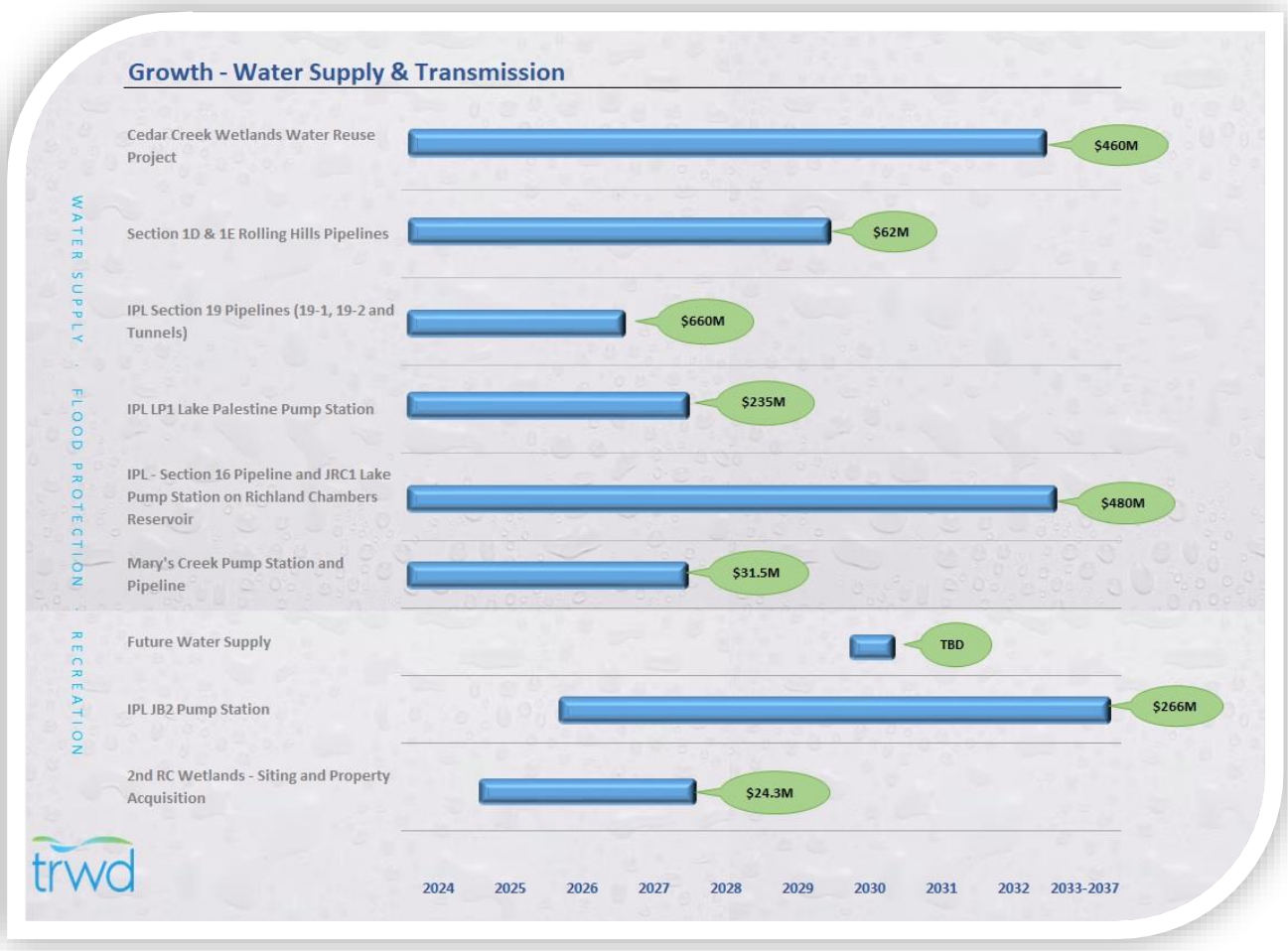


Cedar Creek Wetlands Water Reuse Project

Projected Start: 2021
Projected Construction Start: 2027
Projected Complete: 2032
Projected Cost: $460,000,000
Contact: *Darrel.Andrews@TRWD.com / David.Schroeder@TRWD.com*

Description:

The Cedar Creek Wetlands are a sister wetland facility planned to allow water reclamation and enhance supply storage and yield of Cedar Creek Reservoir. The location of the proposed constructed wetlands is approximately ten miles to the west and north of Cedar Creek Reservoir, immediately east of the main stem of the Trinity River. Water from the river will cascade through a similar sized and configured Cedar Creek wetland facility as the George W. Shannon Wetland in operation at Richland - Chambers Reservoir since 2013. Water courses through the wetlands to remove sediment and nutrients. The water is then re-lifted into Cedar Creek Reservoir for storage. The project will include the design and construction of a river pump station, raw water mains, sedimentation basins and wetlands cells, relift pump station, ten miles of large diameter pipe and a controlled outlet structure.

The Texas Commission on Environmental Quality (TCEQ) has already issued water rights allowing Tarrant Regional Water District (the District) to divert highly treated wastewater from the Trinity River. Since 2014, the District has owned most of the real estate and permanent pipeline easements needed to construct the Cedar Creek Wetland and its supporting pipelines from the river to the wetland and from the wetland to the reservoir.

The 2021 Region C Plan projects the cost of the Cedar Creek Wetland to be $226,318,000, which is based on the original 1,800 acre constructed wetlands facility footprint capable of achieving a permitted supply yield of 88,059 acre-feet. This would enhance the annual supply available from Cedar Creek from 175,000-acre-feet to more than 263,000 acre-feet – a 50% increase. The District is currently exploring an arrangement with Trinity River Authority to treat additional flows incorporating TRA treated reclaimed water flows, which would require significantly expanding the CC wetlands footprint and pumping/transmission facilities, and for which the projected cost of $460,000,000 is developed.

