



Culvert hydraulics

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The ideal culvert:

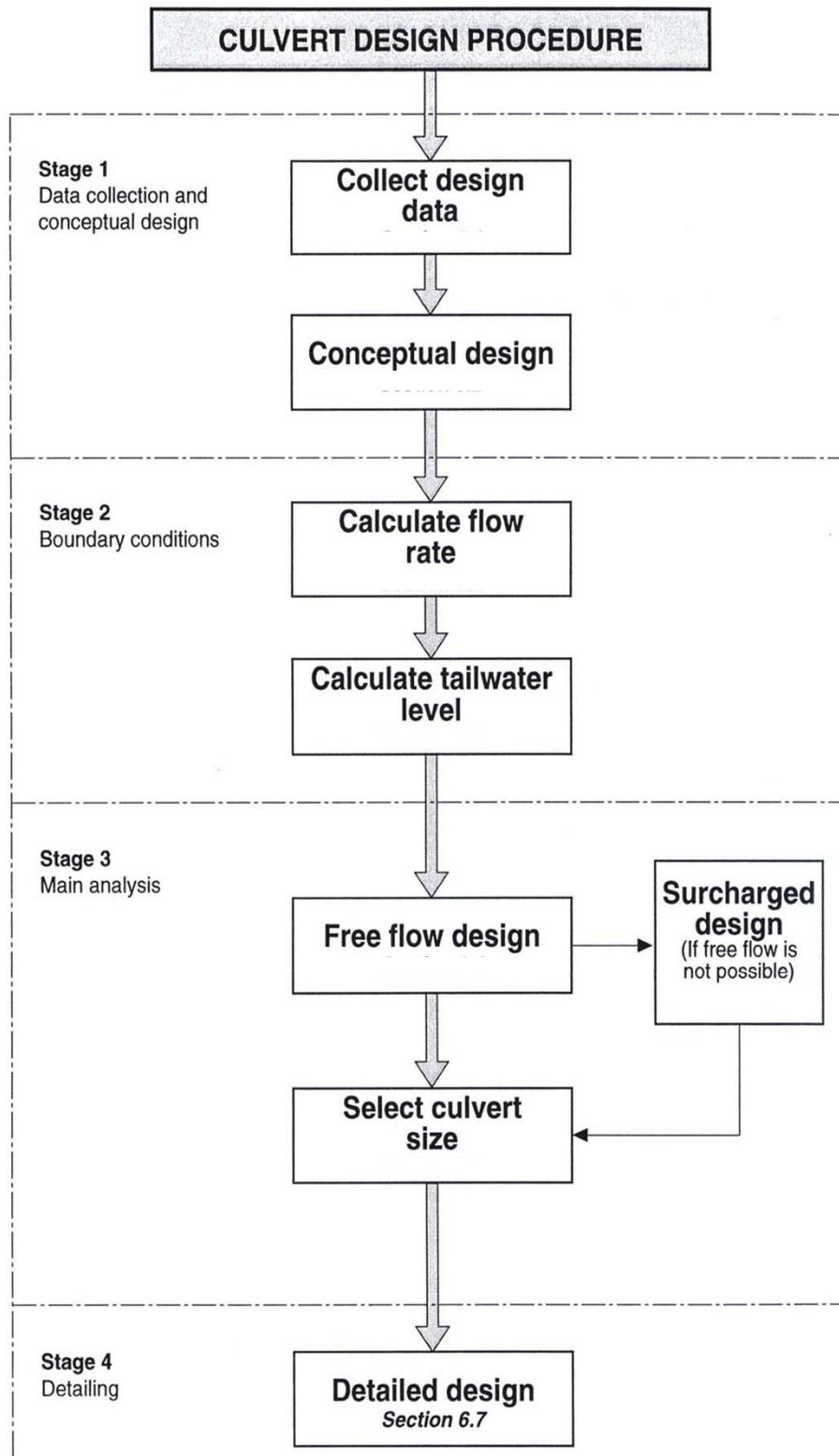
- > Capacity issues (flow, debris)
- > Self cleansing
- > No constrictions/bends
- > Construction and maintenance issues
- > Fish and wildlife issues
- > Safety
- > Appearance

- > Full range of flows
- > Free or surcharged flow (free flow preferred)
- > Inlet or outlet control
- > Conveyance of sediment, trash and debris
- > Ease of construction
- > Safety and security
- > Ease of operation and maintenance
- > Environmental acceptability

