

# Public Consultation report

## River Sowy & King's Sedgemoor Drain Enhancement Options 2016

December 2014

### In this document:

- we explain the benefits of the Sowy & King's Sedgemoor Drain (KSD) flood relief system;
- we summarise options (for consultation) to enhance the operation of the system with a view to starting work in 2016.

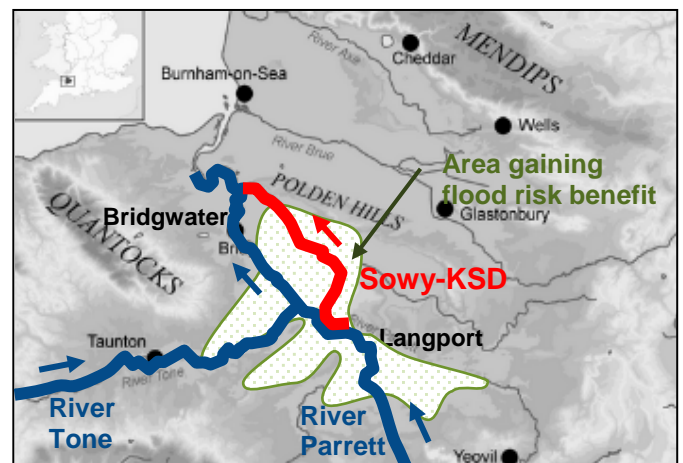
We would like to hear your views for improvements from 2016 on the options we are introducing in this report. An online survey will be available from 10<sup>th</sup> December 2014 to 9<sup>th</sup> January 2015 at:

<http://ow.ly/FpxYa>

## How does the River Sowy and King's Sedgemoor Drain (KSD) system work?

The Sowy was built in the 1960s as a flood water relief channel for the River Parrett, joining it to the KSD. The River Sowy and KSD take diverted water from the River Parrett and out to sea at Dunball. This also creates space in the River Parrett so that more flood water can be pumped into it from the moors. This reduces the extent and duration of flooding across a wide area.

Under normal operation, when the River Parrett reaches a certain level, water flows over spillways near Langport (Allermoor and Beazley's Spillways) and into the Sowy and KSD. Water can also be actively diverted via the Monk's Leaze Clyce – a sluice near Aller. At present, we do not open Monk's Leaze Clyce when the spillways are running to avoid passing too much water through this system. A more detailed description of the system is presented in the Annex to this report (page 7).



During winter 2013/14, the Environment Agency diverted water through the Sowy and KSD to evacuate flood water from the Levels and Moors more quickly. The Somerset Levels and Moors 20 Year Flood Action Plan subsequently identified that we should investigate opportunities to improve this system so that it could be used as an option in future to reduce the duration and/or frequency of flooding.

## Aims of the Sowy & KSD Enhanced Capacity Project

The Environment Agency has completed an investigation of different options to enhance the capacity of the River Sowy and KSD. We have looked into how it could be possible (if we had flooding like we experienced in 2013/14) to enable the system to carry more flood water without increasing the risk to property and infrastructure. Our 'trigger points' work highlights that we would install temporary pumps at Dunball before operating Monk's Leaze Clyce beyond its normal criteria. By making some of the improvements outlined here, we should in future be able to operate this system much more flexibly. The added benefits are that this has the potential to reduce the duration and frequency of smaller scale events and summer floods.

The Environment Agency has undertaken this assessment on behalf of the Somerset Levels and Moors 20 Year Flood Action Plan Partners. The project is one of several being undertaken by Flood Action Plan Partners to address actions in the 20 Year Flood Action Plan. The plan can be found [here](#) or on the Somerset County Council Newsroom web pages.

## Funding

The Somerset Flood Action Plan partnership has identified up to £6M funding to enhance the Sowy-KSD system during 2016. The money is a 'one-off' injection of capital Local Growth Fund distributed via the Heart of the South West Local Enterprise Partnership. The Environment Agency is investigating whether we can add to this from normal flood defence funding.

There isn't enough funding for all the enhancement options described in this report. We therefore need to hear from you to help prioritise any future changes to the Sowy-KSD system.

## Related work

We have been working closely with Somerset County Council and achieved a number of improvements to the system during the summer of 2014. An update of this work is available in our briefing note 'Rivers Sowy and King's Sedgemoor Drain improvements'.

We also have improvements planned for 2015 which are outlined in our briefing note 'River Sowy and King's Sedgemoor Drain enhancement, Improvements planned for 2015'. This is made possible by £2M Local Growth Funding for 2015. We are not consulting on the work for 2015.

