a minimum water level in ditches and mitigate reduced flood conditions.	EA develop and implement operational protocols (winter 2020/21 - Dec 20 to Feb 21)	No WLMP (prepare 2025)	Operate pumps to sustain wetland conditions in winter.
Wet Moor	Reduced flood duration (2 to 7 days) and reduced extent (25-100ha).	Increased conveyance in Sowey and Parrett.	Validation monitoring and operational protocols.	Manage water levels to effect 'no change' in winter months. Confirm with monitoring.	None proposed.	Operate of North Barrier Sluice and Ablake Sluice to mitigate reduced flood conditions. Changes in HEPs operating protocols are considered unrealistic due to flood sensitive infrastructure.	EA develop and implement operational protocols (winter 2020/21- Dec 20 to Feb 21)	2022	None proposed.
West Moor	Reduced flood duration (2 to 7 days) and reduced extent (25-100ha).	Increased conveyance in Sowey and Parrett.	Validation monitoring, infrastructure improvements and operational protocols.	Manage water levels to effect 'no change' in winter months. Confirm with monitoring.	Refurbish and maintain existing RWLA including refurbishment works on 68 structures.	Adjust winter operation of Middelney pumps to mitigate reduced flood conditions.	EA infrastructure (2020) EA develop and implement operational protocols (2020)	2022	Remove RWLA structures to restore connectivity and operate pumps to sustain wetland conditions in winter.
South Moor	Reduced flood duration (2 to 7 days) and reduced extent (<25ha).	Increased conveyance in Sowey and Parrett.	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed.		No WLMP	None proposed.
Huish Level	Reduced flood duration (2 to 7 days) and reduced extent (<25ha).	Increased conveyance in Sowey and Parrett.	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed.		No WLMP	None proposed.
Langport Moors	Reduced flood duration (2 to 7 days) and reduced extent (<25ha).	Increased conveyance in Sowey and Parrett.	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed.		No WLMP	None proposed.
West Sedgemoor	Reduced flood duration (2 to 7 days) and reduced extent (25-100ha).	Increased conveyance in Sowey and Parrett.	Validation monitoring and operational protocols.	Manage water levels to effect 'no change' in winter months. Confirm with monitoring.	None proposed.	Adjust winter operation of IDB weirs (North East Block) to maintain a minimum water level in ditches. Adjust winter operation of pumps and Black Smock Sluice to mitigate reduced flood conditions.	EA/IDB develop and implement operational protocols (2020)	2022	Consolidation of Northside RWLA and operational protocols for enhance floodplain connectivity and floodwater storage in Southside Black Smock system.

