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SLURRY WALL / CUTOFF WALL / SLURRY TRENCH CASE HISTORIES

TRANSFORMING A MINING SITE INTO A RESERVOIR IN BRIGHTON

Construction has started on a soil-bentonite slurry wall in Brighton, Colorado to complete the first of three water storage reservoirs comprising the City's "Ken Mitchell Lakes" facility. Reservoir No. 1 is located within the former Cell No. 1 of the Bromley Lakes Pit. Bill Timmons (Producer Member, Ready Mixed Aggregates) and Alan Howard (Associate Member, Brierley Associates, LLC) worked with City and DMG staff, and other governing agencies including the State Engineer, Urban Drainage and Flood Control District (UDFCD) and the Corps



of Engineers, to facilitate the transfer and development of this vitally needed water storage facility. The site is completely surrounded by Ready Mixed's remaining active mining operations to the south and to the north. To complicate matters, a "land bridge" for material conveyance from the pit to the north to the processing plant to the south transects the reservoir.

The City requested competitive design-build bids from slurry wall contractor teams and eventually selected the team led by Recon of Houston, Texas with TRC Solutions, Littleton, Colorado and Brierley Associates serving as engineers. Prior to construction, Ready Mixed and Brierley Associates worked with Brighton to accomplish a DMG Acreage Reduction without final reclamation being completed in order to preclude immediate disturbance of reclaimed areas by installation of the slurry wall.

The construction includes approximately 9000 LF of wall constructed to depths up to 40 feet, including a five foot bedrock key. The wall is being constructed to "tie-in" to existing wall tabs constructed by others and creating proper tie-ins is crucial to success of the reservoir. Recon is using two track excavators with 30-in. buckets equipped to handle the occasional hard sandstone lenses that occur near the top of the shale bedrock at the site. Construction also includes a narrow reach approximately 2000-ft-long where there is not enough room for traditional excavation and mixing and where spoils must be trucked away and soil-bentonite mixing must be done with an excavator instead of a dozer.

TRC Solutions and Brierley Associates are sharing the engineering design services that include:

1. slurry wall design and QA/QC;
2. geotechnical investigations and engineering;
3. permitting and agency coordination;
4. State Engineer Office performance testing of the slurry wall liner; and
5. Ground water / hydrogeologic modeling to evaluate and mitigate impacts of around water mounding; and to design and evaluate the liner test.

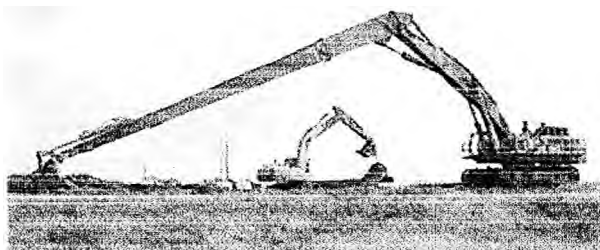
Construction started in late April 2005 and by the end of May approximately 2,500 LF of wall was done. Recon elected to tackle the hardest section first where the available land is too narrow for a traditional setup, yet still achieved production of up to 130 LF/day. QA/QC testing on the first 2000 LF of wall resulted in soilbentonite backfill permeabilities far below the permeability needed to meet the State Engineer lining criteria.

During construction, the cooperative spirit continues_ Ready Mixed is supporting the City's contractor Recon with site access, power, materials and other coordination. The City and Ready Mixed are collaborating on UDFCD spillway design and construction that will be superimposed on the completed wall and will jointly perform final reclamation of this South Platte River open space. Brierley Associates and TRC have formed an engineering team to support Recon on this and other local projects and plan to participate in more of these "win-win" water storage projects that benefit both CRPA mining companies and the local governments so sorely in need of the storage benefits available when the mining is done.