## Introducing the options for 2016

We would like to hear your views about the options and for you to tell us your priorities. We will then present this to the Somerset Levels and Moors Flood Action Plan Partners to make decision about how we spend the Local Growth Fund we have been given for 2016 to enhance this river system. **Please help us prioritise which options we investigate further by completing the online survey at <http://ow.ly/FpxYa>**

To improve the volume of water that can flow through the Sowy and KSD, we have considered (using the winter 2013-14 conditions as a baseline) three aspects:

- **Enhanced operation:** diverting more water from the River Parrett into the Sowy during high flow conditions whilst keeping the impact on land to a minimum;
- **Enhanced capacity:** enlarging the river or installing pumps to allow greater volumes to flow through the Sowy-KSD whilst keeping the impact on land and properties to a minimum;
- **Floodplain storage:** using the natural storage capacity of the moors to accept incoming flood water in areas where this is beneficial and/or acceptable.

## Overview

To achieve the best results we will need to use a combination of options. We can't afford to do everything at the same time, but we can plan for the future ready for when funding becomes available.

Even if we implemented all of the options proposed here, the combined benefit would not prevent flooding in the Sowy-KSD floodplain in an extreme event similar to winter 2013-14.

## Describing the 2016 options

A summary table of the options is on page 6, to help make it easier for you to compare them.

### A. Enhanced operation – greater than normal opening of Monk's Leaze Clyce to divert more water from the Parrett into the Sowy-KSD during high flows

To minimise flooding through the Sowy-KSD corridor, this option would need to run alongside pumping at Dunball (option G) to allow water to be pumped out when the KSD is tide-locked. (This is when the tide is high and pushes shut the gates at Dunball to prevent saltwater entering the KSD. This means that fresh water can't leave the KSD during this period unless pumped). An alternative to pumping would be river widening (options C&D).

In winter 2013-14, Allermoor and Beazley's spillways were running for long periods from December to March. The benefits of option A – for example 50% opening of the sluice when the spillways are running - could reduce the duration of flooding as shown in the table over the page. Even greater reductions could be achieved under option A if temporary pumps were used to drain moors, as we did last winter.

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## Example benefits of enhanced operation of Monk's Leaze Clyce in extreme floods

Floodplain area	↓ Peak flood level	↓ Flood duration decreased by...
Moorland/Fordgate (North Moor)	0.2m	10 days
Mulcheneay, Thorney Moor	0.1m	6 days
Huish Level, South Moor	0.02m	9 days
Hay Moor, Curry Moor	negligible	up to 2 days

If we change how we operate Monk's Leaze Clyce, our experience in 2013-14 demonstrated that we should also implement option B, simple improvements to the KSD channel at Dunball.

Without river widening (options C or D), there may be increased frequency of flooding and duration of flood water on land through the Sowey-KSD floodplain.

The opportunity presented by taking option A without option C, would be that an increase in the frequency of wet conditions could benefit agri-environment land stewardship schemes and enhance wildlife in conservation sites (option E).

### B. Enhanced capacity: KSD simple improvements at Dunball

#### Lower King's Sedgemoor Drain near Dunball, winter 2014



When the Sowey-KSD scheme was designed in the 1960's, it was recommended that the original A38 bridge at Dunball (now the southbound carriageway to Bridgwater) would be replaced at a future date with a wider span to address a significant narrowing of the King's Sedgemoor Drain at this location. This was never done, and today there is a constricted channel of about 200m length, just upstream of Dunball sluice.

Resolving the constriction would minimise damaging turbulent flows encountered in the outlet channel to Dunball tidal sluice. We consider this improvement is a priority to avoid future erosion problems.

Somerset County Council will lead a feasibility study to remove the 'lump of concrete' on the north bridge footing of the old A38 bridge and improve scour protection for both A38 bridges in 2014-2015. They aim to do this during 2015 if possible.

Additionally, our priority work within option B would include:

- fluming (funnelling and smoothing) the channel through the bridge, to reduce turbulence and erosion;
- widening the section of narrower channel section by up to 10m, to slow down the flow.

### C. Enhanced capacity: Channel widening

This option requires the Sowey and KSD channels to be widened by up to 30%. This amount of widening will increase the water carrying capacity in the channel by up to 75%. For the Sowey, this means widening by around 2m; for the KSD by around 8m. If we implemented option G (pumps at Dunball), there would be less need to widen the KSD and the priority within this option would be to widen the stretch of the Sowey between the A372 at Beer wall and the KSD.

