MEMORANDUM

DATE: November 20, 2024

TO: Darren Farar P.E., City Engineer

CC:

FROM: Zan Murray S.E., Weston Bellon P.E. J-U-B Engineers

SUBJECT: Logan 1st Dam Tank Transmission Line Alternative Summary

---

The purpose of this memorandum is to provide a brief background about the Logan 1st Dam Tank and summarize the evaluation of alternatives for the Tank Transmission Line alignment.

Background

Logan City has been planning and preparing for the design and construction of the 1st Dam Water Storage Tank and associated large diameter transmission line project. The need for this infrastructure was first identified in the Logan City 2016 Water Master Plan, which highlighted many improvements including:

1. A new water storage tank near or on the east side of the City to ensure enough stored water is available during periods of high demand for the west side of the City.
2. A transmission pipeline to connect the proposed tank to the City's western pressure zones to meet future demands without large pressure variations at service connections.
3. Supplemental pipelines to provide better water service to the Cliffside and Thrushwood areas of the city.

The purpose of these projects is predicated on a State of Utah requirement to provide a minimum volume of water storage capacity for the City water system. The tank and transmission lines will satisfy that requirement for the existing water system deficiencies and provide additional capacity to satisfy this need as the City continues to grow.

The Tank is located strategically to provide the right amount of pressure for the water system and to receive water from the City's main water source located in Logan Canyon rather than pumping to supply water to areas of the City that are in the most need. Throughout the planning process several locations for the tank were reviewed in detail with input from the

Water Advisory Board to determine the right location. The water tank will be located south and west of the Logan Golf and Country Club and North and East of Canyon Road.

The transmission lines will deliver water to various water pressure zones in the City. The large 42" diameter transmission pipeline will primarily deliver water to the 200 West / 300 North area where existing water lines will distribute water to the surrounding residents to the north, south, and west. Other waterlines will be constructed to better serve the Cliffside area and the Thrushwood neighborhood. These improvements will ensure the delivery of adequate water pressure and flow to residents during normal operating conditions and during firefighting activities, both now and in the future.

Primary Transmission Line Design Requirements

The alignment for the primary 1st Dam Tank Transmission Line was modeled for the 2024 update to the Logan City Water Master Plan. The size of the pipe needed is 42" in diameter to provide adequate capacity to collect water from the water sources that supply the tank and to distribute water that flows from the tank to the western pressure zones in the city that are located primarily west of 200 East.

Based on the water master plan model, the most advantageous connection of the primary transmission line to the City's existing water distribution system in the west pressure zone was identified to be between 300 South to 400 North near 100 West and 200 West. Connecting the transmission line to this area will allow the water to flow into existing large diameter distribution lines and future planned distribution lines to meet areas of future growth in the City.

Alignment Alternatives

To meet the connection requirements for the primary transmission line as identified in the City's water master plan model, multiple alignment alternatives were analyzed and vetted to arrive at the selected alignment. Factors included in the analysis were:

- **Utility Conflicts** - The new primary transmission line will be installed near other existing utility lines located along the alignment. These primarily include water, sewer and storm drain. Alignments that required relocation or significant improvements to other utilities were ranked as higher impact.
- **Maintaining Separation** – The State of Utah has specific spacing requirements for potable water lines that are set in place for the purpose of protecting the consumable water in the lines from being contaminated by other sources. For example, a minimum

10-foot separation is required between a sanitary sewer line and a potable water pipeline. Alignments that require other utilities to be relocated to maintain the required separation were ranked as higher impact.

- **Neighborhood Impacts** – Alignments that would result in higher number of road closures, long detours or otherwise significantly impact traffic during construction were ranked as higher impact.
- **Easement/Property Acquisition** – Alignments that required property or easement acquisition to complete the project were ranked as higher impact.
- **Emergency Services Accessibility** - Alignments that limited accessibility of emergency services during construction were ranked as higher impact.
- **Environmental Impacts** – Alignments that had greater impacts to the environment (tree removal, river crossings, surface restoration, etc.) were ranked as higher impact.
- **Natural Hazards** – With the volume of water that the primary transmission line will carry and the critical nature of keeping this line intact in the event of a natural disaster, avoiding areas that are known natural hazards was a priority. Alignments that required location in areas of known natural hazards were ranked as higher impact.
- **Constructability** - The project must be buildable in terms of equipment access, materials used, design requirements, environmental impacts, safety, cost and schedule. Alignments that had more difficult building conditions were ranked as higher impact.
- **Cost** – The overall cost of the project is a factor in the construction of any project. The City prioritizes responsible use of taxpayer dollars, so alignments that have higher costs were ranked as higher impact.