Supply from the wetland-enhanced Cedar Creek Reservoir to the District's customers will utilize the current Cedar Creek Lake PS and pipeline, as well as the new JCC1 Lake Pump Station and IPL transmission pipeline. The District's goal is to have the new Cedar Creek Wetlands Facility constructed by 2030, followed by two years to establish vegetation in the wetland's cells and fully operational by 2032.

Section 1D & 1 E Pipelines and Phase 1 Arlington Outlet Piping and Valving Improvements

Projected Start: 2024
Projected Construction Start: 2027
Projected Complete: 2029
Projected Cost: $62,000,000
Contact: Rick.Zarate@TRWD.com

Description:

Sections 1D (Rolling Hills WTP - B05/06 to Arlington Outlet) and 1E (RH2 to B05/06 Valves) have been part of the District's water delivery capital improvement planning for more than a decade. They are new pipeline sections that will ultimately connect from the Integrated Pipeline connection at the Kennedale Balancing Reservoir to the Rolling Hills WTP and the District's Benbrook Connection pipeline. Section 1D is the proposed pipeline section parallel to the existing TRWD pipelines from the Arlington Outlet to the City of Fort Worth's Rolling Hills Water Treatment Plant. Section 1E is the proposed pipeline section parallel to the existing TRWD 90-inch-diameter pipeline around the City of Fort Worth's Rolling Hills Water Treatment Plant. The existing 90" pipeline is fed by a 108" pipeline and an 84" pipeline. The system plan always included installation of a parallel pipeline next to the 90" pipeline once water demands justified a second pipeline. The additional pipeline will keep the existing 90" pipeline from experiencing high velocities, high enough to put the pipeline and valves at risk of damage. Demands for terminal storage and at the treatment plants are expected to reach the point where a parallel pipeline will be needed by the time it is designed and constructed. An additional benefit of the project is increased redundancy and resilience. By installing higher pressure class piping along this segment of the pipeline, the District will be able to jump from Lake Benbrook to east of the Kennedale Balancing Reservoir which is reverse of standard operations. It is expected that both Sections 1D and 1E will be 108" pipelines to facilitate pigging between Rolling Hills and KBR. The total length will be approximately 19,000 linear feet. Included in this design and construction are large

diameter valve and piping upsized replacements feeding the Arlington Outlet facility off the Cedar Creek and Richland Chambers pipelines.

IPL Section 19 Pipelines (19-1, 19-2 and Tunnels)

Projected Start: *2020*
Projected Complete: *2026*
Project Estimate: *$660,000,000*
Contact: *Eddie.Weaver@TRWD.com*

Description:

The Section 19 IPL Pipelines project is funded by the City of Dallas and is comprised of two major sub-sections (19-1 and 19-2) and multiple tunnels. Section 19-1 is an approximately 21-mile, 84-inch diameter pipeline that originates at the eastern end of the IPL Project at Lake Palestine and terminates just southeast of the city of Athens, Texas, where it will connect to Section 19-2 of the IPL Project.

The IPL Pipeline Section 19-2 consists of an 84-inch pipeline, approximately 21 miles long and is located entirely within Henderson County, Texas. The downstream portion (western end) of the pipeline begins near a proposed junction structure at the southwest corner of Cedar Creek Reservoir where Section 19-2 connects to Section 18 of the IPL pipeline. The Section 19-2 pipeline route runs generally east and slightly south such that the upstream portion (eastern end) of the pipeline ends at a connection to the western most point of IPL Pipeline Section 19-1, located just southeast of Athens, Tx.

The proposed Corridor is 150’ wide for the entire length of the alignment, to accommodate both the initial pipeline, as well two potential, future pipelines. Two major tunnel contracts have been awarded and are underway for several tunnels in Section 19 for pipeline installations that cannot be made by open cut means. The Lake Palestine Pump Station and Section 19-1 and 19-2 Pipelines will deliver up to 150 mgd of water supply for Dallas Water Utilities from Lake Palestine via the Integrated Pipeline operated by Tarrant Regional Water District.

IPL LP1 Lake Pump Station

Projected Start: *2023*
Projected Complete: *2027*
Project Estimate: *$235,000,000*
Contact: *Eddie.Weaver@TRWD.com*

Description:

The IPL Lake Palestine Pump Station (LP1) is funded by the City of Dallas and is one of three new lake pump stations that are part of the IPL. It is to be constructed on a new site on the southwest side of Lake Palestine approximately a mile upstream of Blackburn Crossing Dam near Frankston, Texas. The LP1 Pump Station will draw raw water from Lake Palestine via a new intake structure constructed as part of the proposed project. It will discharge flow into the new IPL Segment 19-1 Pipeline that proceeds generally west from the site and leads to the suction reservoirs associated with the new Joint Booster Pump Station Nos. 2 and 3 (JB2 and JB3, respectively). The LP1 Pump Station is designed to have 5 vertical line-shaft pumps, each equipped with a variable frequency drive (VFD) and totally enclosed water- and air-cooled (TEWAC) 4,000-horsepower (hp), 900-revolutions-per minute (rpm) electric induction motors. Flows will be discharged from each pump through 36-inch discharge piping including pump control ball valves (PCBV), an individual Venturi-type flowmeter, and an isolation valve. All flows will be discharged into an 84-inch-diameter header and pipeline that connects to IPL Segment 19-1 on the west side of the LP1 site. Design flows range from 150 million gallons per day (mgd) peak down to 15 mgd minimum.