Area	Projected indicative change extent and duration for a typical annual winter flood	Potential mechanism off change (typical winter flood)	Mitigation type	Mitigation objective	Short-term infrastructure improvements	Required mitigation operational protocols	Responsible Body	WLMP update (to incorporate mitigation protocols)	Strategic mitigation options
Stanmoor	No change in flood duration(<12hrs) or extent (<25ha).	None. Small pump system unconstrained by river flows and no bank overtopping.	Early warning monitoring.	Provide evidence of adverse effects.	Monitoring: telemetry required for Saltmoor (remote from pumps).	None proposed.		No WLMP	
Currymoor	No change in flood duration(<12hrs) or extent (<25ha).	Pump system influenced by level at Parrett Tone confluence. Interaction between increased conveyance in Parrett and Sowey.	Early warning monitoring and operational protocols.	Provide evidence of adverse effects.	None proposed.	None proposed.		2022	Operate pumps to sustain wetland conditions in winter by either increasing winter pen level or the retention of splash conditions.
Northmoor	No change in flood duration(<12hrs) or extent (<25ha).	None. Pump system unconstrained by river flows and no spillway flow.	Early warning monitoring and operational protocols.	Provide evidence of adverse effects.	None proposed.	Adjust winter operation of Banklands Bridge Weir to maintain a minimum water level in ditches.	IDB develop and implement operational protocols (2020)	2022	
Aller Moor	Reduced duration (2 days) and reduced max extent (100-250ha) of surface water.	Increased conveyance in Sowey and reduced spillway flow after dredge.	Validation monitoring, infrastructure improvements and operational protocols.	Manage water levels to effect 'no change' in winter months. Confirm with monitoring.	Monitoring: telemetry required for Church Drove and Aller Drove.	Adjust winter operations of IDB and EA weirs to maintaining a minimum water level in ditches (IDB: Lucas Rhyne, Black Withies and Leazeway - EA: Beer Wall, Church Drove, Oxleaze Drove and IDB structure Stathe Drove). Adjust winter operation of Langacre Rhyne at Beer Wall, or IDB structures on Lucas, Leazeway and Black Withies Rhyne to mitigate reduced flood conditions.	EA/IDB develop and implement operational protocols (winter 2020/21 – Dec 20 to Feb 21)	2022	Increase floodplain connectivity of Langacre system.
King Sedgemoor SSSI	Reduced flood duration (2 to 7 days) and reduced extent (25-100ha).	Increased conveyance in Sowey and reduced spillway flow after dredge.	Validation monitoring, infrastructure improvements and operational protocols.	Manage water levels to effect 'no change' in winter months. Confirm with monitoring.	Rebuild Egypt Clyse (EA 2020). Maintain existing RWLA (IDB). Monitoring: telemetry required for Middlezoy Moor, Othery Rhyne and RWLA Block 3.	Recent operational changes for Langacre and Othery Rhyne system already provide adequate mitigation.	EA construction (2020) No operational changes required IDB provision of telemetry	2022	Further enhance floodplain connectivity of Langacre system.
Butleigh & Walton KSM	Reduced max extent (100-250ha). No flood duration model output available.	Interaction between increased volume in KSD and reduced spillway flow from Parrett.	Validation monitoring, infrastructure improvements and operational protocols.	Manage water levels to effect 'no change' in winter months. Confirm with monitoring.	Monitoring: telemetry required for 18ft Rhyne and Butleigh Drove.	Adjust operation of Greylake sluice to mitigate reduced flood conditions or seek suitable alternative. For example, adjust winter operation in adjacent areas, Sutton Moor, Pitney, Somerton Moor, Low Ham Moor to maintain a minimum water level in ditches.	EA/IDB develop and implement operational protocols (2020)	2022	Potential for RWLA type schemes.

Area	Projected indicative change extent and duration for a typical annual winter flood	Potential mechanism off change (typical winter flood)	Mitigation type	Mitigation objective	Short-term infrastructure improvements	Required mitigation operational protocols	Responsible Body	WLMP update (to incorporate mitigation protocols)	Strategic mitigation options
Moorlinch	No change in flood duration(<12hrs) or extent (<25ha).	Interaction between increased volume in KSD and reduced spillway flow from Parrett.	Early warning, infrastructure improvements and operational protocols.	Provide evidence of adverse effects.	Rebuild and maintain existing RWLA, including bunds and flap valves. Rebuild Parchey tilting weir.	Restore operation of micro-roost (NE). Adjust winter operation of Shapwick Right Rhyme (IDB) to buffer RWLA and sustain ditch levels and splash conditions across SSSI.	EA construction (2020) IDB develop and implement operational protocols (winter 2020/21 – Dec 20 to Feb 21)	2022	Remove RWLA structures to restore connectivity and operate IDB structures to sustain wetland conditions in winter. Potential to extend winter splash conditions to include Sutton Hams.
Southlake	No change in flood duration(<12hrs) or extent (<25ha).	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	Permit warping in February
Earlake	No change in flood duration(<12hrs) or extent (<25ha).	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	None proposed.
Langmead & Weston	No change in flood duration(<12hrs) or extent (<25ha).	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	None proposed.
Chedzoy	No change in flood duration(<12hrs) or extent (<25ha).	Interaction between increased volume in KSD and reduced spillway flow from Parrett.	Early warning monitoring and operational protocols.	Provide evidence of adverse effects.	None proposed.	Adjust winter operation of Chedzoy Sluice to maintain a minimum depth of water in ditches.	EA develop and implement operational protocols (2020)	2022	Potential for RWLA type scheme, Sedgemoor Drove.
Bawdrip & Bradney	No change in flood duration(<12hrs) or extent (<25ha).	Interaction between increased volume in KSD and reduced spillway flow from Parrett.	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	None proposed.

Appendix 4

PARRETT FLOOD RELIEF CHANNEL - CURRENT AND PROPOSED OPERATIONAL PROCEDURES

This procedure describes under what circumstances the flood relief channel is used and how Monk's Leaze Clyce operates. It provides details of the current procedure based on an assumed channel capacity of 17m³/s plus the small revisions that will be required following the proposed increase to 24m³/s. Appendix 3 summarises the procedure and provides a schematic showing the relationship of all pumping stations and spillways in the Parrett valley.

