NORTHEAST TRANSMISSION WATERLINE CHALLENGES

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BACKGROUND

To fulfill the mandate issued by the Harris-Galveston Subsidence District to decrease groundwater usage the City of Houston undertook the planning of extending the existing surface water system across the northern portion of Houston. The first step in fulfilling the mandate is the planning and route evaluation.

OBJECTIVE

The objective of the Northeast Partnership Feasibility Study was to determine a feasible alignment to meet the growing demands of the northern and western portions of the City. The preliminary design considered a maximum pipe diameter of 156-inches and an increased pressure of 120-psi for the project.

HYDRAULIC MODELING

Hydraulic modeling was performed to size the pipe for year 2050 demands and assessed any water quality issues for the lower demands in year 2020. Many scenarios were evaluated to properly size the pipe. The first sized the pipe while maintaining the City's current operating pressure. The next evaluated the option of increasing the operating pressure to decrease the pipe size. Dual pipes, inline pumping, and a modified pressure scenario were also evaluated. Ultimately, the current operating pressure, and the increased operating pressure were chosen as the feasible scenarios.

KEY ISSUES AND CHALLENGES

To establish feasible routes, a trench and work zone was established for the maximum pipe size of 156-inch diameter. This includes a trench zone, work zone alongside the trench for construction equipment and materials, and a buffer to maintain separation from existing utilities. The proposed waterline will be placed within existing public right-of-way (ROW) when possible, provided local access is maintained with minimum 10-foot lanes.

Easement acquisition will be required when the ROW is unavailable. Many alignment alternatives were eliminated due to lack of easement availability. The proposed alignment will require at least 160 new easements.

The proposed construction will impact commercial, residential, and light industrial areas. Therefore, traffic control will be critical for the project's schedule and budget. Much of the

alignment is through ROW, further increasing the need for adequate traffic control. Since a majority of the alignment is through urban parts of the City, many tunnels are required for crossings at railroads, highways, channels, and bayous. The alignment includes at least 84 tunnels with the longest extending 850 feet. Proper groundwater control will be critical for the installation of the extra large diameters. As a result, extensive subsurface investigation and proper planning for the discharge of the pumped water will be required.

The City's Standard Details were previously developed to accommodate the range of waterline diameters in the City's system that includes large diameter waterlines ranging from 24- to 96-inches. The proposed project exceeds the 96-inch threshold, as potential diameters range from 108-inches to 156-inches. A review of the City's large diameter standard waterline details was performed to identify modifications to accommodate the larger diameters. Based on this assessment, new details are required to provide adequate operational considerations for the proposed vault for dual air valve assemblies.

COST FACTORS

Most preliminary cost estimates start with an evaluation of historical cost curves. However, limited cost information is available for the extra large diameters. Therefore, additional cost development and research was required for estimating the cost of the project. The cost estimates were generally developed based on discussion with contractors with pervious similar construction experience, Blue Book rental rates, and previous projects. A significant factor affecting the cost estimate is the cost of raw steel. In the past 3 year the average cost of steel has ranged from $500 to $1,000 million/Ton. The cost of the project can vary by plus or minus $35 million depending upon the cost of steel.

Another significant factor considered was the energy cost associated with operating the plant for the feasible scenarios. A 100 year cost analysis was performed for the two feasible scenarios due to the higher energy costs from operating the plant at an increased pressure. Comprehensive system head curves for the feasible scenarios were developed to identify discharge heads for daily system demands from minimum day in 2020 to maximum day in 2050.

CLOSING

The project has the potential to provide water for the anticipated growing demands, while saving the City money, and fulfilling the Harris-Galveston Subsidence District mandate. Many of the key issues and challenges anticipated for this project will require additional planning and proper management to ensure the success of the project. The next step in the process for the project is the agreements. Proper agreements will need to be developed for all participants involved in the project.