DAM REHABILITATION IN EXTREME ENVIRONMENTS
Successful Solutions for Cold-weather, High-Elevation, Low-Visibility Marine Construction
High Altitude Projects in the Rocky Mountains

Hebgen Dam
6,500 Feet

Strontia Springs Dam
6,000 Feet

Cheesman Dam
6,842 Feet
Effects of High Altitude on Diving

High Altitude limits a diver's time on bottom – and their production.

Example:

- Diver working at 80 feet above 6,000 ft.
- Elevation is generally rounded up to the next 1,000 ft. increment, in this case 7,000 ft.
- The “corrected” depth becomes 110 ft. which cuts the “No D” working time in half.
- Altitude directly affects schedule and costs.
Rehabilitation Project of the Emergency Reservoir Drawdown System (ERDS)

Owner: Denver Water

Schedule: August to December, 2016

Two Gates
- Damaged Control Gate Downstream
- Bulkhead installed Upstream of Maintenance Gate
- 200’ Depth – Zero Visibility
Strontia Springs Dam – Littleton, CO

Remove Four 17 Ton Fixed Wheel Gates, Chains and Stands

Remove and Refurbish Maintenance and control Gates, Cylinders and Hydraulic Systems

Install 22 Ton Bulkhead

Remove and Refurbish 12.5 Ton Trash Rack
Cheesman Dam – Deckers, CO

Emergency Hydraulic Refurbishment & Corrosion Projection System Installation
Owner: Denver Water
Schedule: December to January, 2016-17

- **Problem** – Hydraulic leaks in SS cylinders at 50’, 125’ and 175’ due to corrosion
- **Solution** – Emergency repairs of submerged mid and low level gates and top side jet-flow gate.
- Repair four cylinders and hydraulic lines
- Design and install cathodic protection and anode system to prevent further deterioration
Corroded Bubbler System

Corroded Cylinder

Refurbished Cylinder

Cheesman Dam – Sedalia
• Elevations of over 6,000 feet
• Temperatures were routinely below -10°F.
• Water temperatures ~ 40°F
• Remote access
• Delays can cost more than $30,000 per day
• Hot water suits
• Hot water plumbing around the decompression chambers
• Hot water units

Cold Weather Diving
• Bubbler system designed to keep dive site clear of ice
• Crews kept equipment running and water circulating 24/7 to keep hoses from freezing

Strontia Springs Dam Barge
• Diving through ice
• Bubbler system keeping ice back

Air Hose Simply Placed into Reservoir was the Most Effective
Hot Water Around Decompression Chamber

Bubbler System Around Barge

Hot Water Units
• Use of small equipment barge to transport items for increased maintenance
• Narrow, mountainous one-lane, gravel road
• Last ½ mile used ATV’s to get to site
• Winter Demobe Twice as long as Summer Mobilization
• No Turn-around – Crane assistance for turning trucks
• Steep Grades – Heavy off-road equipment used for getting flexi-floats, equipment and trucks in and out of site
Break Ice Daily to get from Shore to Work Site
Nightly Freeze – over 4’- 6’
Cold Weather Mitigation Added 2-3 Hours Daily
Fully Enclosed Dive Conex -
• Diver, Crew and Equipment Protected from Weather
Questions