Culvert design - the parameters

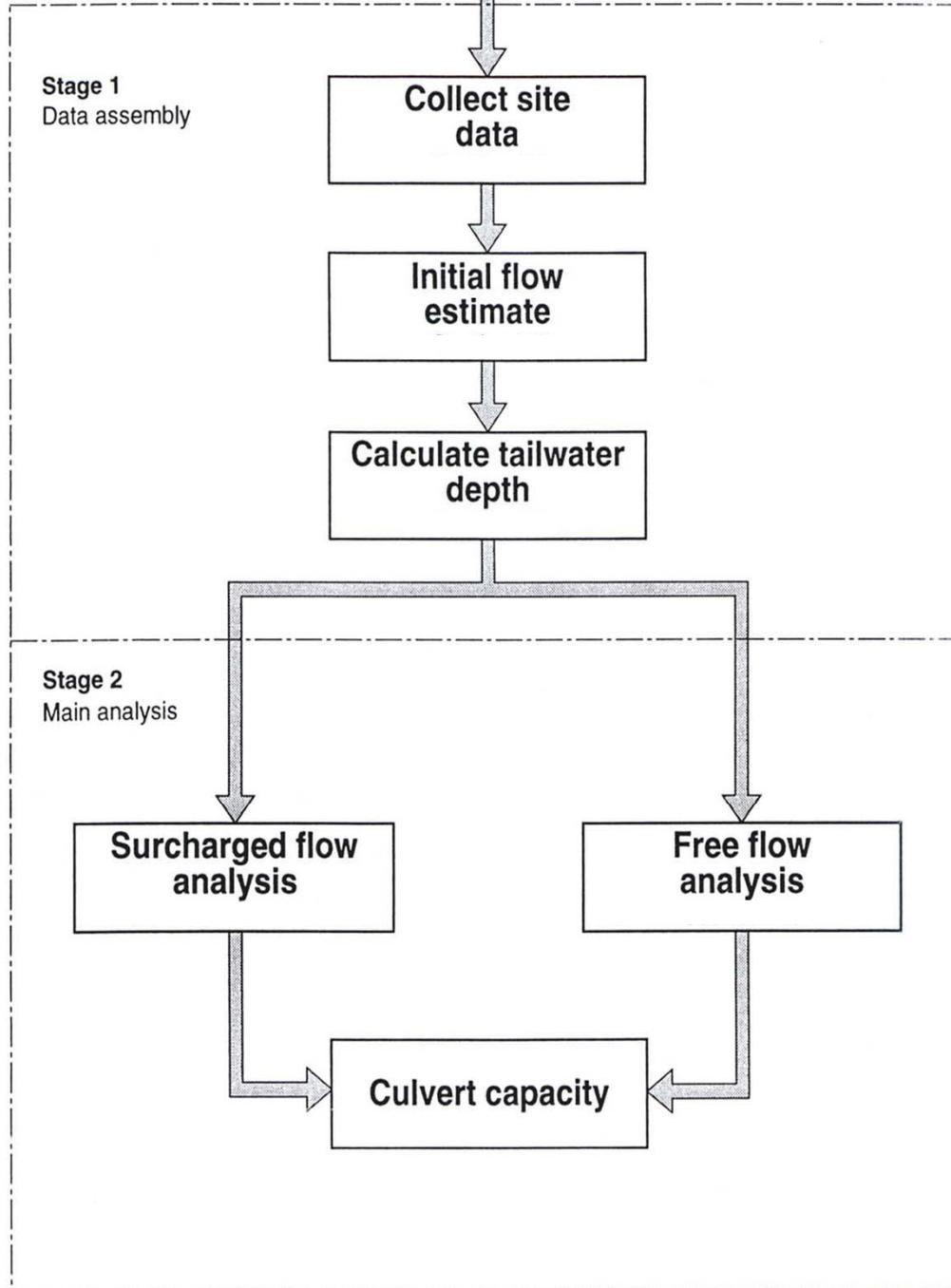
Legend	Performance Criteria													
	<i>Hydraulic</i> →			<i>Environmental</i> →				<i>Operational</i> →			<i>Economic</i>			
<input checked="" type="checkbox"/> Direct impact <input type="checkbox"/> Indirect impact <input type="checkbox"/> Little or no impact Note: 1. The impact of culvert slope will be dependent on head loss through the culvert 2. Foundation conditions may impact on these parameters	Flood flow capacity	Low flow performance	Flow velocity in culvert	Siltation risk	Trash/debris conveyance	Ponding of water u/s	Fish & wildlife migration	Scour of d/s channel	Leakage (in/out)	Access for inspection	Safety/security	Durability	O&M costs	Capital cost
Design Parameters														
Culvert size	✓	○	✓	○	✓	○	○	○	✗	✓	○	○	✓	✓
Culvert shape (see note 2)	○	✓	○	○	○	○	○	○	✗	○	○	✗	○	○
Single or multiple barrels (see note 2)	○	✓	○	○	✓	○	○	○	○	✓	○	○	✓	○
Invert level(s) (see note 2)	✗	○	○	✓	○	✓	○	✓	○	○	○	✗	○	○
Slope (see note 1)	○	○	✓	✓	○	○	✓	✓	✗	○	○	✗	○	○
Freeboard above design flood level	○	✗	✗	✗	✓	✗	✗	✗	✗	○	○	✗	○	✓
Provision of trash screen	✓	○	✗	○	✓	○	✓	✗	✗	✓	✓	✗	✓	✓
Provision of security screen(s)	○	○	✗	○	✓	○	✓	✗	✗	✓	✓	✗	○	✓
Construction materials	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	○	✓	✓	✓
Construction method (see note 2)	✗	✗	✗	✗	✗	✗	✗	✗	○	✗	✗	○	○	✓

