AW Water Engineering

Short Technical Report

PROJECT	Northmoor to M5 dredge – hydraulic assessment
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1 Introduction

This note has been produced to provide a short technical review of the potential hydraulic benefits of the proposed Northmoor to M5 dredge. This extends from the point where the previous 750m pioneer dredge finished to the M5 motorway bridge.

An analysis has been undertaken by the Somerset Drainage Board Consortium of the potential increase in cross sectional area that could be achieved from water injection dredging. This note compares these increases with those assumed for previous dredging assessments in this reach, to produce an approximate hydraulic benefit utilising the results from previous hydraulic modelling.

This work builds on, and references, the considerable amount of work undertaken in previous studies including:

- Somerset Rivers Authority (2014), *Somerset Levels and Moors Flood Action Plan*
- CH2MHill (2015), *Somerset Levels & Moors, Axe, Brue, Parrett & Tone Dredging Assessment,* Environment Agency
- HRWallingford (2016), *Somerset Levels and Moors Flood Action Plan, Dredging Strategy for the rivers Parrett, Tone and Brue,* Somerset Rivers Authority
- AW Water Engineering (2018), *River Parrett – Further Dredging Assessment,* Somerset Drainage Boards Consortium
- AW Water Engineering (2019), *Oath to Burrowbridge Dredging – Hydraulic Assessment,* Somerset Drainage Boards Consortium

2 Previous modelling

The previous modelling undertaken for this reach of the River Parrett is described in detail in the report 'River Parrett – Further Dredging Assessment'. Within this modelling a simplistic representation was made of the potential dredging that could be undertaken in this reach, by widening the channel by either 2m or 4m. Although this was assessed alongside other dredging scenarios this does still allow the relative hydraulic benefit to be quoted. The table below summarises the impacts of the 2m widening at selected locations using data from three historic flood events, Spring 2012, Winter 2012/13 and Winter 2013/14.

Location	**Spring 2012**		**Winter 2012/13**		**Winter 2013/14**	
	Change in peak level	**Change in flood duration**	**Change in peak level**	**Change in flood duration**	**Change in peak level**	**Change in flood duration**
Curry Moor	-100mm	-4.2 days	-30mm	-2 days	-100mm	-1.5 days
North Moor	0	0	0	0	-130mm	0
Aller Moor	0	0	-30mm	-5.8 days	-10mm	-2.1 days
Kings Sedgemoor	0	0	0	-0.1 days	-20mm	-0.6 days
Muchelney Level	-10mm	-0.7 days	-30mm	-2.7 days	0	-0.7 days
Huish Level	0	0	-20mm	0	0	-2.6 days

3 Cross sectional areas

The hydraulic model uses data from a 2015 cross sectional survey of the River Parrett in this location. When this data was input into the model the decision was made to use the hard bed levels, rather than the silt level. This is on the basis that during a larger fluvial event combined with a low tide, the majority of this silt would be mobilised. In reality, not all of this silt may get mobilised, but to retain a consistent approach it is assumed that only dredging beyond the hard bed profile can be considered when evaluating hydraulic benefit.

The following table compares the potential increase in cross sectional area due to dredging at selected cross sections within this reach. To gain a representative sample 20% of the sections have been selected for analysis (i.e. every fifth section). Two scenarios are considered, the first is the increase in cross sectional area that was assumed in the previous dredging assessment (with the channel widened by 2m), and the second is the current assessment.

For both assessments the cross-sectional area is quoted up to a specified level rather than for the whole section. This is based on the peak level that occurs during a high fluvial event combined with a low tide. For both scenarios it is the relative increase in cross-sectional area that is quoted, as they are based on different baseline surveys.