IPL Section 16 and JRC1 RC Lake Pump Station

Project Start: *2023*
Projected Construction Start: *2027*
Projected Complete: *2032*
Project Estimate: *$480,000,000*
Contact: *Eddie.Weaver@TRWD.com*

JRC1

The IPL Project is a raw water supply program that integrates the TRWD and DWU water supplies from Lake Palestine, Cedar Creek Reservoir, and Richland Chambers Reservoir. The program includes raw water pipelines, raw water intakes and pumping stations, booster pumping stations, and storage reservoirs.

The upcoming Joint Richland Chambers Lake Pump Station (JRC1) is the last of three new lake pump stations being built as part of the IPL project. Water supply will be pumped from JRC1 via the new Section 16 Pipeline of the IPL system.

The following criteria and configuration information guide the preliminary design of JRC1.

The JRC1 design flow range is 250 million gallons per day (mgd) peak, down to twenty-five mgs minimum. The maximum lake flood elevation is 320 feet msl (flood easement level) with the Richland Chambers reservoir pool conservation level at 315 feet msl.

Section 16 IPL Pipeline

The future Section 16 IPL Pipeline will connect the future JRC1 Lake Pump Station on the Richland Chambers Reservoir with the rest of the IPL water transmission system. The Section 16 pipeline is designed as a 96-inch diameter pipe of either welded steel (C-200) or pre-stressed concrete cylinder (C-301) pipe. Pipeline Right-of-way between the future JB2 booster pump station and the existing Richland Chambers Lake Pump Station has already been obtained. Depending on the final location of the future JRC1 Lake Pump Station, the Section 16 pipeline may be extended further southeast to another area of the Richland Chambers Reservoir.

Mary's Creek Indirect Water Reclamation Project

Projected Start: *2024*
Projected Complete: *2027*
Project Estimate: *$31,500,000*
Contact: *James.Johnson@trwd.com*

Description:
Tarrant Regional Water District will be coordinating with the City of Fort Worth to indirectly reclaim treated water from the City's Mary's Creek Water Reclamation Facility and pump it through a pipeline to the north of the District's Eagle Mountain Balancing Reservoir where it will tie into the District's existing pipeline for discharge into Eagle Mountain Lake for water supply purposes. This capability will also protect the water quality of the downstream Mary's Creek and Clear Fork of the Trinity River, especially during extended dry periods of minimal natural stream flows. Project components include a channel dam, an intake pump station and pipeline. The Second Cell of the Eagle Mountain Balancing Reservoir is being designed along with this one.

Future water supply

Projected Start: 2030+ (initial study)
Projected Complete: TBD
Projected Cost: TBD
Contact: *Nicole.Rutigliano@TRWD.com*

Description:
TRWD provides wholesale raw water supplies to an 11-county region in North Texas. TRWD is one of the largest raw water suppliers in Texas, providing water supply to over 2 million people, servicing more than 70 cities, and additionally providing irrigation, mining, and industrial water.

The District completed its first Integrated Water Supply Plan (IWSP) in 2014, which provided a planning platform that served the District well for the last decade. The District regularly assesses water demands, tracks growth, and plans for the next water supply decision. With rapid population growth projected to continue, as well as changing technological, environmental, and political conditions, the District has undertaken an update to the IWSP currently underway to develop a roadmap for future supply development.

The IWSP Update currently underway meets the following objectives:

- Quantify the amount of additional supply needed to meet growing demands and determine when and where the supply is needed within the TRWD system.
- Identify the Water Management Strategies (WMSs) available to TRWD to meet the projected demands and assess, narrow down and prioritize the strategies that can be implemented and are most preferred.
- Identify the water supply yield potential and cost-related information for each strategy, including additional transmission infrastructure required to deliver the water, and qualitatively score strategies based on other key evaluation criteria.
- Define an implementation plan and summarize the Capital Improvement Program (CIP) for preferred portfolios.

Studies and related costs for the next future water supply resulting from the current Integrated Water Supply Planning process are shown to begin in the early 2030's followed later by design, permitting and construction.

JB2 Pump Station:

Projected Start:	*2026*
Projected Construction Start:	*2030*
Projected Completion:	*2035*
Projected Estimate:	*$266,000,000*
Contact:	*Eddie.Weaver@TRWD.com*

Description:

The IPL Project is a raw water supply program that integrates the TRWD and Dallas Water Utilities' water supplies from Lake Palestine, Cedar Creek Reservoir, and Richland Chambers Reservoir. The program includes raw water pipelines, raw water intakes and pumping stations, booster pumping stations, and storage reservoirs. The upcoming Joint Booster Pump Station #2 (JB2) is one of three new booster pump stations being built as part of the IPL project. During high flow scenarios, water supply will be pumped from any of the IPL lake sources to the JB2 pump station where the water will be pumped further northwest to the next booster pump station (JB3). The JB2 pump station includes two 40-million-gallon earthen storage reservoirs that the pump station will draw from. The JB2 design flow range is 350 million gallons per day (mgd) peak, down to 35 mgd minimum.