A summary of analysis for each of the alignment alternatives reviewed is included below.

Alignment 1 (dark blue) -– This alignment contemplated constructing the primary transmission line west on Canyon Road to Crockett Avenue then dipping south to 100 North, west to 300 East, north to 300 North, and then west to 200 West. Placing the transmission line along Crockett Avenue was not feasible as shown in the alternative matrix because this alignment had a 27% or 3,490 feet longer length compared to the preferred alignment, (Constructability), a high number of conflicts with existing utilities (Utility Conflicts), and would require purchase of additional right-of-way width (Property Acquisition). Connection from 100 North to 300 North was found to have slope stability issues at the steep slope crossing (Natural Hazards). The relative cost difference between this alternative and the preferred alternative is $3.8M.

Alignment 2 (orange) - This alignment contemplated constructing the primary transmission line west along Canyon Road to 970 East, heading south through the River Hollow Park area

connecting to 100 North, then following Alignment 1 for the balance westward. Placing the waterline through River Hollow Park was found to be not feasible due to the 24% or 3,100 feet longer length compared to the preferred alignment, (Constructability) and conflict with constructing the pipeline parallel with the existing irrigation canal (Utility Conflict) where an easement does not exist. An easement would need to be obtained from the park to 100 North (Property Acquisition). Connection from 100 North to 300 North was found to have slope stability issues at the steep slope crossing (Natural Hazards). The relative cost difference between this alternative and the preferred alternative would be at least $3.4M.

Alternative 3 (green) - This alignment contemplated constructing the primary transmission line across the Logan River to Sumac Drive then southwest along Sumac / Fox Farm Road, then back across the river to 100 North, then following Alignment 1 for the balance. Construction of the transmission line on this alignment has a large number of separation conflicts that would require extensive relocation of existing utilities or acquiring numerous additional properties (Utility Conflict, Maintaining Separation, Property Acquisition). This alternative would also require crossing the Logan River in two locations (Environmental Impacts, Constructability). The crossing at 100 North bridge would limit access for public during construction (Neighborhood Impacts). Property acquisition would be required adjacent to the river (Property Acquisition, Constructability). Connection from 100 North to 300 North was found to have slope stability issues at the steep slope crossing (Natural Hazards). Due to significant qualitative impacts, this alternative was not evaluated for relative cost.

Alternative 4 (light blue) - This alignment contemplated constructing the primary transmission line along the historical Logan and Northern Canal alignment to its intersection with 400 North, then west within the UDOT right of way to 200 West. Hillside stability along the Logan and Northern Canal alignment is a significant concern. There have been 9 historic landslides along the western portion of the canal alignment (Natural Hazard). The pipe requires a stable foundation to continuously support the weight of the water in the pipe, so it doesn't buckle and leak or fail in a manner that would cause injury or harm. To rehabilitate the hillside along the alignment and to provide the levels of construction to overcome the natural hazard would be very costly when compared to the overall cost of the project (Constructability). This alignment is not owned by the City and may require easement acquisition from the irrigation company (Property Acquisition). The alignment would require construction in the UDOT 400 North right-of-way which adds a level of complication and cost due to an existing concrete roadway buried in the alignment (Constructability). For these reasons and the additional pipe length of 770 feet, this alignment would be at least $5M more than the preferred alternative.

Alternative 5 (yellow) – This alignment contemplated constructing the primary transmission line along highway 89 (400 North) west to 200 West. This alignment would not be feasible without the installation of an additional pump station to push water up the hill near the Country Club and ongoing pumping costs (Constructability). The installation of a pump station would require a significant initial financial investment and high operating costs into perpetuity. The alignment would require construction in the UDOT 400 North right of way which adds a level of complication and cost due to an existing concrete roadway buried in the alignment. The pavement restoration required to meet UDOT's standards is expensive and would create high future operational costs (Constructability).