Section reference	Water level used for area analysis (mAOD)	Increase in area from previous dredging assessment (m^2)	Increase in area with current dredging assessment (m^2)	Current assessment as proportion of previous assessment
P103	6.32	14.2	3.4	24.1%
P108	6.28	15.1	3.2	20.9%
P113	6.24	10.7	1.5	13.6%
P118	6.20	12.4	2.1	17.2%
P123	6.16	18.3	6.3	34.3%
P128	6.12	10.3	5.5	53.1%
P133	6.08	20.8	4.9	23.3%
P138	6.04	17.0	6.3	37.1%
P143	6.00	11.0	8.4	76.9%
P148	5.96	17.2	5.8	33.5%
			AVERAGE	**33.4%**

4 Revised Hydraulic Benefits

4.1 Northmoor to M5 dredge

Based on the table above it is possible to assume that the current dredging proposals will provide approximately 33% of the benefits assumed in the previous assessment (with a universal 2m widening). There are a large number of caveats in this approach, including the assumption that there is linear relationship between the cross sectional areas throughout the reach and any hydraulic benefit. The assessment also doesn't take into account any impacts from the baseline cross sectional areas being different.

However, based on the limited hydraulic benefits being quoted, and these being rounded, it is still reasonable to use this average value to produce the approximate benefits of the proposed dredge. These are quoted in the table below for the same events and locations as the table earlier in this note.

Location	Spring 2012		Winter 2012/13		Winter 2013/14	
	Change in peak level	Change in flood duration	Change in peak level	Change in flood duration	Change in peak level	Change in flood duration
Curry Moor	-30mm	-1.4 days	-10mm	-0.7 days	-30mm	-0.5 days
North Moor	0	0	0	0	-40mm	0
Aller Moor	0	0	-10mm	-1.9 days	0	-0.7 days
Kings Sedgemoor	0	0	0	0	-10mm	-0.2 days
Muchelney Level	0	-0.2 days	-10mm	-0.9 days	0	-0.2 days
Huish Level	0	0	-10mm	0	0	-0.9 days

These results show the main beneficiary of any hydraulic benefits will by Curry Moor and its neighbouring moors. There will be minimal benefits on the River Parrett upstream of the Tone confluence.

4.2 Impacts combined with Oath to Burrowbridge dredge

As reported in the 'Oath to Burrowbridge Dredging – Hydraulic Assessment' study (AW Water Engineering, 2019) the water injection dredging that has now been completed shows a hydraulic benefit to a large area of moors within the Parrett catchment. The exception to this is Curry Moor where a small disbenefit was shown, although the flood risk to Curry Moor was still substantially lower than it was prior to any of the Flood Action Plan works being undertaken.

In the simulation of the 2012 event the peak level on Curry Moor was increased by 100mm and the duration of flooding increased by 3 days. For the 2014 event the peak level increased by 80mm and the duration by 1.7 days.

The proposed Northmoor to M5 dredge would therefore go some way to offsetting these disbenefits, but there would still be an overall small disbenefit. If the benefits from the Sowy scheme can also be considered then these could be considered to offset the disbenefits from the Oath to Burrowbridge dredging, but this will depend on the final scale of the Sowy scheme.

5 Discussion

5.1 Optimum dredge locations

The hydraulic benefits from dredging in this reach will be broadly proportional to the overall increase in cross sectional area, therefore there will not be a significant difference in benefit between dredging at different locations within this reach. More important will be to consider the hydraulic efficiency of any dredged reach, and to try to have a consistent cross-sectional area where possible, and avoid any sudden changes in area.

The optimum location for dredging is more likely to be driven by the ease of access, and the additional material that needs to be removed above this fluvial design water level. This quantity of additional material is likely to increase towards the downstream end of the reach, due to the increased tidal influence.

5.2 Tidal flood risk

Increasing the capacity of the channel in this reach will increase the ability of the tide to propagate up the channel during lower fluvial flows. This will result in a very slight increase in overtopping of spillways (and to a lesser extent other banks) during extreme tides, and a resulting slight increase in the volume of tidal flooding into the moors. However, this increase will be minimal and is likely to be easily contained within the rhyne system.

5.3 Sediment transport

Increasing the capacity of this reach of river will increase the amount of marine sediment that can be passed upstream during spring tides. However, it will also increase the hydraulic gradient during fluvial events, which should increase the potential for mobilisation of sediment.

5.4 Additional benefits

The assessment above is a very theoretical exercise to identify hydraulic benefits, but there are additional benefits that this dredging may provide which should be recognised. Regular water injection dredging of the silt within the channel berms will minimise how vegetated the silt can become and therefore ensure it is more easily mobilised.

In addition, any increase in channel capacity in this reach will improve the overall flexibility in the system and allow more operational decisions to be made during flood events.