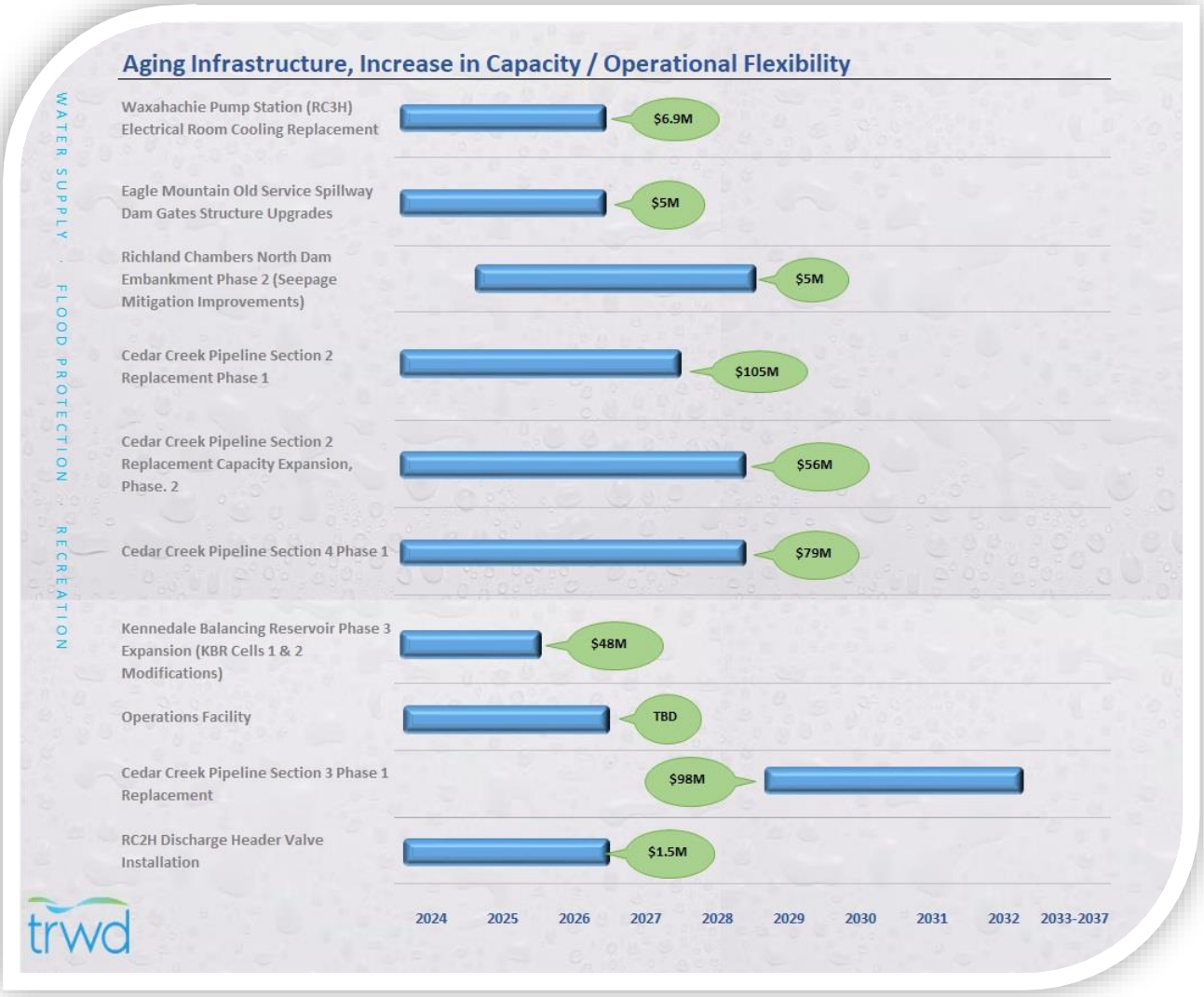
2nd RC Wetlands - Siting and Property Acquisition

Projected Start: *2025*
Projected Construction Start: *TBD*
Projected Completion: *TBD*
Projected Estimate: *$24,300,000 (Permitting and land only)*
Contact:

Description:

Wetland systems provide Tarrant Regional Water District with an efficient, cost-effective approach for treating return flows from the Trinity River prior to delivery in the reservoir systems. The success of the Shannon Wetland System at Richland Chambers has proven this to be the case, with a newly constructed wetland system for the Cedar Creek Reservoir also currently under design and expected to be operational by 2032. The existing RC Wetlands and future CC Wetland System will have the capacity (280,000 ac-ft) to treat TRWD return flows and other contracted water through 2060. Moreover, the District is currently in discussions with other regional water suppliers to treat their future return flows in the Trinity River. As the Dallas-Fort Worth metroplex continues to grow, return flows are also expected to increase in the decades ahead. Initial investigations by TRWD's Environmental department in 2023 have concluded that "It is reasonable to say that Richland Chambers reservoir could assimilate another 90 mgd of reuse water."

Next steps are verification of maximum assimilative capacity of the Richland Chambers reservoir, determination of required land acreage for corresponding wetland capacity for a second RC Wetland and proceeding with siting and land procurement. The 2024 TRWD CIP shows the siting and land purchase to be completed before fiscal year 2028. Actual design and construction will not take place for many decades later; the intent of the land purchase being to acquire suitable property between the Trinity River and Richland Chambers while still available. Ultimately, this siting and land procurement for a 2nd RC Wetlands will provide the basis for a future drought resilient water supply project capable of treating additional future return flows in the Trinity River Basin while protecting future water quality in the District's Richland Chambers and Cedar Creek reservoir systems.



RC3H Booster Pump Station Electrical Room Cooling Improvements

Projected Start: 2022
Projected Construction Start: 2025
Projected Complete: 2026
Projected Cost: $6,900,000
Contact: *Rick.Zarate@TRWD.com*

Description:

The existing RC3H electrical room requires significant cooling due to heat loading from the five, 5,000 hp variable frequency drives. Two-thirds of the existing cooling capability is from the original 2005 pump station installation, and many components have exceeded their expected service life and have frequent mechanical failures. Moreover, the District is interested in moving the air handling equipment out of the electrical room for improved protection of critical equipment and personnel. A more reliable cooling solution employing

air-cooled chillers will be achieved, vital to the continued operation of this critical RC3H booster pump station to move the water supply to the District's customers.

