



SCOTTISH EXECUTIVE



Conveyance Estimation System (CES) Launch

Technical Overview

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The problem to be solved

- Flood management issues are increasing in importance
- Standard modelling methods did not use best available science
- The size of uncertainty in the process was not well understood
- **How could current knowledge be best used to improve the “reliability” of the result?**



Technical context

- 10 to 100 km flow domains
- 12 hour to 2 week event duration
- 3-D models too complex and expensive
- 1-D models are standard industry approach (e.g. ISIS, HEC-RAS)
- Based on averaged equations over width and depth of the flow



The modelling process

- Try to represent the essence of the real life situation
- Physical or numerical analogues
- Many explicit and implicit assumptions
- Range of application



Real World Physics

Assumptions

Mathematical Model Equations



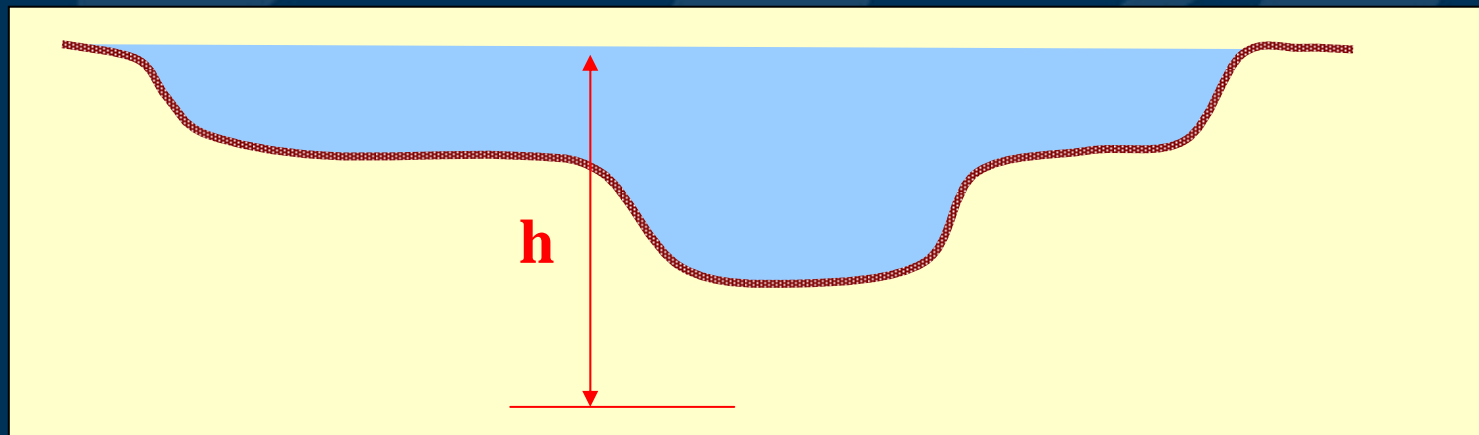
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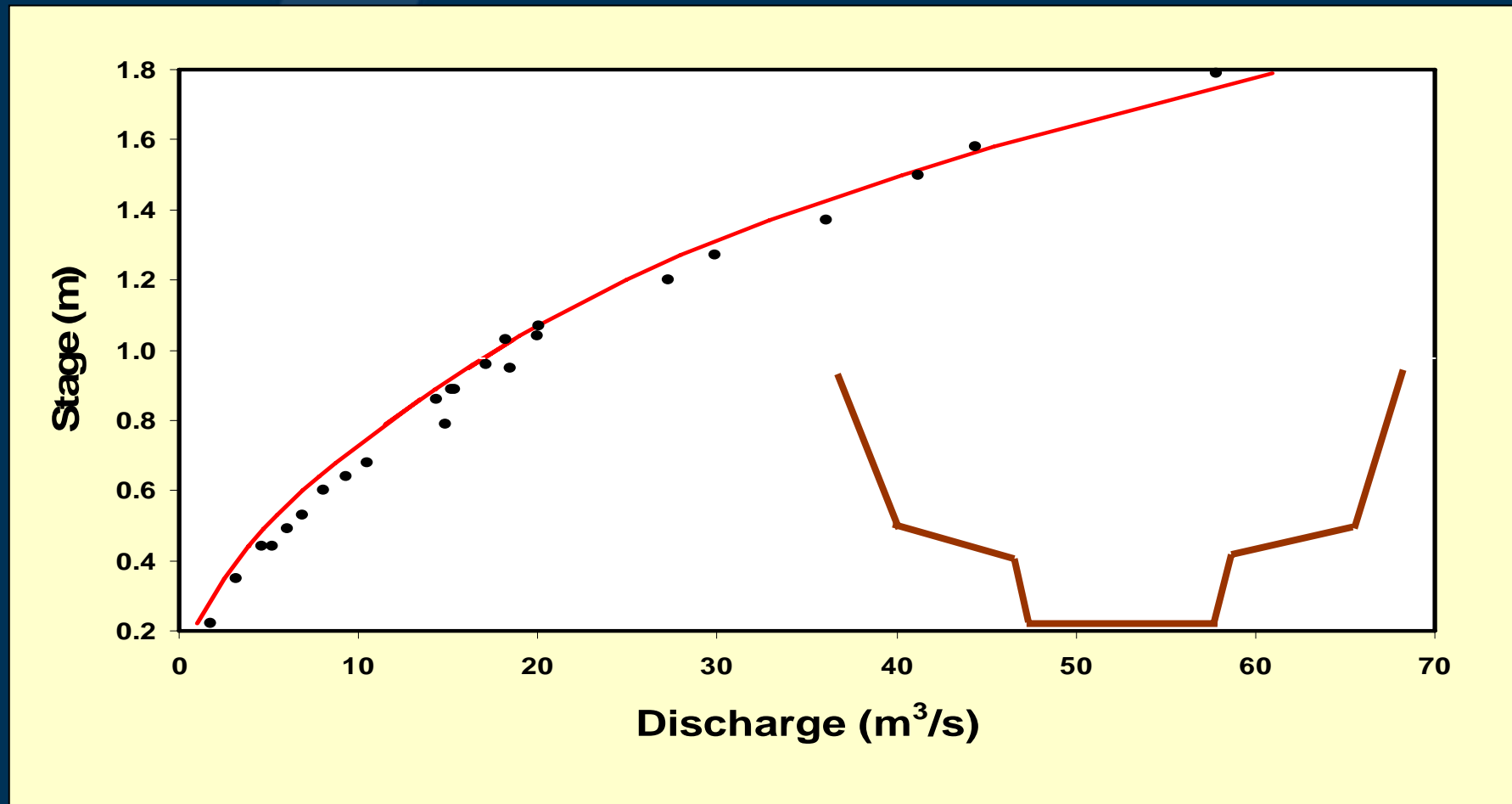