Trigger levels

1. All the side sluices along the flood relief channel are closed and Monk's Leaze Clyce is opened to allow 17m³/s to flow through. This is equivalent to the capacity of channel upstream of Beer Wall and should not cause flooding of land anywhere. These actions are taken when it is anticipated from monitoring and metrological information that when overtopping of the banks of the River Parrett at Aller Moor Spillway and Beasley's Spillway may occur (i.e. Parrett over 6.5m at West Sedgemoor and rising).
2. At a level just below that at which the River Parrett overtops via the spillways, pumping at West Sedgemoor Pumping Station is stopped. Pumping recommences when overtopping both stops and would not occur if pumping re-started.
3. If the River Parrett continues to rise, the water will overtop at Beasley's Spillway first (but only just) and subsequently Aller Moor Spillway. Some water overtopping Aller Moor Spillway will be retained upstream of the "throttle" and the remainder (including the overtopping at Beasley's spillway) will flow into the flood relief channel. If overspill starts to overload the flood relief channel, Monksleaze is progressively closed to keep the flood relief channel just within capacity. When necessary it is completely closed.
4. Monk's Leaze Clyce is incrementally opened when:
 - The Parrett is falling and no further significant rainfall is expected
 - The spillways are expected to stop, or have stopped, overtopping.

Following some modelling work, it is possible to create a balance in terms of volumes entering the Sowy channel either via the spillways or through the clyce and maintain a maximum agreed volume with the incremental opening or closing of the clyce.

The other sluices on the flood relief channel are operated as flooding of the land requires consistency with other EA responsibilities.

Current procedures based on 17m³/s capacity

1. Sowy (Parrett Flood Relief Channel)

- i. If the River Parrett has reached 6.5m AOD at West Sedgemoor and is rising, the Sowy should be put into operation. Levels in the Sowy need to be drawn down in preparation before Monk's Leaze Clyce is opened. This is done by opening both Dunball and Beer Wall sluices first. Monk's Leaze Clyce must be opened no more than 0.70m (this level is highlighted by the white mark on the sluice guide on site) or via EA telemetry system linked to 24-hour duty officers.
- ii. When Monk's Leaze Clyce is to be opened all other sluices (Appendix 2) must be operated in accordance with the instructions below.

- iii. Ensure that flow into Southlake is stopped by closing the inlet at Aller Drove and Challis Wall Sluice (see 2 a) i below). **NO FLOOD FLOW FROM SOWY MUST FLOW THROUGH PENZOY SYSTEM UNDER ANY CIRCUMSTANCES.**
- iv. If Sowy approaches bank full, regulate Monk's Leaze Clyce to avoid overtopping. In a severe event overtopping will cause Sowy capacity to be exceeded.
- v. Whenever Parrett spillways run, pumping must cease at West Sedgemoor Pumping Station, Westover Pumping Station, Huish Episcopi Pumping Station, Middelney Pumping Station and Long Load Pumping Station.
- vi. Check Sowy banks upstream of Beer Wall daily whenever running full.
- vii. Inspect Spillways when they have stopped running.
- viii. If the Sowy is going to operate for flood relief in the summer, inform the IDB.

2. Penzoy

- a) At the approach of flood conditions ensure that flow into Southlake at Aller Drove and Challis Wall is stopped (see 1c) above). If the KSD level rises to cause overland flow near Parchey the newly refurbished flap at Lake Wall will close against the differential level.
- b) The operation of Westonzoyland Pumping Station will then be necessary whenever Monksleaze Clyce is opened and the flood relief channel is in flood (***Start Westonzoyland Pumping Station when Lake Wall level is greater than, or equal to, 2.8m and gravity flow has stopped at Chedzoy Clyce.***)

3. King's Sedgemoor Drain

- a) During summer pen period, very heavy rainfall in the KSD/Cary Valley IDB area may require the operation of Greylake Sluice. Consult with Water Level Operative and IDB. (NB: Extended opening will rapidly reduce levels).
- b) Walton Sluice should be operated under similar conditions to the above.
- c) Nythe Sluice is not currently operated – but there is the possibility of using it with a major flood event on the Upper Cary or Parrett and the need to maintain levels in the KSD area.
- d) During an extended flood event Monk's Leaze Clyce should be shut periodically so that drainage from the Chedzoy and KSD area can occur – approximately one day in seven but needs to be at times when impact on the Tone is minimal. This is subject to a degree of flexibility with IDB approval/ agreement.