Eagle Mountain Original Service Spillway Gate Structure Upgrades

Projected Start: 2024
Projected Complete: 2026
Projected Cost: $5,000,000
Contact: Louie.Verreault@TRWD.com

Description:
The original (old) service spillway consists of three vertical lift gates and an ungated overflow section in the fourth bay of the spillway. The superstructure and hoists are in overall fair condition, and evaluation of structural, mechanical, and hydraulic considerations are underway to determine appropriate next steps for reconfiguring and renewing the original service spillway structure.

Richland Chambers Dam North Embankment Seepage/Stability Mitigation Construction - Phase 2

Project Start: 2025
Projected Construction Start: 2026
Projected Complete: 2028
Projected Cost: $5,000,000
Contact: Louie.Verreault@TRWD.com / Dorota.Koterba@TRWD.com

Description
The Richland Chambers Dam has performed very well since it was filled over 30 years ago. Some areas between the dam's north embankment and the District's constructed George Shannon Wetlands, along US 287, have exhibited seepage/wet soil conditions over the years. Construction of the wetlands has revealed a sand boil formation in the treated water canal that appears to have resulted from deep-formation seepage from the reservoir or other sources. It is essential to identify and monitor these sources to determine if mitigation is required to reduce any potential hazards to the structural integrity of the dam. Subsurface hydrogeological monitoring and analysis to begin as part of Phase 1 over 2-3 years, after which time any mitigation measures will be identified to implement if needed.

Cedar Creek Section 2 Pipeline Replacement – Phase 1 (11 miles including FM 664)

Project Start: 2019
Projected Construction Start: 2024
Projected Complete: 2027
Projected Cost: $105,000,000
Contact: Courtney.Jalbert@TRWD.com

Description:
In this area of the Cedar Creek pipeline, approximately one third of all pipe segments have pre- stressing wire breaks due to hydrogen embrittlement. Potential pipeline ruptures in this area of highly distressed pipeline would result in significant negative consequences. Moreover, the loss of this section of the CC Pipeline due to a pipe failure would negatively

impact District's ability to deliver water to several primary customer cities fed directly from the pipeline. The planned course of action is to remove and replace approximately eleven miles of 72" pre-stressed concrete cylinder pipe (PCCP) with 90" and 102" welded steel pipe in the Mansfield to Midlothian area which will provide additional water delivery capacity. The new 102" pipe will run west from the S2x12 Interconnect to the western end of this Phase 1 Replacement (Mouser Way), providing increased water delivery capacity from the IPL. Preliminary design began in Fall 2019, with construction planned to start in late - 2024. Construction will be divided into two contracts with the first to be in the FM 664 area in preparation for TXDOT widening of the highway.

Cedar Creek Section 2 Pipeline Replacement (4.4 miles) – Phase 2

Projected Start: *2024*
Projected Construction Start: *2027*
Projected Complete: *2028*
Projected Cost: *$56,000,000*
Contact: *Courtney.Jalbert@TRWD.com*

Description:

Section 2 of the CC pipeline conveys water from the Waxahachie Pump Station to the Kennedale Balancing Reservoir (KBR). It can also convey IPL water through the S2x12 Interconnect. Phase 2 of the Cedar Creek Section 2 Pipeline Replacement project will continue the replacement of the 50-year-old 72" PCCP with 102" welded steel pipe. In addition to the added water delivery capacity benefit, the 4.42 miles from KBR to Mouser Way would replace several areas with high likelihood and consequence of failure. This section of pipeline has 125 out of 984 pipes with defects (13%), and 15 of those pipes are a repair priority 1, which means the pipe has the potential for failure based on risk analysis. This entire section of pipeline was installed in 1971 and is also approaching its end of useful life. This stretch of PCCP is a known area with no shorting straps, resulting in reduced ability to protect the pipelines from corrosion if there are multiple breaks in the same pipeline. If a catastrophic failure should occur, the surrounding community would be negatively impacted, so executing this project will remove additional hazards and improve community safety. Moreover, the loss of this section of the CC Pipeline due to a pipe failure would negatively impact the District's ability to deliver water to several primary customer cities fed directly from the pipeline.

The recommended course of action is to remove and replace approximately 4.42 miles of 72" pre-stressed concrete cylinder pipe with 102" steel pipe from ROW station 319+74 near KBR to 552+89 which will connect to the Phase 1 project at Mouser Way in Mansfield and provide a continuous stretch of 102" pipe from S2x12 to KBR.

Cedar Creek Section 4 Pipeline Replacement (8.6 miles) Phase 1

Projected Start: 2024
Projected Construction Start: 2027
Projected Complete: 2028
Projected Cost: $79,000,000
Contact: Courtney.Jalbert@TRWD.com

Description:

The Cedar Creek Section 4 Pipeline Replacement Project will replace 8.6 miles of the existing 72- inch prestressed concrete cylinder pipe with a new 90-inch welded steel pipe from the CC Lake Pump Station to the Trinity River. The existing 1970s vintage pipe has operating pressures up to 225 psi and has encountered joint end failures not able to be detected by electromagnetic condition assessment technologies in this flood prone area. If a pipe break occurs in this Trinity bottoms area during a major flood event, it could result in an extended CC pipeline operations shutdown spanning several months until flood waters recede, only after which time repairs could be made and the pipeline cleared of mud and debris making this a critical area for rehabilitation. The District intends to replace the buried pump discharge header pipe from the CC1 lake pump station later as part of a future capacity upgrade of the Cedar Creek Lake Pump Station (CC1). The new pipe will follow the same alignment as the existing pipe which will be taken out of service during the installation of the new pipeline. Construction is expected to begin in 2027.

Over the next two to three decades, the District will be replacing the distressed 1970s era 72" PCCP with 90" spiral welding steel pipe from the Cedar Creek Lake to the S2X12 Interconnect. This along with the upsizing of the Cedar Creek Lake Pump Station, will increase the Cedar Creek transmission capacity to 250 mgd.

