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Managing Water in the West

Alphabet Weir Design Guidelines

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Alphabet Weir Design Guidelines

- Existing designs are based upon anecdotal information that apply to a narrow range of conditions. Therefore many applications fail to perform their intended function.

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Alphabet Weir Design Guidelines

- Identify failure modes and factors leading to success
- Develop engineering and hydraulic performance
  - Field performance review
  - Laboratory testing
  - 3-D Numerical modeling

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Alphabet Weir Design Guidelines

- **Failure Modes**
  - **Scour-Geotechnical**
  - **Hydrodynamic-Fluid Forces**

Alphabet Weir Physical Modeling

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Objectives

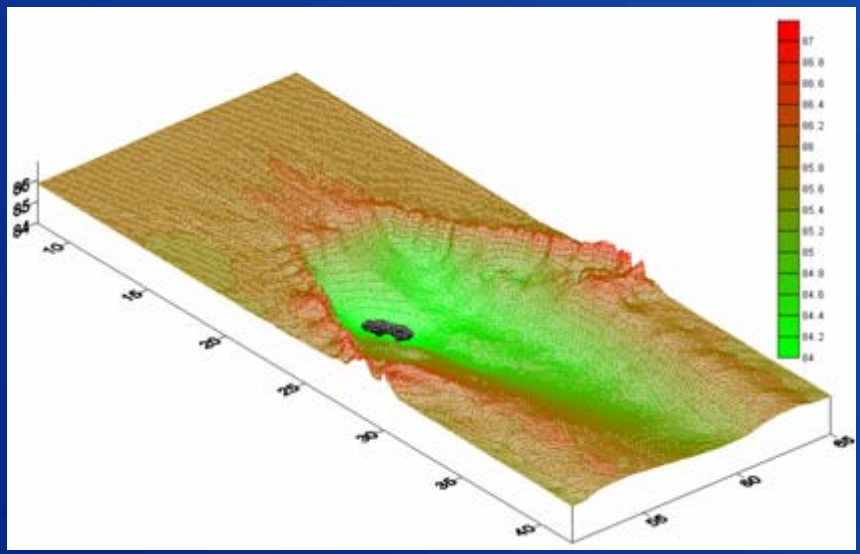
- Field investigation identified growth of a scour hole causing geotechnical movement as the primary failure mechanism for rock weirs.
- A physical model was designed to develop and measure the maximum scour depth downstream of rock weir structures.
- Testing includes:
  - three rock weir types (U-Weirs, W-Weirs, and A-Weirs);
  - three prototype bed material sizes (FG, MG, and VCG); and
  - typical channel characteristics (hydraulic geometry).
- Results will assist in developing a scour prediction method.

Physical Model Results to Date

Scour hole downstream of a U-weir after testing.

- **Laboratory results confirmed the geotechnical failure mechanism shown by field investigation.**
- **The location and dimensions of the scour hole is sensitive to irregularities in the rock crest.**
- **Scour occurs primarily due to the elevation drop not contraction from the arms.**
- **Scour and hydraulics did not depend on whether material filled in upstream of the crest.**
- **Stepped footer configuration reduces the size of the scour hole and moves the location downstream.**

Future Efforts



- Physical modeling results will relate maximum scour to the local hydraulics.
- 3-Dimensional Numerical Modeling will increase the range of applicability.
- Integration with field datasets will validate the scour methods.
- Parameterization to 1-Dimensional hydraulics will facilitate application of the methods.

Alphabet Weir Design Guidelines

- Rock Size
- Rock Shape
- Construction Technique
- Arm Horizontal Angle
- Arm Vertical Angle
- Rock Stability Relative to bed material size and hydraulics
- System Morphology
- Scour Estimate

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