### D. Enhanced capacity: Bank raising/set-back

This option involves either raising and extending the existing banks that run along the sides of significant lengths of the Sowey and KSD, or setting-back the banks to provide a wider area of land for high flows to run through. It would be cost effective to use the material from any channel widening to raise banks. Therefore a combination of widening and bank works may be preferable. Within this option, our priority area for bank raising and set back would be the stretch of the River Sowey downstream of the A372 at Beer

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Wall, and widening the channel between the Sowy and Langacre Rhyne. This could achieve some aspects of both options C and D and create habitat.

Banks need maintaining and this will need funding in future. It is also important to understand that floodwater in the floodplain behind the banks may stay at a higher level on land for a longer period during and after a flood event.

### **E. Enhanced capacity: Floodplain storage / water spreading**

This is an alternative to extensive channel widening. The option assumes that it would be acceptable to increase flooding in some parts of the moors through the Sowy-KSD system, particularly during tide-lock periods and if we use option A (enhanced operation). This may be a cost effective option and create future flexibility for flood and agri-environmental management.

Flood storage in the Sowy-KSD may work best for smaller scale events, rather than extreme floods, as the benefit is less once the storage area is full. To illustrate this point, during winter 2013-14 the flooded areas of the Somerset Levels and Moors stored an estimated 15-20% of the total water entering the system.

No areas of land have yet been identified or volunteered for floodplain storage. This option needs significant consultation & investigation and is considered a longer-term solution, which may be prohibitive for delivery using the Local Growth Fund in 2016.

### **F. Enhanced capacity: KSD comprehensive improvements at Dunball**

This is a more comprehensive version of option B, which gives similar benefits to flow, and has the added benefit of providing an alternative solution to option G (pumping at Dunball). This would require a complete rebuild of the KSD outlet at Dunball, including:

- widening the approach channel to Dunball;
- increasing the capacity of the Dunball gravity outlet sluice;
- extending the span or replacing the old A38 (southbound) bridge;

This represents major infrastructure work, and the costs are expected to exceed £10M.

### **G. Enhanced capacity: Dunball pumps**

Pumping at Dunball during tide-locking could be an alternative to options C or D (river widening). During winter 2014 we installed temporary pumps with a combined capacity of 15m<sup>3</sup>/s (cumeecs). More than 70m<sup>3</sup>/s (cumeecs) leaves the KSD by gravity at peak flow, when it isn't tide-locked. The benefits of pumping on flood level reduction are modest although pumping does enable a more consistent evacuation of water from the floodplain during a flood event like we experienced last winter.

A platform for temporary pumps has been installed over the summer. The cost of hiring and installing pumps at Dunball is in the region of £68k/week, based on our experience in winter 13-14 of hiring from Holland. Operating and maintenance costs have not been included. If pumps were held in the UK, we may be able to reduce this cost significantly. For the purposes of this report, we are assuming that temporary pumps would be required for 10 weeks per annum, though in dryer years this could be reduced. Pump hire costs would not be met from the Local Growth Fund, but from one of the Environment Agency's other budgets.

Upgrading this facility to a permanent pump station would be a possible option, and to build it would cost about £0.5M for every m<sup>3</sup>/s (cumeecs) of pump capacity, plus operating and maintenance costs. To illustrate, a permanent pump station of the same capacity as the temporary pumps we used in winter 2014 (15m<sup>3</sup>/s) would cost an estimated £7.5M to install.

## **Areas gaining benefit**

The figure over the page shows the areas benefitting from the options. Shading indicates the areas flooded in winter 2013-14. For option A (enhanced operation of Monk's Leaze Clyce), the benefits will be an average of more than 5 days reduction in flood duration to the areas in the red outline. The peak flood level could be lower by about 0.2m (based on winter 13-14 flood). Each option can also provide benefit in the more frequent flooding events experienced on the Somerset Levels and Moors.