Kennedale Balancing Reservoir – Phase 3: Yard Piping and Modifications to Cells 1 & 2

Project Start: 2015
Construction Start: 2022
Projected Complete: 2025
Projected Cost: $48,000,000
Contact: Donna.Stephens@TRWD.com / James.Johnson@TRWD.com

Description:

Construction activity will be continuing at the Kennedale Balancing Reservoir (KBR). The first two phases – 108" Bypass Piping and the 3rd Cell Foundation have been completed. This third phase of construction, awarded in December 2021, is being constructed over a four-year period, and involves the installation of 120-inch diameter flow-through inlet and outlet piping for the existing two cells, along with large diameter yard piping and valve connections to the Cedar Creek, Richland Chambers and Integrated Pipeline pipelines that supply KBR. Two large concrete splitter box weirs will be removed, and current leakage attributed to existing cell inlets plugged. Enhanced operational flexibility and improved water quality will also result. The final phase after this construction is to complete the new 165-million-gallon third cell at KBR providing additional emergency storage and optimized time-of-day operational capability.

Operations Facility

Projected Start: 2023
Projected Complete: 2026
Projected Cost: TBD
Contact: JL.Cabrera@TRWD.com
Lexi.McCalip@TRWD.com

Description:

The current Operations Facility located at 1022 North Calhoun has been occupied for over 60 years. The facility no longer meets the work needs of staff and material storage is beyond maximum capacity. A 25-acre parcel located at the intersection of Old Decatur and 820 North was purchased and a new compound will be constructed by 2026. The new compound will be home for the following groups: operations field and administration staff, emergency management personnel, law enforcement division, fleet mechanics, welding staff, purchasing, and receiving personnel along with warehouse inventory. Accommodation for fleet and heavy equipment will be included along with bulk material storage. This new compound will accommodate the current workload and allow for future growth.

CC Pipeline Section 3 Phase 1 Replacement

Projected Start: *2029*
Projected Construction Start: *2031*
Projected Completed: *2032*
Projected Cost: *$98,000,000*
Contact: Courtney.Jalbert@TRWD.com

Description:

The Cedar Creek Section 3 Pipeline Replacement Project will replace 11 miles of the existing 72-inch prestressed concrete cylinder pipe with a new 90-inch welded steel pipe from near the Waxahachie Pump Station to Black Jack Road and Garrett Creek. Section 3 of the CC pipeline conveys water from the Ennis Pump Station to the Waxahachie Pump Station. This section of pipe was installed in 1971 making it more than 50 years old which is the estimated useful life for prestressed concrete cylinder pipe. This stretch of pipe has had many in-house individual pipe replacements over the years and a handful of failures, mainly due to distress-prone wire, causing hydrogen embrittlement wire breaks over the years. Materials used in the manufacturing of C301 50 years ago were much lower quality than current C301 pipe. Wire forensic testing has shown that the wire used is extremely susceptible to hydrogen embrittlement. This section of pipeline currently has 150 pipe segments with known distress remaining, 22 of those are repair priority 1 which means the pipe has the potential for failure based on risk analysis, and 11 are Zone 5 pipes. If a catastrophic failure should occur the surrounding community would be negatively impacted, which is one driver of this project. This project is also part of the water transmission master plan to upgrade the Cedar Creek pipeline from 72” to 90” from the Cedar Creek Lake Pump Station to S2x12 for additional capacity. Executing this project will remove the hazard, improve community safety, and increase TRWD’s water transmission capacity for the future.

RC2H Discharge Header Valve Installation

Projected Start: *2024*
Projected Completed: *2026*
Projected Cost: *$1,500,000*
Contact: *James.Johnson@TRWD.com*

Description:

Currently the Richland Chambers pump station in Ennis, Texas, cannot be isolated from the pipeline. The impact of this is that some maintenance can only be performed when the pipeline is out of service. Therefore, a 90-inch butterfly valve will be added in the discharge header so the station can be isolated. The valve has been purchased and should be delivered in late 2024 and will likely be installed when the pipeline is taken out service for annual maintenance in 2025. The design is planned to be completed by TRWD and the construction by a contractor.

Benbrook Pump Stations Backup Power

Projected Start: *2023*
Projected Construction Start: *2026*
Projected Completion: *2027*
Projected Cost: *$5,200,000*
Contact: *Rick.Zarate@TRWD.com / Devin.Taylor@TRWD.com*

Description:

The District is considering backup power for two pumps at our Benbrook Lake PS (with the possibility of a future upgrade to all four pumps), as well as backup power for its smallest pump at Benbrook Booster PS. The Benbrook Lake Pump Station can deliver very large flows of water (over 200 mgd with all four pumps) to nearby customers with relatively low power required, when compared to East Texas pumping. However, the two Benbrook pump stations are the only two TRWD pump stations on distribution-level power, and thus more susceptible to extended power outages. The District, through a series of coordination meetings with its customers, has confirmed that they are taking measures to add additional backup power across their own systems (though not at Rolling Hills WTP due to it being served by transmission level power). Diversifying and expanding the District's capabilities to provide raw water to customers during extended power outages is a major driver for adding backup power at the Benbrook Lake PS, as well as for a single pump at the Benbrook Booster PS to provide raw water to FW's Westside WTP.

The required Benbrook Lake PS backup power would be somewhere in the 2.5 to 3 MW range; the Benbrook Booster Lake PS would be around a 1 MW, both at 4160 v medium voltages.

Both are on USACE property, so permitting will be a consideration. All improvements are expected to be located within TRWD's existing easement with the Corp of Engineers.

