

# **Appendix J Parrett Dredging and River Sowy 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.

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

### 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.

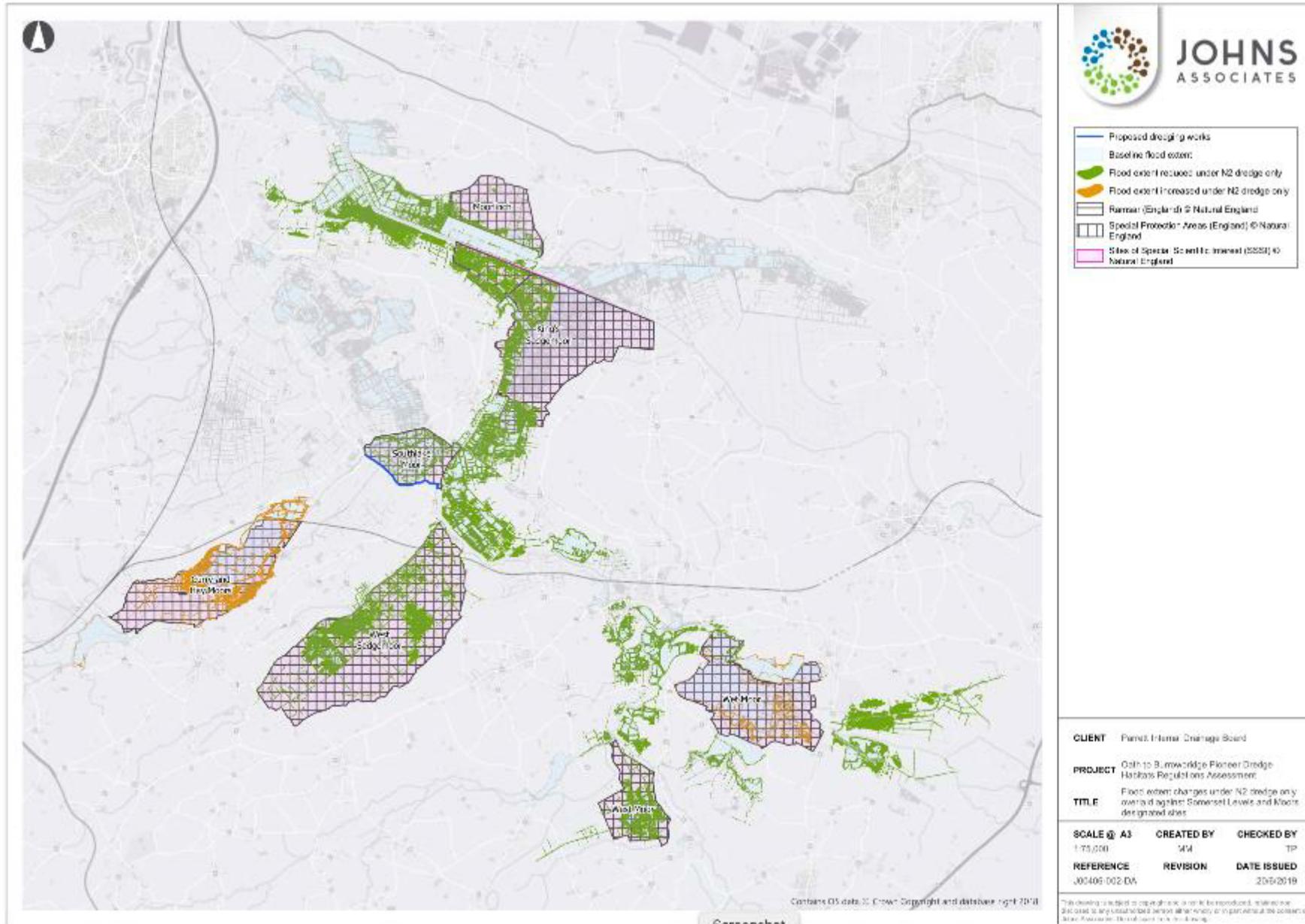


Figure D3.1 (from HRA and Appropriate Assessment): Analysis of Indicative Changes in Flood Extent for the Parrett Dredge