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**B. C. Cobb Electric Generating Facility
Muskegon, Michigan**

Remedial Construction Services, L.P. (RECON) was awarded a contract to install a soil-bentonite slurry wall around an existing fly ash storage area in response to a corrective action mandate Scheduling of this contract was critical. The project was initially designed as a two-year installation to avoid the winter months. The original completion date was scheduled for October 2002. There were severe monetary penalties if this



completion date was not met.

RECON mobilized to the site on May 29, 2001, taking a standard slurry wall crew and its own 410,000-pound Koehring 1466 hydraulic excavator. This machine has a digging capability of 102 feet. The 6,768 linear foot slurry wall, with depths ranging between 63 and 82 feet was completed in five months. Demobilization activities were completed on November 22, 2001; 11 months ahead of schedule.

Cost/Time Saving Program

RECON presented to the client a backfill program that saved cost and time. Backfill mixed adjacent to the trench was placed with excavators using the lead-in trench method. RECON also brought in several thousand yards of imported clay and mixed it with the backfill, increasing the fines content in the backfill, therefore reducing the quantity of bentonite required to meet the 1×10^{-7} cm/sec requirement. All backfill entering the lead-in trench was placed in such a manner that the backfill entered at the point where the trench's slope intersects the ground surface. Backfill placement continued from the point where the backfill surface breaks the surface of the slurry. At the completion of the backfill operation, a final protective clay cap was placed on the top of the slurry wall.

Challenges

The fly ash on the surface had an excessive softness in several areas, which caused the equipment to sink. RECON designed a temporary working platform (2,000 linear feet long) to hold the 410,000-pound excavator using a high strength geogrid and 24 inches of sandy clay cover. The geogrids were high strength polymer grid structures that formed an extremely efficient reinforcing system by performing as a network of distributed anchorages within a soil matrix. The platform was constructed over the soft soils to help distribute the loads over the platform area to improve site access for the excavator. Additionally, the backfill material was mixed to a homogeneous condition using excavator equipment, rather than the conventional dozer method.

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B47 BLOCK CONTAINMENT SYSTEM Freepport, Texas

In the environmental remediation industry, Remedial Construction Services, L.P. (RECON) is recognized for its ability to provide innovative, first-of-a-kind solutions to complex and challenging projects. Such was the case at a chemical plant's former landfill adjacent to the Brazos River in Freepport, Texas.



Total encapsulation of the 200-acre landfill area was required to prevent the flow of groundwater contaminated with numerous Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) A soil-attapulgitic slurry trench, keyed a minimum of two feet into the underlying clay, provided the majority of the

containment. Attapulgite, a naturally occurring clay with properties similar to the more commonly used bentonite, was selected for this project by the consulting engineer because of its compatibility with the contaminants. Where the alignment of the slurry trench encountered two water crossings continuous, unspliced, steel sheetpiling was specified to complete the encapsulation.

Scope and Execution of Work

Prior to the work, RECON conducted a significant amount of research and development on the stability and use of attapulgite slurry to ensure the long-term effectiveness of the completed barrier. The 10,100-foot long, 3-foot wide trench was continuously excavated under the stabilizing slurry to an average depth of 90 feet using a company-owned Koehring 1466 hydraulic excavator, specially customized to achieve a reach of 102 feet. The excavated material was blended at the side of the trench with dry and hydrated attapulgite in ratios calculated to meet the permeability requirement of 1×10^{-7} cm/sec or less, and placed in the trench using the lead-in method. After backfilling was completed, a compacted clay cap was placed to ground level.

The continuous, unspliced steel sheet piles were installed to depths ranging between 78 and 104 feet. To accomplish this, RECON designed and constructed special driving templates two stories tall, and drove the sheets in place using 250-ton cranes with specially designed vibratory impact hammers, and using biodegradable hydraulic fluid.

Construction Milestones

This project marks a significant advance in slurry trench construction. At the time of completion, RECON was:

- x The first to construct a soil-attapulgite slurry wall of this magnitude
- x The first to dig a 100-foot deep slurry wall with a hydraulic excavator
- x The first to drive 105-foot long unspliced sheets of steel piling.

To date, these achievements have not been matched.

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