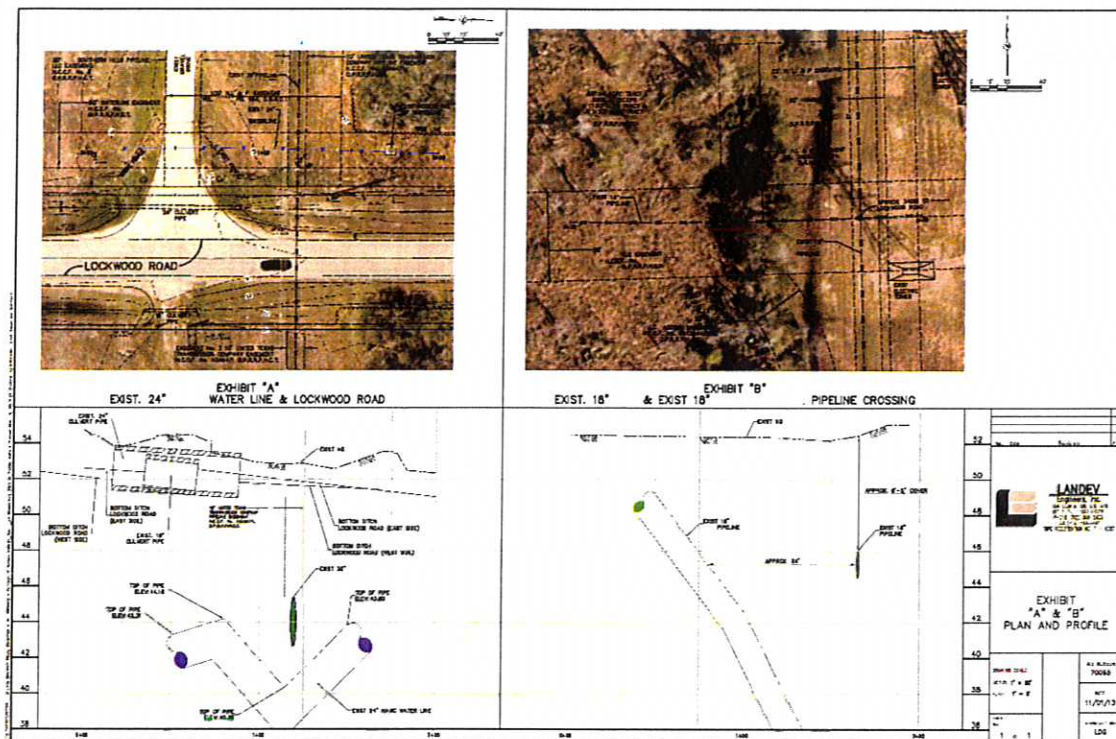


# Model-based Deep Line Utility Survey

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**T**he Subsurface Utility Engineering (SUE) Group of Binkley & Barfield, Inc. (BBI) has established a systematic methodology to manage risk through the Quality Level A through D system (QL-A: Test Holes, QL-B: Designation, QL-C: Surface Feature Survey, QL-D: Records Information) as prescribed by the American Society of Civil Engineers (ASCE). This frame work has proven very successful in preventing damage to existing utilities throughout the nation. Technological advancements in equipment have led to more accurate horizontal positioning of utilities while the vertical positioning has remained a function of the SUE QL-A Test Hole. What alternatives are there when access or economics renders a SUE QL-A Test Hole unfeasible? BBI in Houston, Texas faced this dilemma on three projects where subsurface utility lines were excessively deep or access for the vacuum truck was not possible.

BBI is a Houston, Texas based engineering design firm with branch offices in Austin, Dallas and College Station that has been in business over 43 years. BBI provides multiple discipline design services in transportation,

municipal and industrial facilities, water, wastewater, telecommunication, overhead and underground electric and power distribution. They also provide inspection services, SUE and through their subsidiaries Baseline Corporation and Landev Engineers, Inc., they provide Survey and Land Development Services.

