Dredging to reduce flood risk on the River Parrett and the River Tone in Somerset

Floods and Coast Conference 2017

29 March 2017

David Middlemiss and Iain Sturdy
Input to a dredging strategy for the Somerset Rivers Authority

- Dredging is part of the flood risk management strategy for the River Tone and Parrett;

- The SRA keen to understand how it can be done most effectively:
  - Hydraulic benefit
  - Cost
  - Restrictions
  - Disposal options

- Need to understand why there is a dredging requirement:
  - Where does the sedimentation occur?
  - How much, how frequently, where from?
  - What dredging methods could be appropriate?
- Flow confined to channel under normal conditions
- Above a particular discharge spillways come into operation
- Moors are flooded
- Pumping stations used to lift water back into main river channels
- Rate of pumping can be significantly lower than flow rate over spillways
Hydraulic Objectives:

1. To avoid any increase in flood levels on North Moor with the 2014 ‘pioneer’ dredge in place, in the case of a repeat of the 2013/14 event;
2. To maximise the reduction in flood level on Kings Sedgemoor;
3. To maximise the reduction in flood level upriver of Aller Moor spillway.

Analysis of previous modelling work to inform decisions on locations and sequencing of where dredging required
Take a step back ....

A need to understand physical processes:

- Hydrodynamics
  - Tidal regime
  - Freshwater input
  - Effect of vegetation
- Sediment loads
  - Sources
  - Properties
  - Behaviour in relation to hydrodynamics

A need to understand ‘dredgeability’:

- Accessibility
  - Land use
  - Infrastructure
  - Disposal
- Environmental Factors
  - Seasonality
  - Sensitivity
- What had been done before?
  - Historical dredging methods
  - Recent dredging campaigns
Develop conceptual model of physical processes:

- Large majority of sediment deposited is estuarine / marine in origin
- Sedimentation is generally fine material (muds)
- Peak sedimentation events associated with tides of largest range and lowest river flow
- Location of greatest rate of sedimentation in zone of maximum turbidity – consistent with measurements of sediment flux.
- Dredging affects the way in which sedimentation occurs – creating a sediment trap. Planning of the sequence of dredging required.

A good understanding of the mechanism and pattern of sedimentation – what could this mean for dredging?
Infrequency of dredging in some areas has allowed material to accumulate:

- Pioneer (capital) dredge material:
  - Older, more consolidated, more m³/m

- Maintenance dredge material:
  - Newer, less consolidated, less m³/m

- Key factor is sustainability of disposal in the long-term
Different dredging methods appropriate for the different materials.

- Mechanical methods for pioneer material ….
  - Pro: Established technique, higher degree of control over dredging programme
  - Con: Disposal options, relatively expensive

- Agitation / hydrodynamic methods for maintenance material ….
  - Pro: Disposal options, relatively cheap
  - Con: Unproven recently, lower degree of control over dredging programme

Other factors that influence choice

- Environmental Impact
- Accessibility

Recommendations made to SRA regarding trials of methods….
Recommendations ….

General

- Mechanical for pioneer sections – governed by strength of material and availability of disposal volume
- Hydrodynamic / agitation for maintenance – less cohesive, sustainable disposal and significantly lower cost
Dredging Trials

- The Parrett IDB undertook dredging trials (maintenance) on behalf of the SRA during November 2016
  - Use of Water-Injection Dredger
  - Use of Agitation Dredging technique
Dredging Trials

- Understand how this dredging method works:
  - Key Questions: Is it effective? Where does the material go? Is more cost-effective?

- Comprehensive monitoring programme:
  - Bathymetry (single and MBES)
  - Sediment properties – settling rates, strength, size etc.
  - SSC and DO measurements

- Findings
  - Both methods successful at removing material
  - WID is more productive
  - Agitation more accurate
  - No significant deposition observed close to dredge site (yet)
  - No adverse impact on environment or local community (yet)
Main Points

- River Parrett and River Tone is a complex environment
- Dredging can increase the conveyancing capacity of river channels – reducing the frequency and duration of spillway events.
- A good understanding of the whole system is required
- Trials are a very useful exercise to undertake – opportunity to gather lots of data to refine approach.
- In the case of the tidal sections of the Parrett and Tone - mechanical most suitable for pioneer dredging, hydrodynamic dredging trialled for maintenance activities.
- Trials are proving successful.
Thank you - Questions