Kennedale Balancing Reservoir – Phase 4: Third Cell Construction

Project Start: 2015
Projected Construction Start: 2025 (pending Federal Funding)
Projected Complete: 2027
Projected Cost: $60,000,000
Contact: Dorota.Koterba@TRWD.com

Description:

Kennedale Balancing Reservoir (KBR) currently consists of a two-cell balancing storage reservoir with a capacity of about 1,000 acre-feet. As part of a KBR expansion project, the addition of a third reservoir cell is to be constructed in two phases. The first phase consisting of the construction of an engineered foundation was completed in 2018. The second phase consists of the construction of the third cell directly west and adjacent to the existing cells increasing the total combined capacity to about 1,500 acre-feet. The third cell of approximately 165 MG will be constructed of an earth fill embankment with a maximum height of about 65 feet and minimum 3 horizontal to 1 vertical slopes. The nominal crest elevation of the embankment will match the elevation of the existing two cells at 740 feet-msl. A 200-foot-wide overflow weir will be used as an emergency spillway for the third cell.

Aquifer Storage and Recovery (ASR) Demonstration Project

Project Start: 2018
Construction Start: 2023
Projected Complete: 2027
Projected Cost: $8,500,000
Contact: Zach.Huff@TRWD.com / David.Schroeder@TRWD.com

Description:

Aquifer Storage and Recovery (ASR) is a proven technology to store water underground for later use. Benefits of ASR systems include improved resilience in times of drought, avoidance of evaporation, storage for emergency situations, and an intermittent source of supply to be used during peak demand periods. Based on the results of studies completed for the District in 2000, 2002, and 2015, ASR appears to be a technically feasible water supply strategy for the District. A more detailed business case evaluation was completed in 2016, and based on those results and discussions with other agencies that have implemented ASR, the District decided to implement an ASR demonstration project to verify aquifer performance. The primary purposes of the project are to verify that ASR is feasible in the Trinity aquifer in this region, verify geochemistry reactions, verify recharge rates, verify feasible storage volumes, verify recovery rates, and to verify construction and operating costs.

Eagle Mountain Balancing Reservoir 2nd Cell

Projected Start:	*2024*
Projected Complete:	*2028*
Project Estimate:	*$34,000,000*
Contact:	Dorota.Koterba@TRWD.com

Description:

The Eagle Mountain Balancing Reservoir (EMBR) is a 118-million-gallon storage reservoir located in west Fort Worth. The reservoir serves several functions within TRWD's Eagle Mountain Connection Project system by providing storage, surge control, and hydraulic control.

To address increasing water supply needs of the City of Fort Worth Westside Water Treatment Plant, along with the potential need for operational flexibility, the District is planning on expanding the balancing reservoir to have a second cell.

The addition of a second cell will provide redundancy and the ability to bring one cell down for maintenance. The addition of approximately 90-120 million gallons of elevated storage in the new second cell of the EMBR facility will provide increased resilience in meeting Westside WTP demands in the case of extended emergencies. This project is being designed along with the Mary's Creek Indirect Water Reclamation Project.

Cedar Creek Pump Station Chlorine Demolition and Caustic Soda Improvements

Project Start: 2023
Projected Construction Start: 2025
Projected Complete: 2026
Projected Cost: $1,700,000
Contact: *Fred.Hernandez@TRWD.com / James.Johnson@TRWD.com*

Description:

The District currently uses three chemicals at the Cedar Creek Lake Pump Station. The first two are chlorine gas and aqueous ammonia (also called ammonium hydroxide). They are mixed to form chloramines that are injected into the water before being pumped into the transmission system. Originally the chloramines were injected to reduce biofilm growth in the pipeline and therefore reduce the pumping cost. However, the cost/benefit did not turn out as expected because the pumping costs are dominated more by the significant pipe roughness of the previously deteriorated Cedar Creek pipeline than biofilm growth. These chlorine chemical feed systems are now inactive. A chlorine system employing sodium hypochlorite and ammonia will only be reactivated to control zebra mussels if they appear in the lake, which is only a moderate risk for Cedar Creek. (The goal of controlling zebra mussels is to reduce the number that attach to the transmission system.) The third chemical is sodium hydroxide (also called caustic soda). It is injected in the pipeline downstream of the pump station to maintain the Langlier Saturation Index to a safe range for protection of the pipeline lining.

The District is planning the following changes and improvements.

- Remove the chlorine tank, associated scrubber tank (but not the containment structure for this tank as it will be reused), and associated feed system; then repurpose the building that houses the chlorine tank and feed system.

- Relocate the sodium hydroxide metering pumps so that the tank can completely drain.
- Reline the aqueous ammonia containment structure.
- The following step will only occur if zebra mussels are found at the Cedar Creek Lake in the future:
  - Install a new sodium hypochlorite tank and feed system. The tank will be sized to fit within the containment structure that will be reused, and a covering will be added over the tank and feed pumps. The sodium hypochlorite and aqueous ammonia systems will be mixed to form chloramines for zebra mussel control. The benefits of sodium hypochlorite are that it is less hazardous, does not require an EPA Risk Management Plan, and deliveries seem to be more reliable.

This project will be phased. Phase 1 will include all work described above except installing the new sodium hypochlorite system – it will be designed in Phase 2 but only installed if zebra mussels appear. The District is designing Phase 1 but plans to bid out the work. Phase 2 may be designed by a consultant and installed by a contractor.

Arlington Outlet and Benbrook Outlet Dechlorination Facility Improvements

Projected Start: 2023
Projected Construction Start: 2025
Projected Complete: 2026
Projected Cost: $3,600,000
Contact: Donna.Stephens@TRWD.com

Description:

The purpose of the Arlington Outlet Dechlorination Facility is to remove any chlorine residual that may remain in the raw water pipelines prior to release into Village Creek upstream of Lake Arlington for meeting water supply and terminal storage needs. Among the planned improvements to the dechlorination facility are a roof to protect the tanks, piping and pumping components from outdoor elements, improved ventilation, relocation of the sampling equipment, and additional sampling and injection taps on the three nearby TRWD transmission mains. Improvements to the existing Benbrook dechlorination facility will also be made.