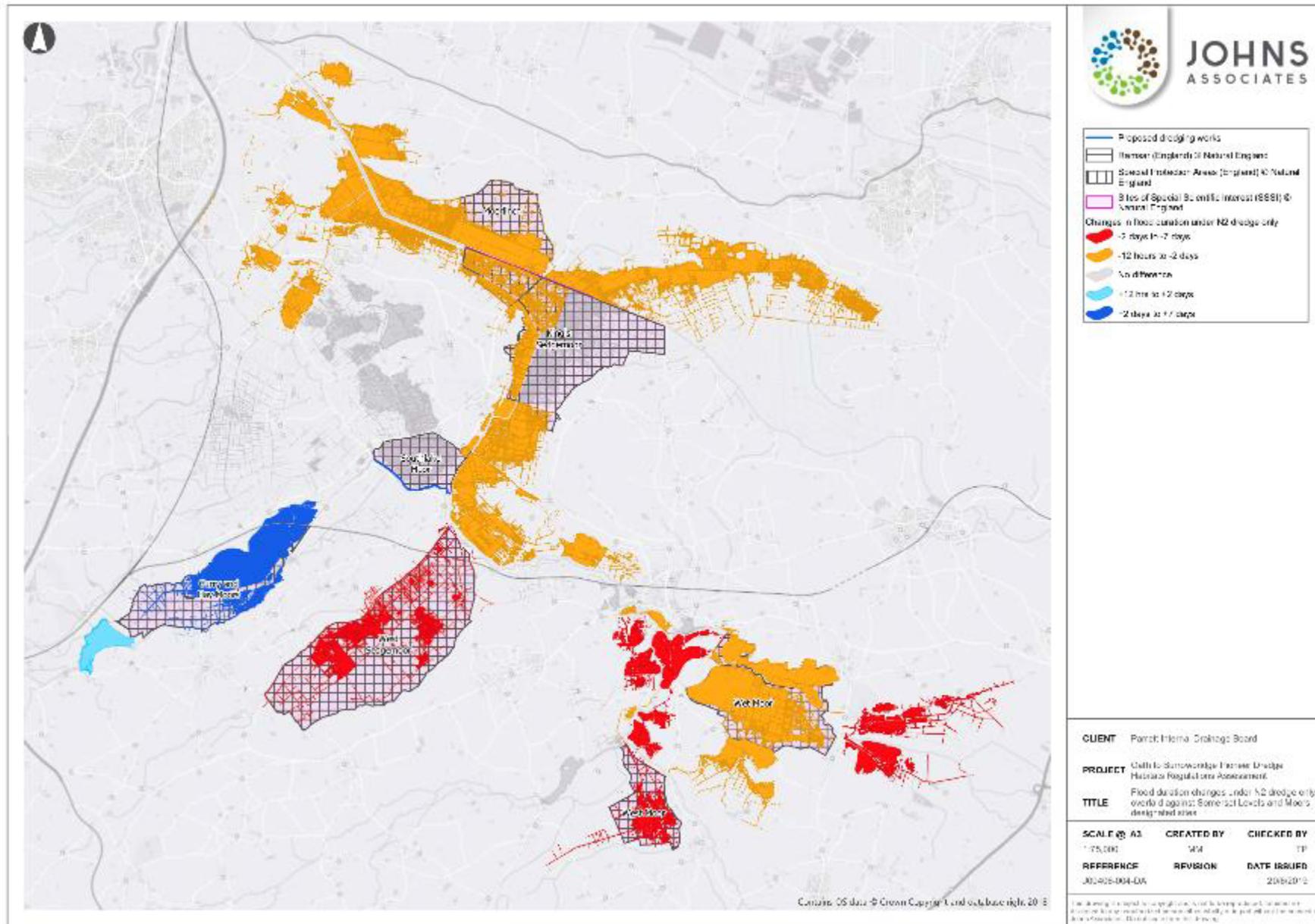


Figure D3.2 (from HRA and Appropriate Assessment): Analysis of Indicative Changes in Flood Duration for the Parrett Dredge

