

TRADITIONAL SKILLS AND MINIMUM TOOL LEADERSHIP AWARD

Age, downstream population growth, more stringent dam safety requirements, and location are compounding issues impacting many of the dams located in the Selway Bitterroot wilderness area. Canyon Lake Irrigation District is the owner of one of those dams, a high hazard dam called the Canyon Lake Dam. A number of compounding problems with the Canyon Lake dam prompted the Forest Service to require the Canyon Lake Dam Irrigation District to upgrade and repair the dam or breach it. Among the problems were,

- The outfall structure on the Canyon Lake dam has partially collapsed impeding flow thereby limiting the ability of the outfall structure to lower the pool elevation in a specified time in an emergency.
- Wave erosion has severely degraded the upstream dam face leaving a relatively narrow dam section at points along the length of the dam which are susceptible to piping.
- Recent geotechnical investigations have determine that the dam is comprised of liquefiable, cohesionless, silty sand.

Consultants hired by the irrigation district determined that it may take as much as one million dollars to renovate and repair the dam. This revelation caused a division within the irrigation district eventually spawning a movement to breach the dam. However, despite considerable debate no clear course of action came out of the irrigation district meetings. The only option considered involved using mechanized equipment to construct a partial breach of the dam to lower its hazard rating followed by the repair of the outfall structure and entire dam the following year, again using mechanized equipment. Estimates to accomplish the work on the partial breach ranged from \$300,000 to \$500,000. With the deadline for action on the dam looming the Forest Service, in an effort to end the gridlock, suggested the use of non-traditional methods to construct the partial breach. Forest Service engineers and rigging experts worked closely with the irrigation district, irrigation district consultants, and the Montana Conservation Corps (MCC) to develop a plan that would enable the use of economically efficient, non-motorized, primitive methods in the construction of the partial breach.

1. **Uniqueness or ingenuity displayed in completing the job without the use of motorized equipment or mechanical transport.**

The primary challenge to overcome in executing the project was the prevailing attitude amongst observers and, to some extent, team members that the work could not be accomplished using primitive methods. Many believed that mechanized equipment would have difficulty moving the large rock on the downstream face of the dam. Therefore, many reasoned, it would be extremely difficult if not impossible to do the work with inexperienced crews using primitive methods.

Creativity, good planning and hard work carried the day however. The work on Canyon Lake Dam went off without a hitch and was completed for approximately \$125,000, a savings of up to \$375,000. The project was completed almost entirely with the use of non-motorized equipment which included lifts, wenches, sky lines, and hand labor.

The project was a testimony for cooperation between public and private interest with the ultimate beneficiary being public safety. Work that seemed impossible to accomplish due to financial constraints was made possible through the creative efforts and hard work of the

many people involved with this unique project.

2. **The resurrection or relearning of skills or tools that have been abandoned or nearly lost.**

The limiting variable in the partial breach effort was the movement of the large rock on the downstream face of the dam and rip rap placement in the breach channel to prevent erosion. Some of the rocks on the downstream face weighed in at 2000 to 3000 pounds. The pervasive view amongst engineers and contractors in and out of the government was that primitive methods would not be practical to use in the construction of the breach due to the large rocks involved. In a collaborative effort between local engineers, Forest Service engineers, rigging experts and the Montana Conservation Corps, a plan was crafted using primitive methods. Those involved felt that they had a high likelihood of success despite the inexperience of all involved. Primitive methods had never been used before in reconstruction efforts on dams. Steps taken in the development of the plan were tentative at best. The plan involved the use of sky lines, rigging, spar poles, and manual labor to construct the partial breach in a manner similar to methods originally used to construct the dam nearly one hundred years ago. The plan worked with a savings of more than half of the original projected project costs.

3. **Accomplished a job with traditional skills and tools when approval for motorized equipment could probably have been obtained.**

Approval for motorized equipment had been obtained to accomplish the work. In fact, given the inexperience of the MCC crews and engineers (private and public) with primitive methods a secondary plan was formulated which involved airlifts and mechanized equipment should problems develop in the execution of the project which would prevent completion before inclement weather moved in.

4. **Difficulty or challenging nature of the task.**

Since there were no examples to follow in planning the setup and execution of the project everything had to be developed from scratch. The difficulty in constructing the partial breach using primitive methods was the planning and execution of the project using unproven dam construction techniques. Some of the planning decisions that were made to accomplish the project,

- Conceptualization of possible methods and techniques to accomplish the work on the dam using primitive techniques in a limited amount of time.
- Layout of work site to include,
 - Selection and positioning of spar poles,
 - Anchoring of the spar poles to include anchor types available for the given conditions,
 - Selection of landing for large rocks that would enable not only their removal and temporary storage but replacement once reconstruction was complete,
 - Selection of alternate setups to facilitate construction effort in the event problems occur with the primary setup.
- Logistics of supporting MCC crews onsite.
- Logistics of packing required materials to the site.