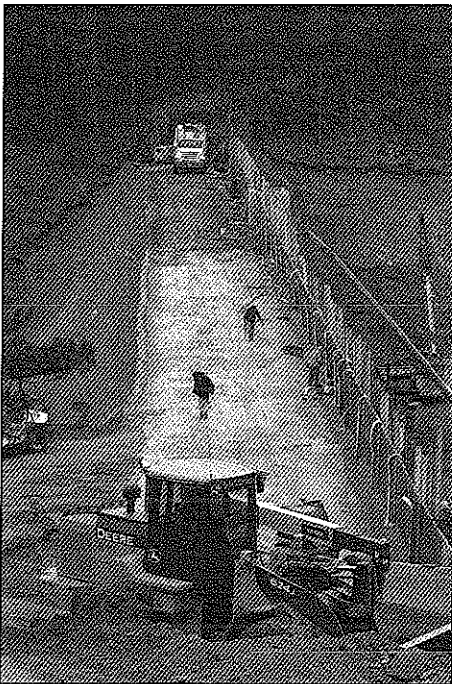


USSD Award of Excellence in the Constructed Project

Cost and Time Savings Realized from Design/Build Process

Pine Brook Dam and Reservoir, located two miles northwest of Boulder, Colorado, was built to store raw water for municipal use by the Pine Brook Water District. The District's surface water source on Four Mile Creek had gone dry several times since 2002, resulting in extreme water restrictions. The dam is a RCC gravity structure 85 feet high with a crest length of 600 feet. Substantial cost, materials and time savings were achieved by the design/build team. The USSD Award recognized the owner, Pine Brook Water District; the contractor, **ASI Constructors, Inc.**; and the consultant, **TCB**.



The project began in January 2005, as a design/build team involving the owner, contractor and engineer. During team meetings, key design elements were posed, debated, studied, evaluated and refined. Issues such as RCC design strength, foundation issues, emergency and service spillway configurations, outlet works and other elements were discussed and yielded design concepts selected in a *single* meeting. Out of these meetings, the project and its features took shape, and

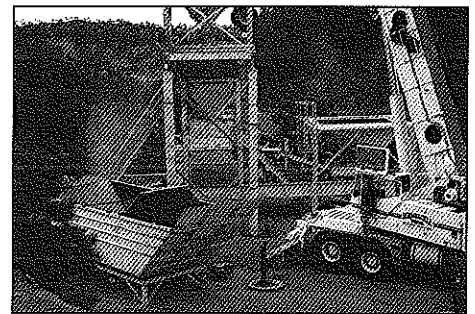
the design progressed until its completion in June 2005. Throughout the process, the contractor and the consultant worked closely with the Colorado State Engineer's Office.

Balancing cost-effectiveness with the need for a safe structure is always a challenge. However, the design/build team was able to focus on several areas to achieve cost, materials and time savings without jeopardizing safety, which included:

- The owner and contractor shared the cost liability equally on items such as foundation excavation, construction scheduling, etc. in order to remove "buffers" in the construction budget that were based on unknowns. This controlled the construction budget and reduced expenditures.
- Use of control gates and valves downstream of the dam eliminated expensive control gates mounted on the upstream face of the dam and increased visual appeal of dam face, which was important given that this dam is situated in a residential neighborhood.
- Economical cross-section required no chimney or gallery and was designed for full uplift pressures negating the need for foundation drains. This design put a greater value on the ease of construction (and the associated cost savings) versus minimizing materials.
- A zone of sacrificial concrete was designed and constructed on the downstream slope of the dam as protection for the dam and removed the need for costly form work while maintaining proper concrete compaction.
- A parapet wall on the upstream crest of the dam provides flood protection as well as fall protection removing the need for expensive guardrails.
- It was anticipated during the design to excavate the foundation in stages, first to verify the primary foundation rock, and then to determine the refusal point for the cutoff wall. This approach could have cost significantly more time and money if not anticipated in the design and planned for during the excavation phase — a

significant benefit to the design/build process. It also eliminated a considered interim design phase of additional foundation exploration and investigation prior to construction and formalizing the design, thus reducing time and cost.

- By adopting a flexible working schedule early in the process construction efficiency was optimized. When cold weather limited RCC production and placement, RCC production was suspended until warmer weather returned and overall costs of the project were reduced.
- To keep construction schedules on track and minimize downtime, the engineer reviewed and responded to requests for information and change orders extremely quickly (sometimes in less than an hour).
- The entire design/build team worked together and took equal ownership of the project. The understanding that this project was the responsibility of all involved created an atmosphere of trust. No one entity tried to take advantage of the situation; rather, the team created a mutually beneficial environment.



The entire project costs for the design and construction of the Pine Brook Dam were \$4.5 million, significantly less expensive than cost estimates discussed during the proposal phase. The design/build process and Pine Brook Dam Team conceivably reduced the overall design and construction costs by between one and two million dollars. Additionally, the time savings were significant and judged to be between a water season and a full year. □