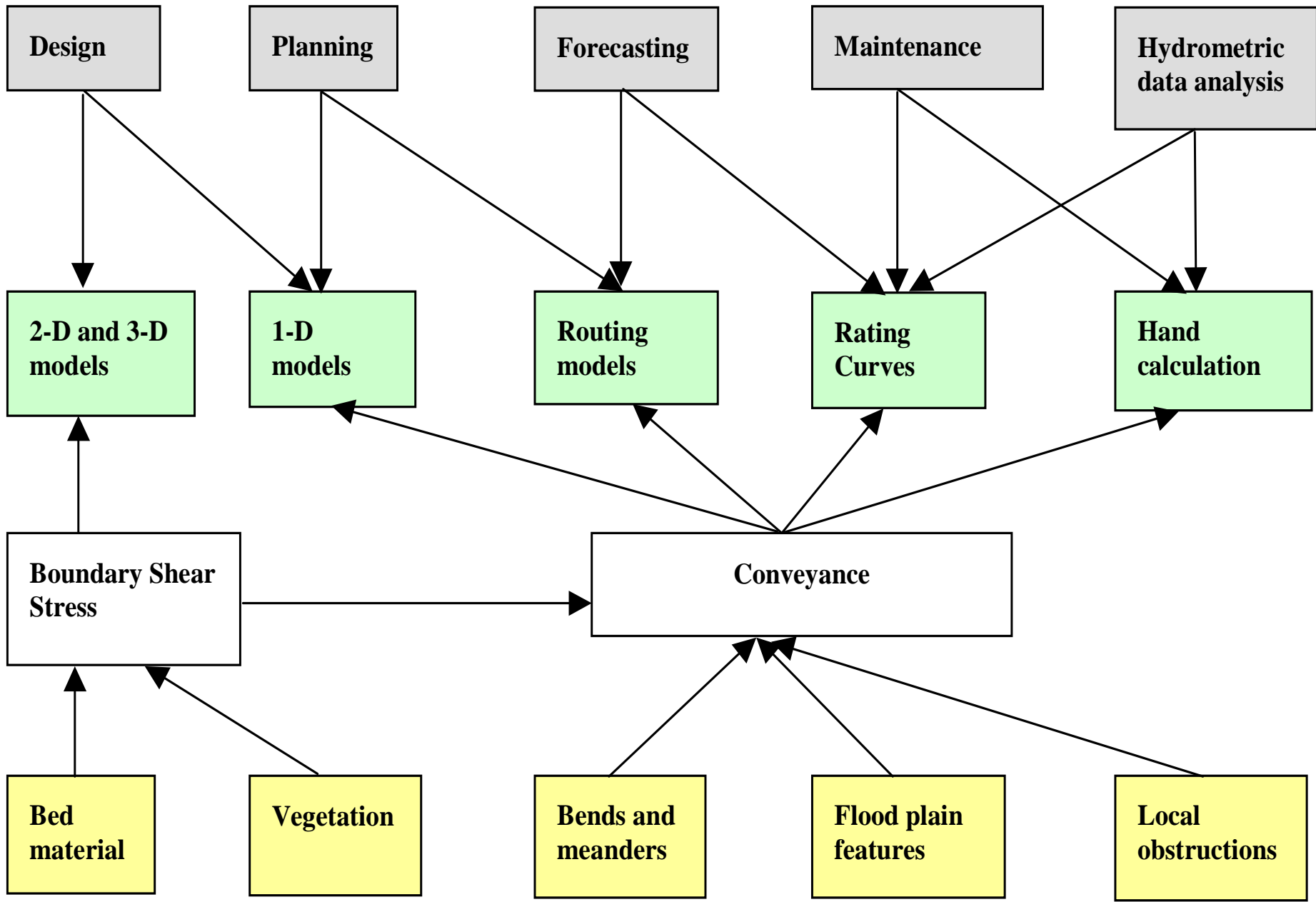
What is conveyance?