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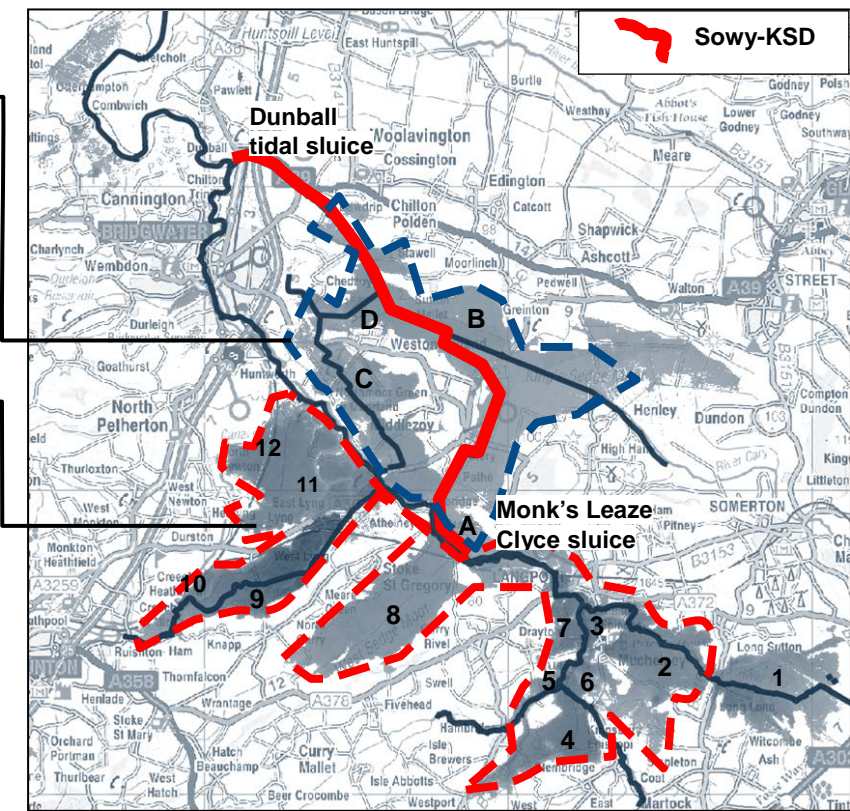
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The enhanced capacity options (other than E), complement option A (enhanced operation) by minimising flooding through the Sowy-KSD floodplain, illustrated as the area within the blue outline. The greatest benefit would be achieved using several of the options combined, if funding permits in future. Each option can provide a degree of benefit in exceptional winter and summer flooding and in the lower order events more commonly experienced on the Somerset Levels and Moors.

- Enhanced capacity benefit area:**
- A. Aller Moor
  - B. King's Sedgemoor
  - C. South Moor
  - D. Lang Moor

- Enhanced operation benefit area:**
- 1. King's Moor
  - 2. Wet Moor
  - 3. Mulcheney
  - 4. West Moor
  - 5. South Moor
  - 6. Huish Level
  - 7. Thorney Moor
  - 8. West Sedge Moor
  - 9. Hay Moor
  - 10. Curry Moor
  - 11. Salt Moor
  - 12. North Moor



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## Summary of options

	Options	Requirements	Cost	Benefit/Risk
<b>A</b>	<b>Enhanced operation</b>	Agreement of landowners & stakeholders to open Monk's Leaze Clyce whilst spillways are running. (The clyce is normally closed when the spillways run)	Costs of associated options as described	Average >5day reduction in flood duration in Parrett and Tone moors. Requires that pumps are positioned at Dunball if flood risk to the Sowy-KSD floodplain is to be minimised, or that river widening (option C or D) compensates for the need to pump.

### The following options (other than option E) complement option A by minimising flooding through the Sowy-KSD floodplain.