Revised procedures based on 24m³/s following completion of the River Sowy and King's Sedgemoor Drain Enhancements Scheme

1. Sowy (Parrett Flood Relief Channel)

- a) If the River Parrett has reached 6.5m AOD at West Sedgemoor and is rising, the Sowy should be put into operation. Levels in the Sowy need to be drawn down in preparation before Monk's Leaze Clyce is opened. This is done by opening both Dunball and Beer Wall sluices first. Monk's Leaze Clyce must be opened no more than 1.30m (a new mark will be placed on sluice guide to ensure that opening is accurate to reflect the height of the gate and the volume of water passing through) or via EA telemetry system linked to 24 hour duty officers.
- b) Once the spillways run, Monk's Leaze Clyce will be closed and uncontrolled flooding will occur and water will pass over the traditional flood plain of Aller Moor and King Sedgemoor (via Beer Wall). The operation of the new tilting weirs at Moorlinch and West Moor described in Appendix 2 will follow the same protocols as currently in place i.e. levels set out in WLMP.

- c) Monk's Leaze Clyce is incrementally opened when:
- The Parrett is falling and no further significant rainfall is expected
 - The spillways are expected to stop, or have stopped, overtopping.

Following modelling work, we can create a balance in terms of volumes entering the Sowy channel cumulatively via the spillways or through the clyce and maintain a maximum agreed volume with the incremental opening or closing of the clyce.

Water levels will be maintained within the channel to provide a status quo by operating water control structures as present:

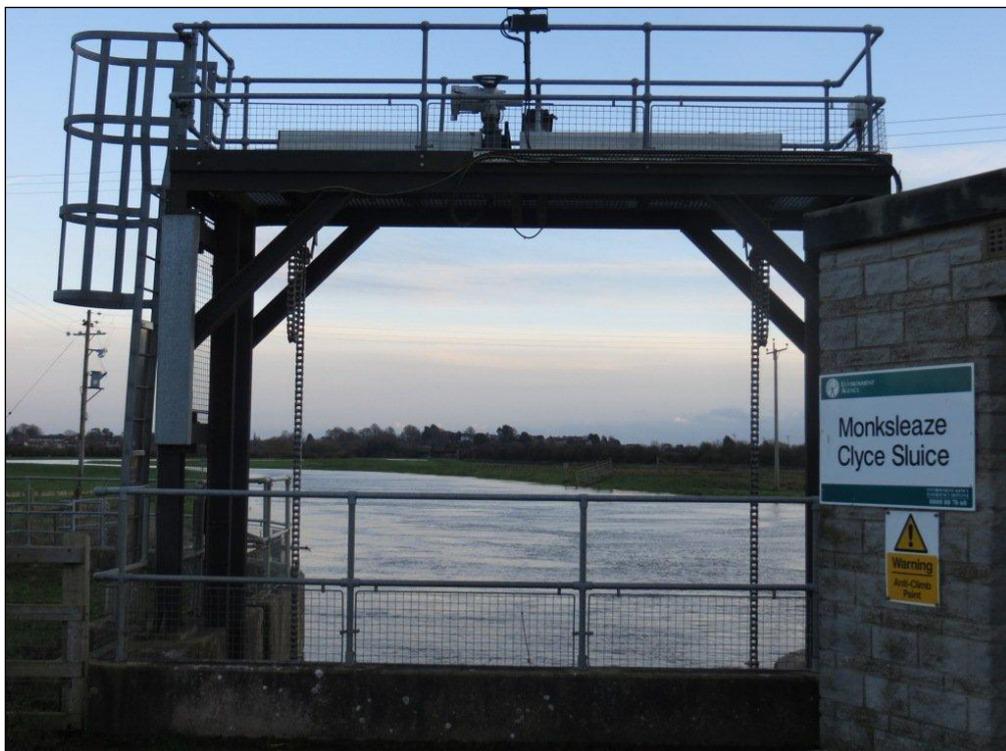
- a) Facility to get water from Sowy into Middlemoor and Aller Moor using sluices near the upstream end of the Sowy;
- b) Sowy and Langacre Rhyne are interconnected at Blindman's Gate (A361); and
- c) Bimpits rhyne is supplied from Sowy at the Bagenham Farm inlet.