- A measure of the capacity of a river in a one-dimensional analysis
- $Q = K(h) s^{1/2}$
- Q is discharge, h is “stage” (water level), s is slope (surface gradient)



A rating curve



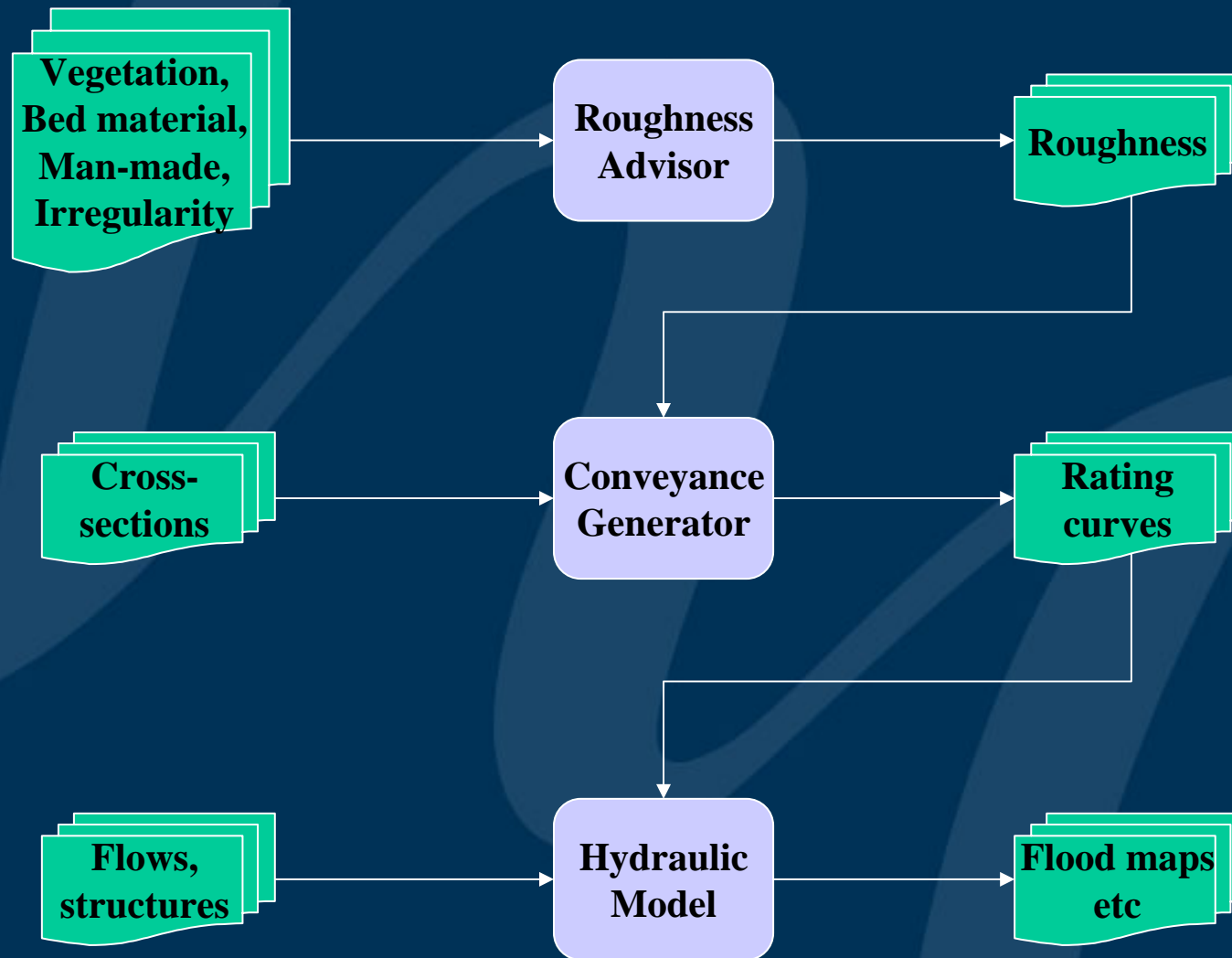


Conveyance estimation system components

- **Roughness Advisor**
 - improved roughness estimate
- **Conveyance Generator**
 - improved conveyance calculation
 - based on current knowledge
- **Uncertainty Estimator**
 - indication of uncertainty associated with calculation



CES - ID model



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Method selection

- **Compilation of knowledge on resistance of UK rivers**
- **Provide “no-data” estimation of roughness**
- **Represent the essence of the flow physics with important energy “loss” mechanisms**
- **Re-introduce some complexities lost by cross-section averaging**



Criteria for selection

- **Little additional data needed for model construction**
- **Suitable for all channel types in UK**
- **Ability to incorporate lateral variations of flow and local roughness**
- **All methods were to be reviewed and accepted by the project's expert panel**



Review and consultation

- Academic advisory group
- User Consultative Group
 - Individual visits
 - 3 meetings at HR Wallingford
- Meeting with S105 consultants group
- Influenced software features and appearance
- Notes circulated to all involved



Quality management

- Project management plan
- Quality plan
- Testing procedure (“alpha” and “beta”)
- Academic validation of methods
- Document review
- WS software development process
- Pilot testing in practice



Implementation and uptake

- **Pilot testing on live projects**
- **Training material on new method and its use**
- **Arrangements by the Environment Agency to ensure its use**
- **Open access to the project results on web:
www.river-conveyance.net**



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Project deliverables

- **The CES “stand-alone” version**
 - Software application for improved estimation of the carrying capacity of open channels
- **Produced as Open Code with components:**
 - Roughness Advisor
 - Conveyance Estimator
 - Uncertainty Estimator
- **Implemented in ISIS for use in modelling**



Project documentation

User Documentation:

- Conveyance Manual
- Initial training materials

Technical Reports

- Data sets
- Review of methods for estimating conveyance
- Testing in 1D models
- Roughness Review

Visit website: www.river-conveyance.net



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Summary of innovation in the CES

- New calculation method (updates simple use of Manning's equation)
- Index of river resistance from vegetation “morphotype”
- “No-data” advice on river vegetation from RHS
- Advice on seasonality of resistance
- Explicit estimates of uncertainty