<b>B</b>	<b>KSD simple improvements at Dunball</b> Choose between option B or F	<ul style="list-style-type: none"> <li>- remove concrete obstruction from A38 bridge (if not already done)</li> <li>- channel/bridge fluming</li> <li>- widening constricted channel</li> </ul>	£4M to £7M	Protect highways network. More efficient outlet at Dunball. Modest flood reduction impact at the top end of the KSD system.
<b>C</b>	<b>Channel widening (by up to 30%):</b> - up to 2m wider on Sowy - up to 8m wider on KSD	<ul style="list-style-type: none"> <li>- Over 9km of Sowy</li> <li>- Over 9km of KSD (this may not be necessary if pumps at Dunball)</li> <li>- Could increase flow capacity to around 20m<sup>3</sup>/s, though 30m<sup>3</sup>/s may be possible</li> </ul>	£4M to £7M	Less flooding in Sowy-KSD floodplain. Fewer summer floods. Greater operational flexibility ie we can put through more water without creating more flood in flood plain Impact on conservation sites and archaeology from ground works. Impact on conservation requirements. Impact on stewardship payments if less water is on the land.
<b>D</b>	<b>Bank raising or extension in the lower section of the system</b>	<ul style="list-style-type: none"> <li>- infill low spots (as part of channel widening)</li> <li>- more extensive raising or extending banks</li> </ul>	£4M to £7M	As for option C Additional structures required (and will need operation and maintenance to drain flood water back into channel if trapped behind embankment)
<b>E</b>	<b>Floodplain storage / water spreading</b>	<ul style="list-style-type: none"> <li>- Potential storage downstream of Beer Wall based on conservation areas</li> <li>- Agreement from landowners</li> </ul>	TBC	Obtaining agreements takes time. Storing water here has limited value during bigger and longer floods. Benefit to wildlife & eco-tourism through improved conservation opportunities.
<b>F</b>	<b>KSD comprehensive improvements at Dunball</b>	<ul style="list-style-type: none"> <li>- bridge extension / replacement</li> <li>- fully widening constricted channel</li> <li>- improvements to Dunball basin</li> <li>- upgrade/expansion of tidal sluice</li> </ul>	> £10M	As for Option B but larger scale Costs are significant Would provide robust foundation for other system improvements in future
<b>G</b>	<b>Dunball pumps</b>	<ul style="list-style-type: none"> <li>- temporary pumps (15m<sup>3</sup>/s), or</li> <li>- permanent pumps with total capacity from 10 to 40m<sup>3</sup>/s</li> </ul>	<ul style="list-style-type: none"> <li>- temporary: ~£0.7M p.a*</li> <li>- pumping station: £5M - 20M</li> </ul>	Similar benefits to Option C May be alternative to channel improvements in KSD (option F) High energy/operational/maintenance.

Cost estimates include 30% optimism bias for contingency (other than pump stations), but do not include operation, maintenance or compensation costs. Options are not presented in a priority order. The flood mitigation benefits of options are not equivalent.

\* Temporary pump costs are based on winter 13-14 experience and assume a requirement of 10 weeks in operation per annum. If pumps were held in the UK, costs could be reduced. Pump hire costs would not be met from the Local Growth Fund, but from another Environment Agency budget.

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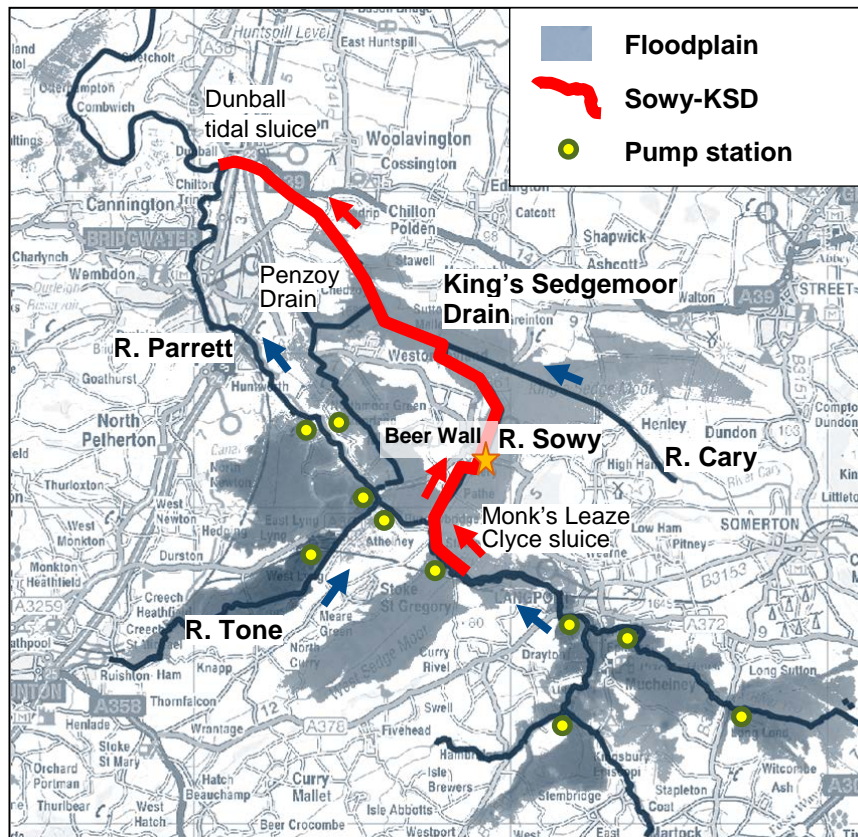
## Annex: Describing the Sowy & KSD flood relief channel

In response to severe flooding in the 1960s the Parrett flood relief channel, combining the new River Sowy and existing King's Sedgemoor Drain, was built and completed in the early 1970s.