Alternative 6 (purple) - This alignment contemplates constructing the primary transmission line west along the north side of Canyon Road to the hillside crossing just west of 600 East, then continuing along 300 North west to 300 East where it would then follow Alignments 1, 2, and 3 for the balance. The south side of Canyon Road has an existing high voltage powerline that cannot be moved without significant additional cost. This alignment provides a path that is relatively free of utility conflicts, the steep hill crossing is located in an area that has been found to have higher levels of stability, and was not found to require property acquisition. The alignment does anticipate requiring the removal of trees within the right-of-way to maintain the separation requirements (Utility Conflicts, Maintaining Separation, Environmental Impacts). Connection from Canyon Road to 300 North was found to have relatively minor slope stability issues, when compared to the other alternatives, at the steep slope crossing (Natural Hazards). This alignment's opinion of probable cost was the lowest of all the alternatives.

Alternative 7 (brown) – This alignment would proceed west along Canyon Road to Crockett Avenue, then south to 200 North. Then head west along 200 North to Canyon Road. Then the pipeline would be installed up the hill to the Boulevard then west to 400 East, then north to 300 North where it would follow Alignments 1,2 and 3. This alignment would require installation of an additional 1,750 feet of pipeline or 14% more than the preferred alignment. This alignment would also require reconstruction of the existing curb, gutter and sidewalk (Constructability), or relocation of overhead powerlines and utilities (Utility Conflict). Connection from 200 North to the Boulevard was found to have slope stability issues at the steep slope crossing (Natural Hazards). The relative cost difference between this alternative and the preferred alternative is $2.8M and does not include hillside stabilization costs.

Other Alignments

Other alternatives that connected to the distribution system at other locations were found to be cost prohibitive due to additional pipe length, property acquisition and relocation of existing utilities. So they were not reviewed in detail.

Preferred Alignment

After evaluating the seven alignment options for the transmission pipeline, Alternative 6 was selected for the following reasons:

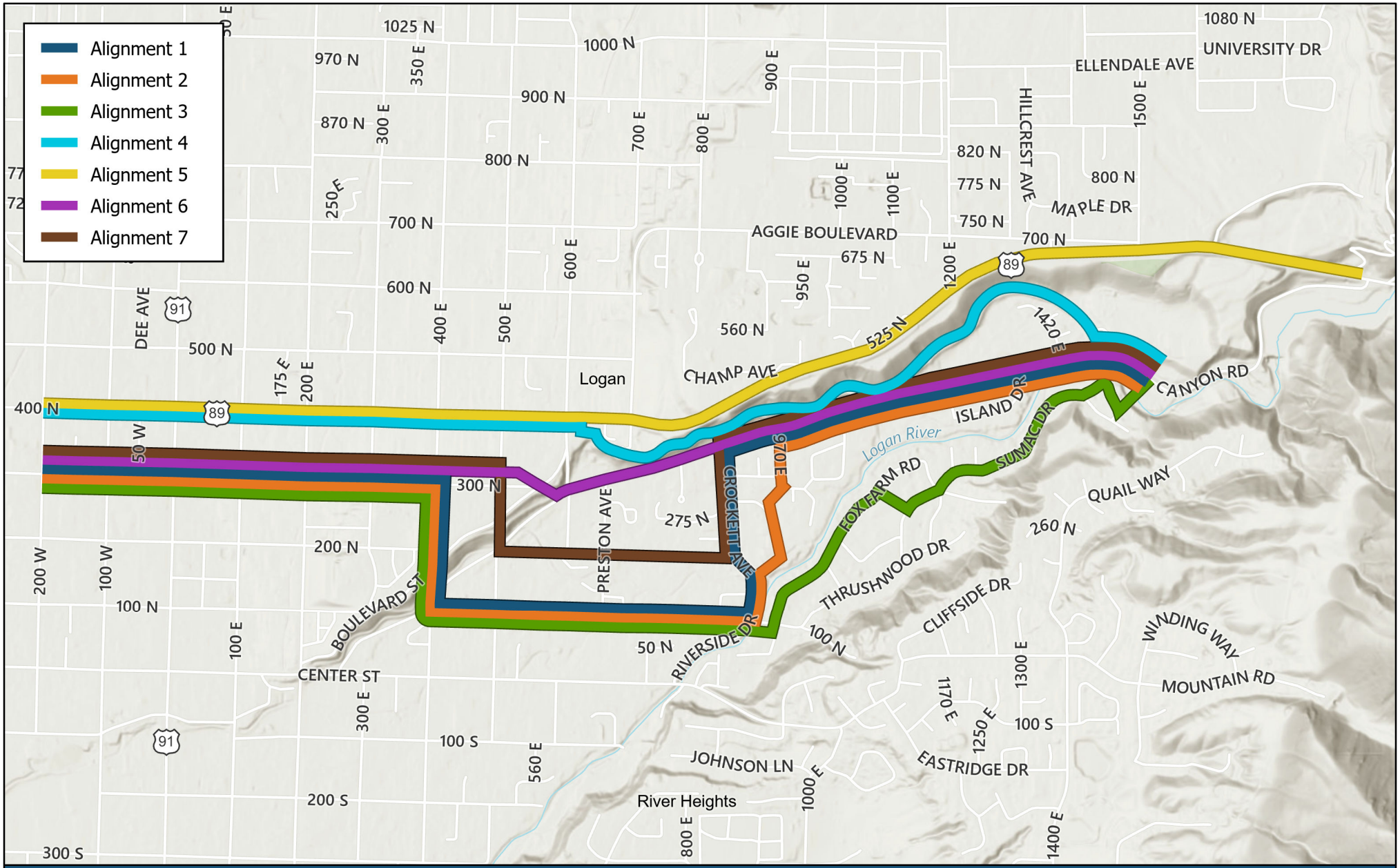
- **Better connection to the Logan 1st Dam Tank:** The Canyon Road alignment provides a more direct and efficient path from the west side of Logan to the future water storage tank location, improving system performance and reducing construction complexity, consequently reducing overall project costs.
- **Uses City Right-of-Way:** Most of the pipeline will run along public roads and areas managed by the City, minimizing the need to acquire easements and private property for the project.
- **Maintains Neighborhood Access:** There are alternate access routes to the properties along the alignment. This route preserves access to the Thrushwood neighborhood throughout an estimated 18-month construction period for both residents and emergency medical services.
- **Slope Stability Issues:** This route avoids the areas where historically the ground is unstable, leading to erosion, shifting, or landslides.
- **River Crossings:** This alignment does not require that the primary transmission line cross the Logan River. While two smaller lines will still need to cross the river at one location, this impact is significantly less.
- **More Space in the Roadway/Fewer Utility Conflicts:** The Canyon Road alignment runs through wider sections of roadway and has fewer existing utilities, minimizing interference with existing utilities while staying inside the city right-of-way.
- **Fewer Bends:** By maintaining a straighter alignment, the pipeline will experience less pressure loss, increased efficiency, faster construction, and it will lower the chance of leaks and future maintenance issues.