All other requirements for the Sowy, Penzoy and KSD listed under the 17m³/s channel capacity operating procedures will continue to apply.

Action to be taken prior to Soway being used for flood relief

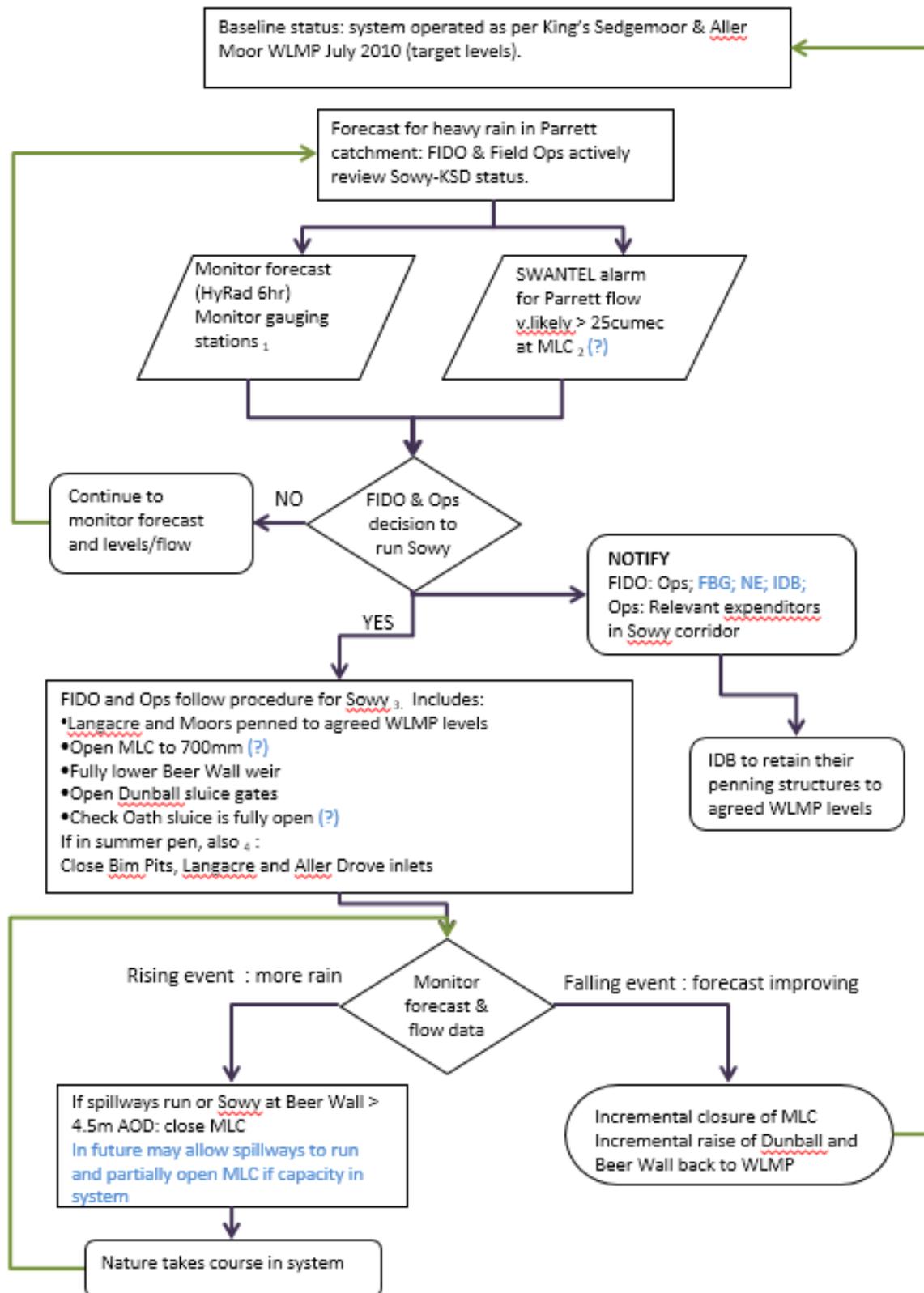
<u>NAME</u>	<u>RIVER</u>	<u>NGR ST</u>	<u>ACTION</u>	<u>OPERATOR</u>
Monksleaze Clyse	Soway (Parrett Relief Channel)	410 276	Open	EA
Aller Drove (2)	Soway (Parrett Relief Channel)	380 304	Close	EA
Chedzoy Inlet	Langacre Rhyne	379 349	Close	IDB
Bimpits Lane	Bimpits Rhyne	384 345	Open	EA
Bagenham (Bimpits Inlet)	Soway (Parrett Relief Channel)	3878 3117	Close	EA
Bagenham Outlet Flap	Soway (Parrett Relief Channel)	3857 3121	Clear debris	EA
Bagenham Outlet sluice	Soway (Parrett Relief Channel)	3857 3121	Close	Farmer
Aller Drove	Langacre Rhyne	381 303	Open	EA
Langacre	Langacre Rhyne	380 351	Open	EA
Blind Man's Gate	Langacre Rhyne	393 339	Open	EA
Beer Wall	Langacre Rhyne	392 315	Open	EA
Oxleaze Drove	Langacre Rhyne	383 294	Open	EA
Decoy Orchard T/W	Langacre Rhyne	402 282	Open	EA
Decoy Orchard Sluice	Misbrook Rhyne	402 282	Open	EA
Decoy Outlet to Soway	Decoy Rhyne	402 279	Close	EA
Weir Bridge T/W	Weir Bridge Rhyne	4016 2830	Keep Closed	EA
Middlemoor	Middlemoor Rhyne	412 279	Open	EA
Headwall Inlet (R.Parrett)	Poolmead Rhyne	410 276	Close	EA
Headwall Outlet Middlemoor	Poolmead Rhyne	412 279	Open	EA
Gas House Bridge	North Street Rhyne	420 266	Open	EA
Chedzoy Outfall Flap	Langacre	379 349	Clear debris	EA
Lake Wall Flap	Penzoy	3441 3384	Clear debris	EA
Pathe Control Structure	Burrow Wall Rhyne	3772 3049	Close	EA
Beer Wall T/W	Bimpits	3893 3162	Lowered	EA

