Boring the Oklahoma Red Beds

By Doug Davis
Drilling Engineer
Davis Corporation
Healdton, Oklahoma

In the seasonally arid plains of central Oklahoma, heavy rains can have devastating effects on the cover above buried pipelines. Recently Davis Corp., a construction and engineering firm headquartered in Healdton, Okla., got a first-hand look at what spring flooding could do to buried lines along the Washita River. The company was hired to solve a recurring problem of pipes that were exposed by the river shifting out of its bed into new channels when inundated by flood waters.

Using directional boring, Davis replaced an existing 20-inch pipeline on the Washita River near Lindsay, Okla. The pipeline and utilities at the crossing had been exposed several times in previous years when the flooded river bed had shifted — sometimes hundreds of feet — into the opposite bank, only to shift back again with later rains.

The basis of problem lies in the geography of the land beneath the river. The soil formation present in the river bottom is generally a 20- to 30-foot section of silts with occasional gravel seams. Beneath the silt lies a weathered shale formation commonly called Oklahoma Red Beds. This section continues to bedrock. The weathered shale is resistant to erosion, which limits the channel's depth. Because the depth is limited, rivers and creeks in the area meander from side to side during spring and fall rains. Rapid collapse of the banks normally follows this process.

During the pipeline's lifetime from 1982 to present, exposure from shifts in the river was a constant concern. Within an eight year period, the pipe had been completely replaced once. A section was lowered in place on another occasion, and an attempt was made to stabilize the banks upstream. Still the problem persisted. The pipeline was again exposed following the spring rains of 1990.

For Davis, directional boring provided the best solution to the problem. A profile of the river was made. A 1,435-foot directional profile was designed to allow 500 feet of river movement toward either bank without exposing the pipeline.

At the client's instruction, the river banks were not to be disturbed by construction. Also a 300-foot section of large timber and underbrush was to be left untouched. Directional boring technology made all of this both possible and economical.

The pipe section was welded and tested in advance by K-M Pipeline. All of the overbends and side-bends on tie-in sections were made and tested before drilling began. Because of this, all specifications of the drilling plan had to be strictly followed.

Horizontal directional boring beats the problem of pipelines exposed by the Washita River shifting from its bed when flooded by heavy rains.

The pilot hole was drilled in 12 hours. The exit was within inches of the stake. Silt and a few gravel seams made up the majority of the entry and exit portions of the bore. The lowest portion was in a weathered shale, and shale was also consistent in the level portion of the bore.

The ream and pull back operation took 17 hours. The pipe was pulled into place without interruption. Examination of the epoxy pipe coating revealed no holidays resulting from the pull back.

After the pipeline was pulled into place, preparations began for the tie-ins. The approach pipe and prefabricated bends were welded together. The bell holes were each dug in advance of the tie-ins. Since the existing pipeline was taken out of service during the replacement operation, time was important. Two 20-inch tie-in welds were required on each side of the river and a four-inch line had to be tied in on the south end. After blow down, making the tie-ins required six hours.

Now for the first time, this 20-inch pipeline crossing has a cushion if flood waters force the river to move. The river banks have not been disturbed. The river itself was untouched.

Using directional boring achieved good results from an engineering standpoint, but it also gave the most environmentally safe approach possible.