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# Estimating costs and benefits of WFD implementation by FCRM at a water body scale

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# Presentation structure

- Project aims and objectives
- Approach
  - Estimating costs
  - Estimating benefits
  - Cost-benefit tool
- Results
  - GES vs GEP
  - Spatial variations
  - Mitigation measures



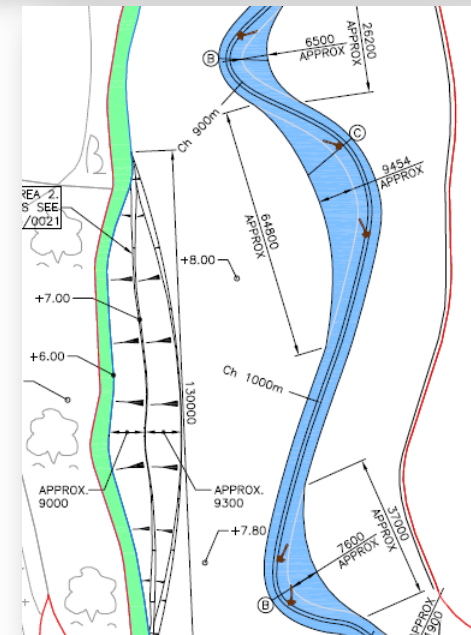
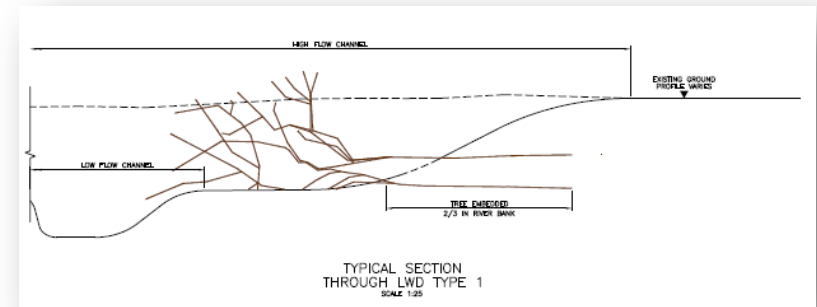
# Aims and objectives

- Environment Agency (England): FCRM
- Understand investment needs for WFD delivery
  - Costs
  - Benefits
- Develop a tool to help prioritise spending



# Approach

- Use water body level data as the basic “building blocks”
- Based on real costs and measured data
- Key assumptions based on expert judgement



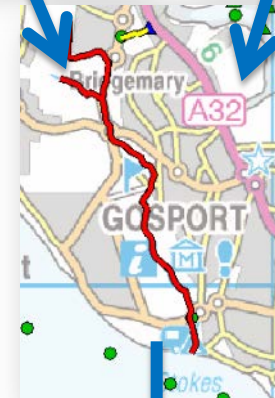
# Approach

- GEP:
  - Mitigation measures
  - Identified for each water body
- GES:
  - Reasons for failure
  - Investigations programme
  - Base costs and benefits on GEP measures
- Protected Areas
  - Based on GEP/GES measures



# Estimating costs

- Appraisal costs
- Construction unit costs
- Water body parameters
  - Length
  - Number of structures
  - Length of defences
- Assumptions on extent of implementation
- Number of applications



# Estimating benefits

- Ecosystem services approach
- Benefits transfer values
- Provisioning
  - Crops, livestock, aquaculture, biomass, water
- Regulating
  - FCRM, Climate, water quality, pests and diseases
- Cultural
  - Heritage, landscape
- Supporting
  - Maintenance of biodiversity



# Cost-Benefit tool

- Excel-based tool
- Based on user-programmable assumptions
- Calculates costs, benefits and BCRs
- Outputs at different spatial scales
  - Water body
  - Management catchment
  - River Basin District
  - National
- Prioritisation scenarios
  - Least cost
  - Maximum benefit

The screenshot shows an Excel spreadsheet with the following structure:

- TOTAL COSTS**: A table with columns for Aspect, Capital, OpEx, OpEx, Subtotal, OpEx, OpEx, OpEx, Subtotal, OpEx, OpEx, OpEx, Subtotal, and TOTAL. It lists various cost components like 'Indicative work costs', 'Discount factor (3% mid-9s)', 'Indicative present value costs', and 'Indicative annualised costs'.
- COSTS PER MITIGATION MEASURE**: A similar table structure for specific measures like 'Reduced nitrogen measures'.
- COSTS PER CATCHMENT**: A table for catchment-level costs, including 'Reduced catchment'.
- COSTS PER OPERATIONAL CATCHMENT**: A table for operational catchment costs, including 'Urban and Docks'.
- COSTS PER RIVER BASIN DISTRICT**: A table for river basin district costs, including 'Anglia'.
- COSTS PER EA REGION**: A table for EA region costs, including 'Anglia'.



# Model sensitivity

- Simple analysis
  - High, medium or low certainty
  - Vary parameters by % increase/decrease
- Results shown for  $\pm 10\%$
- All other parameters <1% change

Parameter	% change
<i>Costs</i>	
Construction	9.51
Number of applications	8.93
Length of defences	7.87
<i>Benefits</i>	
Willingness to pay	10
Households per km	9.58

# Results



- Detailed results subject to ongoing discussions with Environment Agency and UK Government
- Present preliminary results and conclusions for England
- Based on default model assumptions

# Results: National summary

	<b>GEP</b>	<b>GES</b>	<b>PA<sub>s</sub></b>
<b>% expenditure</b>	81	1	18
<b>% benefits</b>	65	30	5
<b>Benefit-cost ratio</b>	4.5	148	1.3

- All activities provide benefits which outweigh costs
- Delivery of GEP accounts for greatest expenditure and greatest benefits
- Benefits from delivery of GES proportionally much greater
- Benefits from delivering PA objectives proportionally smaller

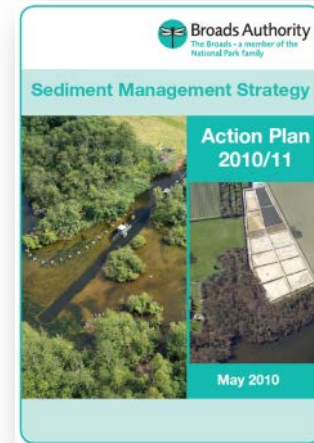
# Results: Spatial variations

- Considerable spatial variation in BCRs
  - Water body: 0 - 300
  - Catchment: 0.8 - 260
  - RBD: 1.8 - 42
- Dependent on measures required



# Results: Performance of different measures

- 21 out of 22 measures have a BCR >1
- Positive BCR (higher):
  - Management strategies
  - Floodplain reconnection
  - Structure modifications
- Positive BCR (lower):
  - Habitat creation
  - Fish passage
- Negative BCR:
  - Fish entrainment



# Conclusions

- Expenditure on FCRM's contribution to GES/GEP as set out in the first RBMPs gives a positive BCR
- Proportionally greater benefits from GES measures than GEP or PAs
- Strategies, floodplain reconnection and structure modifications provide the greatest benefits



# Any questions?

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# Performance of different measures

Measure	BCR
Sediment management strategies	996
Channel maintenance strategy	570
Improve floodplain connectivity	490
Remove structures	430
Habitat creation	150
Change operational regime	120
Improve longitudinal connectivity	110
Removal or replacement of hard bank reinforcement with soft engineering	105
Preserve and restore habitats	56
Increase in-channel morphological diversity	55
Water level management strategy	52

Measure	BCR
Protect and maintain natural sediment processes	49
Habitat management	45
Modify structure	44
Change vegetation management practices	41
Enable fish passage (e.g. fish pass)	38
Protect existing vegetation	33
Managed realignment	21
Re-engineering of the river where the flow regime cannot be modified	20
Bank rehabilitation / reprofiling	16
Plant new vegetation	7.8
Manage risk of fish entrainment	0.14