**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.

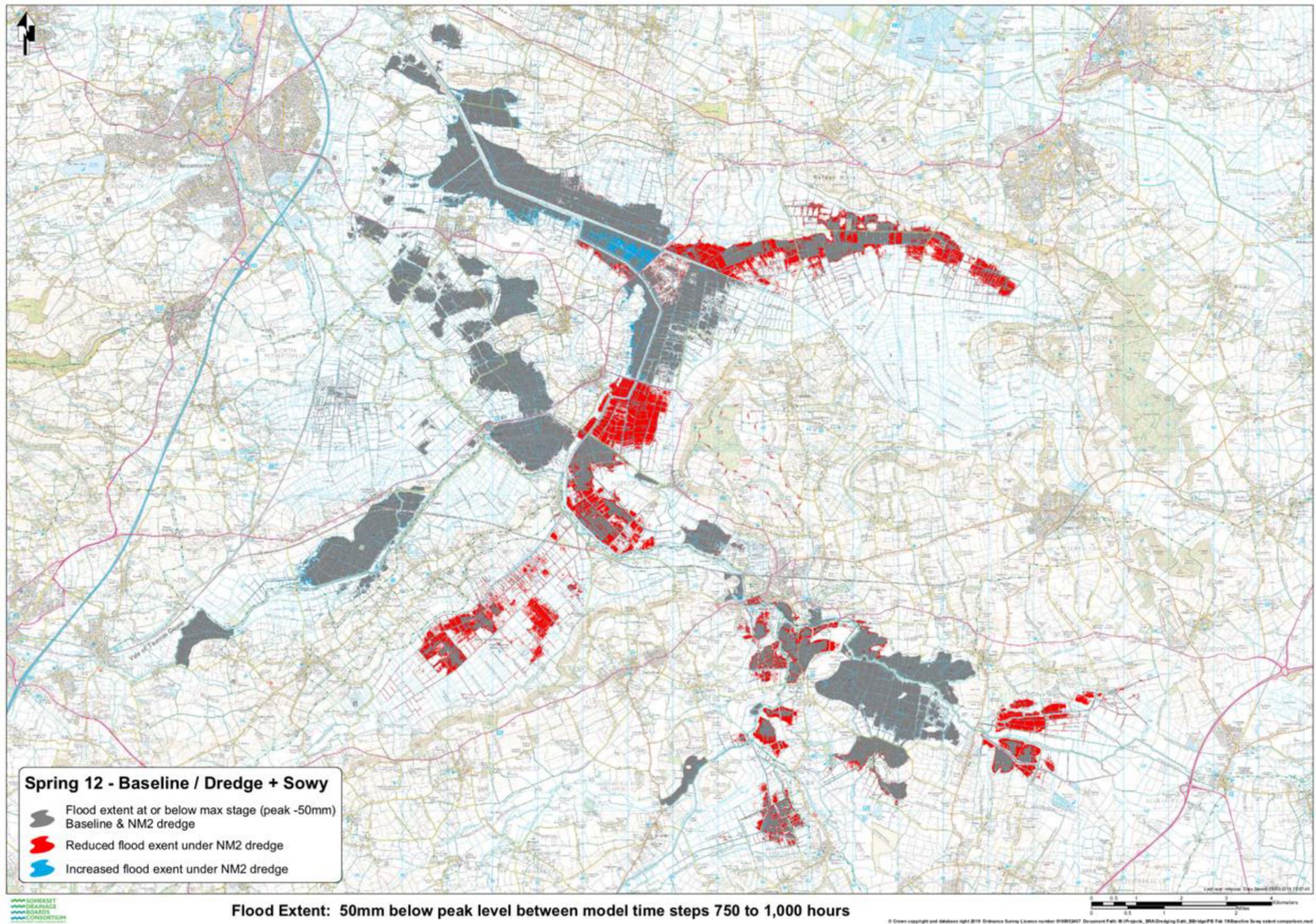
# ANNEX 1

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

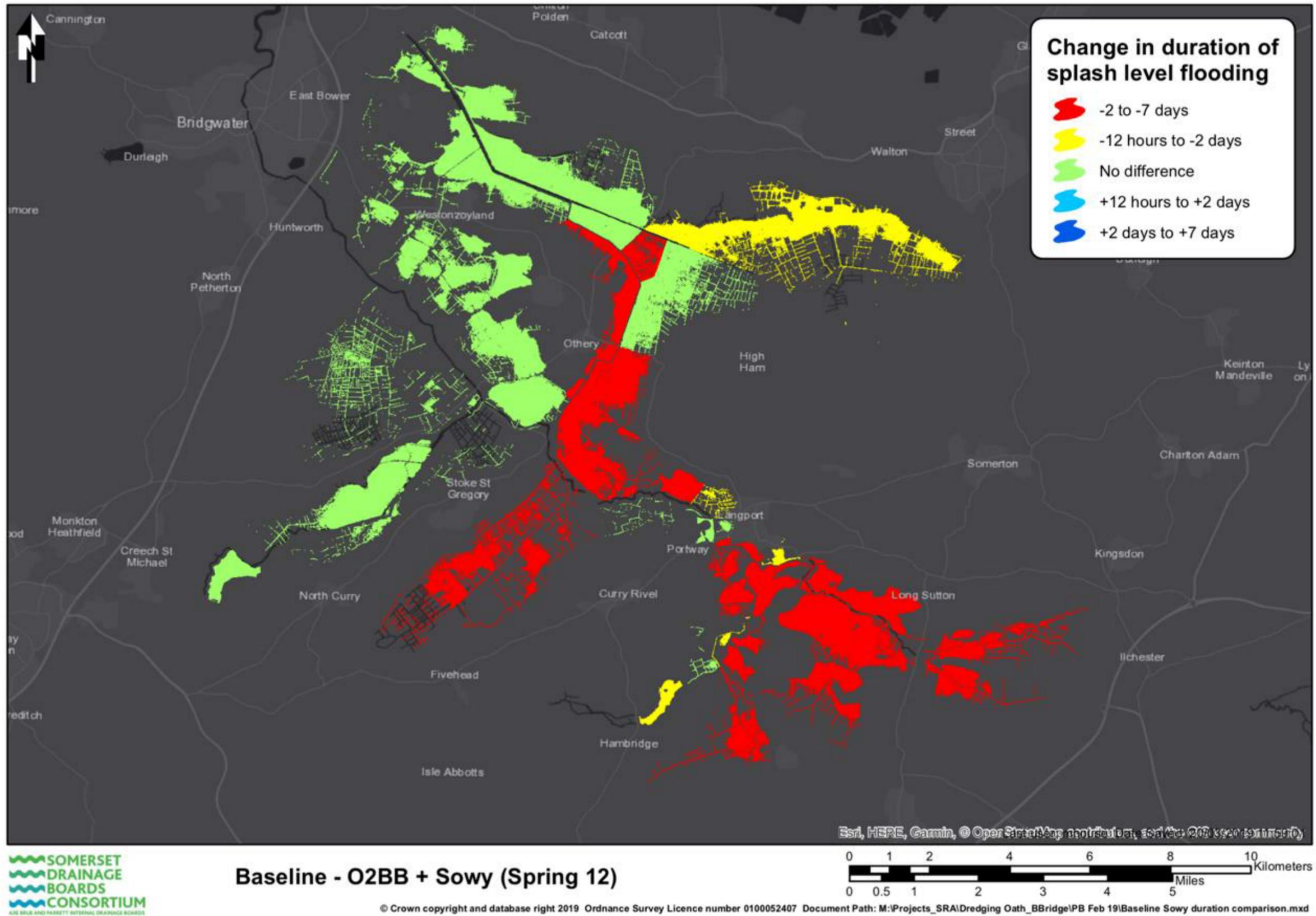
Hydraulic modelling was used to identify potential changes in the level and duration of flooding, for a small winter flood, as a consequence of the combined Parrett Dredge and River Sowy and King's Sedgemoor Drain Enhancement Scheme.

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 3.** Indicative change in flood extent for a typical annual winter flood determined from hydraulic modelling of the Parrett Dredging and Sowy projects



**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	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	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	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	Permit warping in February
Earlake	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	None proposed.
Langmead & Weston	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	None proposed.
Chedzoy	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	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	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	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.

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	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	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	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	Permit warping in February
Earlake	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	None proposed.
Langmead & Weston	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	None	Early warning monitoring.	Provide evidence of adverse effects.	None proposed.	None proposed		2022	None proposed.
Chedzoy	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	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	<b>No change in flood duration(&lt;12hrs) or extent (&lt;25ha).</b>	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.