RECLAMATION
Managing Water in the West
U.S. Department of the Interior
Bureau of Reclamation

Technical Service Center, Denver, Colorado **Sedimentation and River Hydraulics Group**

Qualitative Evaluation of Rock Weir Field Performance

Design Guidelines for River Spanning Rock Structures

What Is The Problem?

Rock weir structures can provide bank protection, channel profile stability, improved aquatic habitat, and fish passage in river engineering projects. Current design methods primarily rely on professional experience and anecdotal information. Many structures no longer meet the intended design goals and will require repair and retrofitting. Failure to meet biological and geomorphic requirements may restrict water operations.

What Is The Solution?

The Sedimentation and River Hydraulics Group is combining field investigations, physical modeling, and computer simulation to develop design guidelines based upon predictable engineering and hydraulic performance criteria. In the summer of 2005 a field investigation evaluated 87 structures to qualitatively evaluate performance and identify successful and less successful practices.

What Are The Benefits Of This Solution?

The qualitative phase identified beneficial practices and common failure mechanism to consider during design. Intact structures appeared to succeed in modifying flow patterns and bed characteristics justifying future use. Results from the evaluation include:

- Improved understanding of common failure mechanisms and potential countermeasures for longer lasting designs;
- Evaluation of hydraulic performance to meet project specific objectives while avoiding adverse impacts; and
- Improved ability to meet regulatory requirements governing habitat and fish passage.

Understanding process governing success and failure allow designers to construct more robust river structures while minimizing the effort required to meeting project constraints.

Who Can Benefit?

Offices responsible for constructing and maintaining diversions in addition to fish passage can benefit from improved designs. In-stream structures can provide mitigation against environmental degradation and also stabilize stream banks and profiles.

Where Have We Applied This Solution?

Observations have been applied to repair of a diversion structure on the Lemhi River in Salmon, ID. Design repairs for the summer will incorporate countermeasures to defend against common failure mechanisms.

Future Development Plans

The qualitative observations are part of a multifaceted approach incorporating a quantitative evaluation of field data, laboratory physical modeling, and numerical simulations. The end product will develop tools and guidelines for more robust structure design or retrofits based upon predictable engineering and hydraulic performance criteria

More Information

Successful techniques included deep foundations to protect against scour, grouted weir crests, using multiple structures in series, and using interlocking blocky shaped rocks. Impairment of the structure primarily occurred through movement of the constituent rocks through enlargement of the downstream scour pool and undercutting of footer rocks. Rivers flanked several structures through migration and bank erosion. Rarer failure mechanisms included piping beneath the structure and burying from high sediment loads. Rock sizes seen in the field appeared large enough to resist overturning and sliding from hydraulic forces though incipient motion may play a role in some cases.

The qualitative report is available on the Sedimentation and River Hydraulics Group web site:
http://www.usbr.gov/pmts/sediment/kb/spanstructs/index.html

Contact Information

Elaina Holburn, (303) 445-2550, eholburn@do.usbr.gov

a.

b.

3D velocity measurements on a rock weir structure during high flow (a) and rock weir summer low flow conditions (b).