Travel time approximately 20 hours from Monksleaze to Dunball



Flood management operating regime summary

Flood management operating regime for Sowy-KSD scheme



Notes:

1. Three upstream gauging stations are automatically monitored using *in situ* flow monitoring instruments linked to a telemetry system, on the three main river inputs to the Parrett in the Somerset Levels respectively: Chiselborough (River Parrett), Pen Mill (River Yeo), Ashford Mill (River Isle).
2. If the combined flow at these three gauging stations exceeds 25 m³/s, an alarm is automatically raised on the EA's flow monitoring system SWANTEL. The alarm notifies the Flood Incident Duty Officer (FIDO) to consider opening Monk's Leaze Clyce. Empirical evidence is that when the combined incoming flows to the Parrett are at or exceed 25cumec, it is very likely that the Parrett overflow spillways (Aller Moor and Beazleys) will run. This occurs at 6.5m AOD at Monk's Leaze Clyce. In future, we will refine these triggers as we gain evidence on the behaviour of an enhanced Sowy system.
3. The FIDO will follow a predefined protocol for operating the Sowy. Preparing the Sowy to "run" in a flood event is summarised in Section 7.2 (Current Flood Management Regime) of the King's Sedgemoor and Aller Moor Water Level Management Plan – Parrett Internal Drainage Board, approved July 2010. Importantly, all penning structures (EA and IDB owned) off of the main rivers (KSD, Sowy and Langacre) should be held at agreed pen levels to ensure WLMP on adjacent moors are maintained, should river levels fall.
4. In summertime extra care must be taken to avoid water levels in main rivers from falling below agreed WLMP. This is to protect fish and aquatic life, more prone to significant impact of low river levels when the system is at summer pen.

Blue text denotes proposed or potential changes to existing operating regime to accommodate the enhanced Sowy Scheme. FIDO protocols should be reviewed to ensure Natural England, EA Fisheries Biodiversity and Geomorphology staff are notified by email or call/text ahead of operating the Sowy for flood management.

Schematic of pumping stations and spillways



Somerset Levels and Moors - Schematic

Legend

- Large settlement
- Small settlement
- Pumping Station (PS)
- Gate
- Designated spillway
- Unofficial spillway