As the conclusion to move forward with Alternative 6 was determined, other additional benefits were quickly identified solidifying this alternative as the preferred alignment. Canyon Road is a significant road for Logan City citizens. The condition of Canyon Road has been deteriorating and City Public Works staff have been looking for an opportunity to improve the roadway. Since

much of the road will be damaged with the waterline construction, completing a roadway improvement project at the same time will allow for a significant overall cost savings to city residents. Another benefit is the City trail masterplan outlines the need for a bikeable corridor and pedestrian paths along Canyon Road.

Construction of the waterline along the preferred alignment will cause damage to trees in proximity to the pipe according to a 3rd party arborist. This was identified as a concern given their size and maturity. This can be mitigated by replacing the trees along Canyon Road with new trees along the street creating a consistent streetscape for the neighborhood.

In summary, the Canyon Road alignment was chosen because it is simpler, less disruptive overall, safer, and more affordable than the other alternatives considered during the early design phase.



LOGAN FIRST DAM TRANSMISSION LINE ALIGNMENT ALTERNATIVES

Logan First Dam Tank Water Mains

Logan First Dam Transmission Line Alignment Alternatives Evaluation Matrix

Criteria	Utility Conflicts	Maintaining Separation	Neigborhood Impacts	Easement / Property Acquisition	Emergency Services Accessibility	Environmental Impacts	Natural Hazards	Constructability	Relative Cost	Impact Conclusion
Alternative										
Alignment 1 - Dark Blue	High	Medium	Medium	Low	Medium	Low	Medium	Medium	Medium	**Medium**
Alignment 2 - Orange	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	**Medium**
Alignment 3 - Green	High	High	High	Medium	High	High	High	Medium	High	**High**
Alignment 4 - Light Blue	Medium	Medium	Low	High	Low	High	High	High	High	**High**
Alignment 5 - Yellow	Medium	Medium	Low	High	Low	Low	Low	High	High	**Not-Feasible**
Alignment 6 - Purple	Medium	Low	Medium	Low	Medium	Low	Low	Low	Low	**Low**
Alignment 7 - Brown	High	Medium	Medium	Low	Medium	Low	Medium	Medium	Medium	**Medium**