- > Data collection
- > Boundary conditions (flow and downstream water level)
- > Conceptual design
- > Detailed design
- > Detailing



Outline design procedure for new culverts

PROCEDURE FOR ASSESSING THE CAPACITY OF EXISTING CULVERTS



**Outline design
procedure for
assessing
existing
culverts**

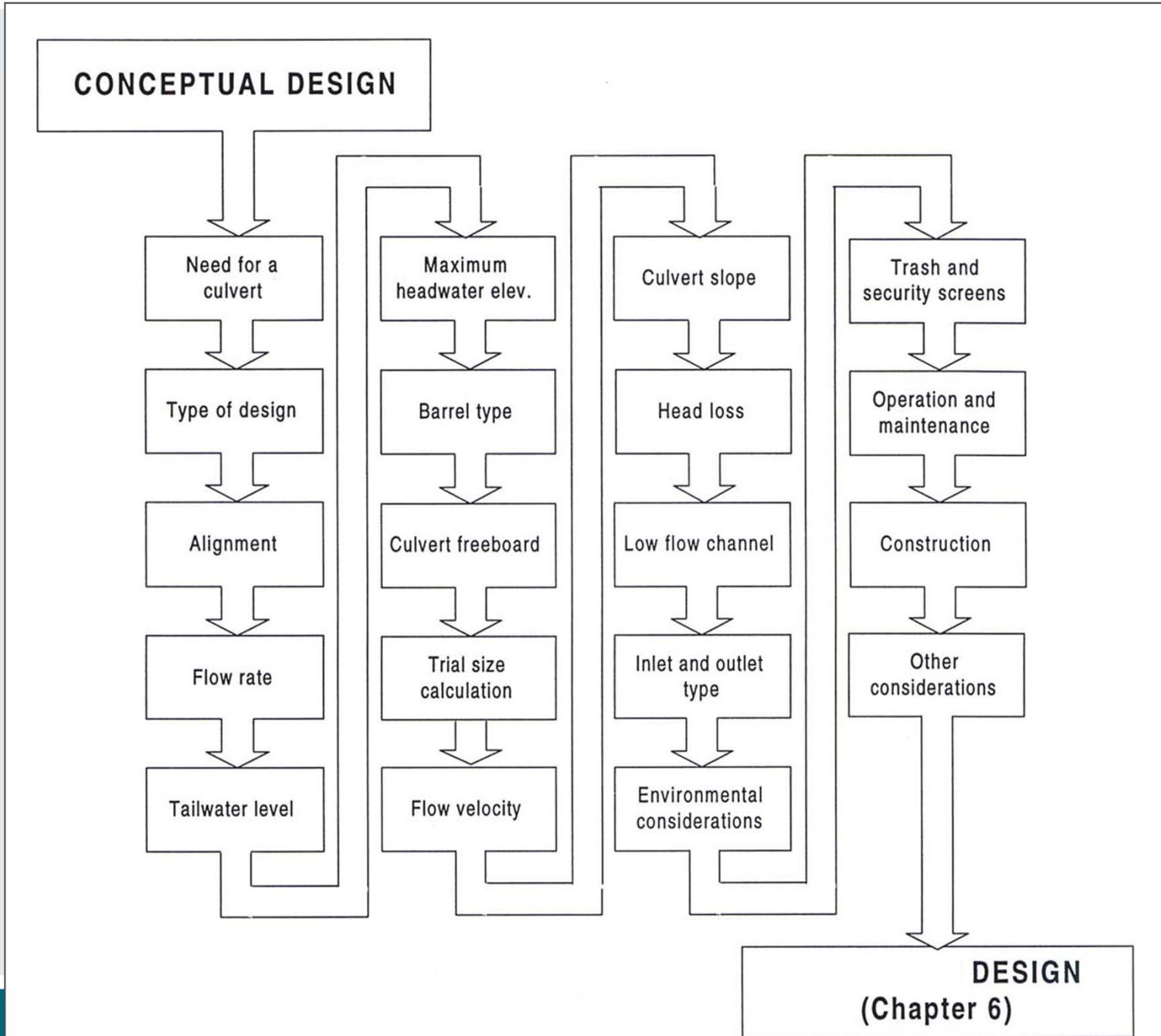
Identification of all constraints

Sketch design

Leading dimensions and levels

Estimates of:

- > barrel dimensions
- > design flow
- > tailwater & headwater elevations
- > inlet & outlet invert levels
- > other requirements (screens, maintenance, etc)





Any questions?

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