BBI was asked to provide SUE QL-A Test Hole Services to find the horizontal and vertical position of a water line and a gas line in a land development project. These two lines were to be crossed perpendicular with new utilities and finding the depth and separation was critical to avoid damage. The Test Hole area was remote and required building an earthen bridge to gain access for the vacuum truck and economically the project wasn't feasible. Further discussions revealed that the required data didn't need to be the Test Hole accuracy of 2 to 4 cm. BBI proposed use of 3D Designating Technology to alleviate the access and economic issues while still rendering an accuracy well within the Client's needs.

Optimal Ranging, Inc. (ORI) in Santa Clara, California (<http://www.>

[optimalranging.com](http://www.optimalranging.com)) manufactures geospatial utility surveying equipment that provides highly accurate utility location and survey. The equipment is operated using Trimble Access controllers, running a Trimble-supplied application called Utility Survey. ORI's Dual Spar system was selected for its ability to 3D render highly accurate X, Y, and Z locations of deep utilities without excavation or line incursion.

BBI directly connected to one end of the water line with a low frequency (98 Hz) transmitter. The Base and Rover Spar units were then placed perpendicular to the water line, using an approximate geometry that would render an equilateral triangle enclosing all three points (Base Spar, Water Line and Rover Spar). After achieving satellite lock and connection to the Trimble VRS System on the Trimble TSC3 Data Collector, the water line and its orientation appeared on the screen along with the signal strength and confidence level of the data. Geospatial data collection of ground level, offset location, utility location and utility depth were done by simply pushing a

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button. To get a smooth profile of the water line, data was collected at eight to ten foot intervals. After recording all this data, the transmitter was relocated to the other side of the waterline and the entire process was repeated (designating from two directions – best practices).

The data collection work on the two lines was completed in less than four hours and did not require any surface restoration or probing. The resulting horizontal and vertical positioning matched the utility location information and was delivered much faster and at a substantially lower cost than QL-A Test Hole excavation.

On another project, BBI was asked to use the Dual Spar to find a 35 foot deep gas line that a one month effort of designation and excavation had produced no results. Using the Dual Spar methodology, the gas line was designated in less than two hours and shown to be at a depth of  $33.5 \pm 1.2$  feet. The location was immediately hydro excavated and the line found at a depth of 34.1 feet (an 8 inch difference between the exposed depth and the remote sensing depth, and within the reported error).

That same day, BBI went to another location and used the Dual Spar to locate two gas lines crossing under Beltway 8. Due to interference from electric towers these lines had proven to be un-locatable by standard methods.

Again the Dual Spar System quickly collected the X, Y, and Z data on the two lines and work was completed within



four hours. The collected data showed the gas line depths to be  $16.1 \pm 0.9$  and  $15.4 \pm 0.8$  feet deep. A QL-A Test Hole was excavated where each Dual Spar reading was taken and showed the line depths to be 16.8 and 15.8 feet deep (9 inches and 5 inches difference, and within the confidence intervals reported by the software).

Remote sensing has always been seen as the safest, lowest cost, and most convenient way to find utilities. Unfortunately reliable elevation data is not attainable with conventional tools. The Dual Spar reports geospatial elevations of the targeted utility, and renders vertical accuracy which has not been previously realized by existing electromagnetic locating equipment.

Should this be considered a replacement for performing Test Holes, which can cost thousands of dollars (or much more, depending on depth)? Where some variation in the location is acceptable, the answer is yes. For those occasions where absolute location is necessary, the answer is perhaps not. At a minimum, the reported horizontal and vertical accuracy of a Dual-Spar measurement can help determine where Test Holes are required. There will always be times where nothing but exposing a utility will satisfy the project requirements so Test Hole utility elevation determination will remain a key component of the Subsurface Utility Engineering. But in situations similar to those presented here, Dual Spar underground utility positioning technology represents a more economical alternative when managing SUE risk. ■



**Know what's below.  
Call before you dig.**

*Special caution also must be taken along a right of way when drilling wells, pile driving, cutting trees or pulling heavy loads in the area.*

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For more information about natural gas safety, visit [atmosenergy.com](http://atmosenergy.com).