Copper Ion Feed for Benbrook Lake Pump Station for Zebra Mussel Control

Project Start: 2023
Projected Construction Start: 2025
Projected Completion: *2026*
Projected Cost: $3,300,000
Contact: Rick.Zarate@TRWD.com

Description:

The District is considering a copper ion injection project to control zebra mussels at the Lake Benbrook Pump Station to prevent attachment and accumulation in connecting raw water supply pipelines. The project is not needed yet because zebra mussels are not in the lake. But, given that they are in surrounding lakes, Lake Benbrook is identified as a high-risk for infection, and the nuisance that they are, the design is being prepared so the system can be built as soon as they appear.

TRWD uses chloramines for similar purposes at other lake pump stations. But the cost to install chloramines at Lake Benbrook is too high. Therefore, knowing some utilities have successfully used copper ions, the District and Carollo conducted a two-year pilot and found that copper ions are effective in preventing zebra mussel attachment and have a lower life cycle cost than chloramines.

The use of copper ions has been reviewed and approved by the TCEQ. Final design is expected to be prepared to build the project if and when zebra mussels appear.

RC Lake Pump Station Backup Sodium Hypochlorite for Zebra Mussels and Pump Discharge Valve Hydralic Actuators Installation

Project Start: 2021
Projected Construction Start: 2023
Projected Complete: 2025
Projected Cost: $4,800,000
Contact: David.Schroeder@TRWD.com

Description:
Following the discovery of zebra mussels at various locations in the Richland Chambers Reservoir in 2020, TRWD worked with Texas Parks and Wildlife (TPWD) and the Army Corps of Engineers (USACE) to ensure deliveries from Richland Chambers were not disrupted. Permission to pump to Lake Benbrook, an Army Corps Lake that does not yet have zebra mussels, was given with some conditions: TRWD needs to have the ability to dose chloramines in the Richland Chambers pipeline 24 hours per day, 7 days per week during active zebra mussel spawning months (typically March through October of each year) to prevent the transportation of zebra mussels to currently uninfected reservoirs. To ensure that the District can meet the goal of uninterrupted service to our customers, TRWD is installing a secondary, redundant method for dosing chloramines at the Richland Chambers lake pump station that will provide protection for the wet well, pumps, pump cans, pipeline, and appurtenances. The new method for dosing chemicals in the pipeline will operate as the backup to the current chloramine delivery system in place. Having two different methods for chloramine dosing ensures that if one system fails, a second is on stand-by to continue protecting our pipeline as well as prevent the transportation of zebra mussels between reservoirs.

Richland Chambers Lake Pump Station Sodium Hypochlorite Conversion from Chlorine Gas

Projected Start: 2025
Projected Construction Start: 2027
Projected Complete: 2028
Projected Cost: $14,500,000
Contact: James.Johnson@TRWD.com

Description:
The District currently receives bulk chlorine and mixes it with aqueous ammonia (also called ammonium hydroxide) to form chloramines that are injected upstream of the pump station to control biofilm growth and reduce zebra mussel attachment to the transmission system. Both biofilm and attached zebra mussels reduce the flow capacity during higher flow operations.

Since chorine is a hazardous chemical, the District must protect personnel and the public from risks, maintain an EPA Risk Management Plan, and be subject to periodic inspections and audits by the EPA. In addition, chlorine deliveries can be interrupted by factors outside of the District's control.

To reduce the hazard and eliminate the EPA's requirements listed above, the District plans to replace the chlorine system with a sodium hypochlorite system. The sodium hypochlorite may be delivered in bulk or generated on site. While on site generation requires more equipment, and maintenance, it allows greater autonomy from the chemical market.

The District will contract with a design consultant and contractor to design and build this project.

Cedar Creek Lake Pump Station (CC1) Electrical Building with VFDs

Projected Start: 2024
Projected Construction Start: *2026*
Projected Complete: 2028
Projected Cost: $22,000,000
Contact: *Rick.Zarate@trwd.com*

Description:

Currently, the medium voltage 4,160 volt switchgear and soft starts at the CC1 Lake Pump Station, along with the master control center (MCC), are located in the existing pump station building adjacent to the mechanical equipment. Apart from the MCC, the electrical equipment is dated and does not have modern safety features. In addition to improved staff safety and equipment reliability, another driver for a new electrical building to house all electrical equipment is the desire by TRWD to have the capability to operate the six 3,000 hp pumps at different speeds through the installation of VFDs. This would facilitate the District's ability to better optimize real-time pumping during peak power demand periods and times of high-power pricing variability.

Richland Chambers Lake Pump Station (RC1) Electrical Building with VFD

Projected Start: 2024
Projected Construction Start: *2026*
Projected Complete: 2028
Projected Cost: $26,000,000
Contact: *Rick.Zarate@trwd.com*

Description:

Currently, the medium voltage 4,160-volt switchgear, soft starts, and capacitor banks at the RC1 Lake Pump Station are in the pump and basement floors of the existing pump station building. The electrical equipment is dated and does not have modern safety features. Moreover, the capacitor banks are installed in the basement and are subject to damp conditions. In addition to improved staff safety and equipment reliability, another driver for a new electrical building to house all electrical equipment is the desire by TRWD to have the capability to operate the six 5,000 hp pumps at different speeds through the installation of VFDs. This would facilitate the District's ability to better optimize real-time pumping system wide during peak power demand periods and times of high-power pricing variability. The use of VFDs would also eliminate the need for the existing capacitor banks installed for power factor correction purposes at RC1.