The Sowy was designed and built as a gravity system, without pumping at Dunball. The scheme was to provide winter and summer flood protection to land on King's Sedgemoor, Southlake Moor, West Sedgemoor, Chedzoy drainage area, Aller Moor and the Langport Moors. It was recognised that significant floods would still occasionally occur in larger rainfall events.

Initially conceived as a 30m<sup>3</sup>/s (cumecs) capacity system, many of the bridges were built or modified to this specification. Due to funding constraints, channel excavation was limited to 17m<sup>3</sup>/s.

### Location and arrangement of the River Sowy and King's Sedgemoor Drain flood relief channel



Monk's Leaze Clyce inlet sluice under construction



River Sowy

### Dimensions of the Sowy-KSD river channels

Dimensions	Bed width	Depth	Side slopes
River Sowy	6m	2m	1:2
KSD (Sowy to Bradney Bridge)	24m	1.8m	1:3

### Operating the Sowy-KSD flood relief channel

Flow is diverted from the River Parrett into the Sowy system via a sluice at Monk's Leaze Clyce, just downstream of Langport: this is 'managed' flow where we can control the flow rate. In flood conditions, the Parrett overflows into the Sowy via two engineered 'spillways' built into the east bank of the Parrett. This is 'unmanaged' flow, as the flow rate passing over the spillways is largely uncontrolled.

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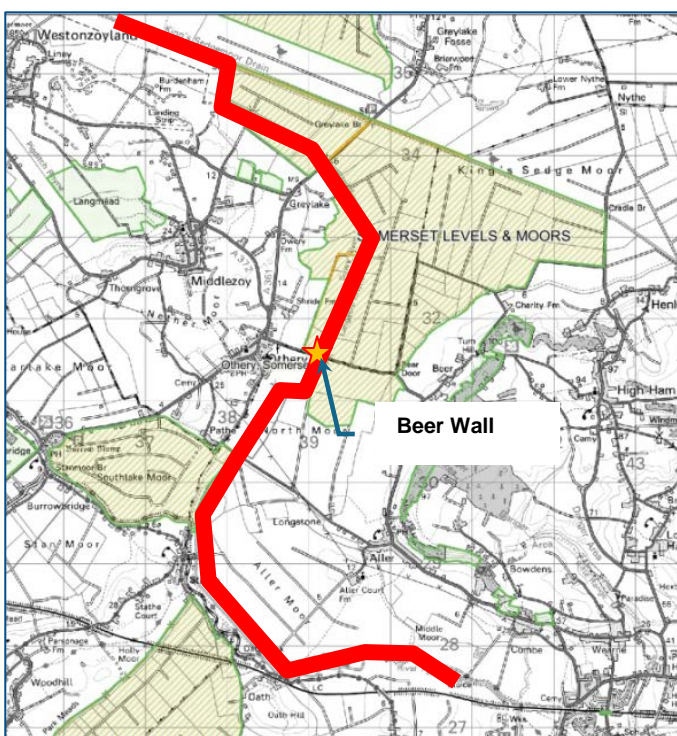
Using sluices at Monk's Leaze Clyce, Dunball and elsewhere in the system, water levels in the KSD and Sowy can be maintained to satisfy local water level management plans under normal flow conditions.

In winter 2014, the Environment Agency contracted Van Heck to put in place large temporary pumps at Dunball and Beer Wall to aid flow through the Sowy-KSD system. The pumps at Dunball enabled water to discharge during periods of tide-locking, when levels in the receiving waters of the tidal river Parrett prevented gravity discharge. On the A372 at Beer Wall, pumps were put in place to convey flow from upstream (Aller Moor) to downstream (King's Sedgemoor) of the road and embankment; the works by Somerset County Council in 2014-15 to install new culverts will remove the need for temporary pumps here should we experience an event similar to winter 2013-14 in future.

### Land use

The Sowy-KSD corridor mostly comprises agricultural land, with a relatively low density of residential properties and several access roads across the functional flood plain. Land towards the lower end of the Sowy system and confluence with the KSD has international conservation designations, principally due to wetland habitat value and overwintering birds (SSSI, Ramsar, Special Protection Area). Land stewardship funding is used for management of some land in this area, and there is potential to further exploit this habitat for eco-tourism.

### Conservation sites in the Sowy-KSD floodplain (shaded)



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