Tulare Irrigation District

Area 18 Water and Energy Efficiency Modernization Project

Tulare County, California

APPLICATION SUBMITTED TO THE UNITED STATES BUREAU OF RECLAMATION FOR A WATERSMART GRANTS: WATER AND ENERGY EFFICIENCY GRANTS FOR FISCAL YEAR 2021

(Funding Opportunity No: BOR-DO-21-F001)

Tulare Irrigation District

Project Manager: Jeremy Barroll, Assistant Engineer

6826 Avenue 240
Tulare, California 93274
Phone: (559) 686-3425
Fax: (559) 686-3673
E-mail: jab@tulareid.org
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Date:	September 15, 2020
Applicant Name:	Tulare Irrigation District
City:	Tulare
County:	Tulare County
State:	California

Project Summary

The Tulare Irrigation District (District), has been delivering surface water to the growers of its service area for 130 years through a system of gravity canals and pipelines with the more recent addition of pressurized pipelines. The District proposes to redesign one of the older and problematic pressurized pipelines called the Area 18 Water and Energy Efficiency Modernization Project (Area Pipeline, Pipeline System, or Project) in order to increase both water efficiency and energy efficiency while providing additional operational flexibility. The Pipeline System serves 704 acres of crops spread across five (5) separate growers. It has delivered an average of 690 acre-feet per year from 2011-2020 (excluding 2013-2015 in which there were no surface water deliveries to any District growers due to a prolonged drought), ranging from 161 acre-feet in 2020, which was a dry year, to 1,367 acre-feet in 2011 which was a wet year[1]. The current system is highly inefficient, having been constructed in 1962 and served by a gravity line running a full half-mile from the source canal to the pump system; this pump system lifts water into a single stand from which lines radiate in four (4) separate directions. This layout severely restricts the number of turnouts/growers that can be served simultaneously, limits operational flexibility, is highly energy inefficient, and fails to adequately support growers served by the Pipeline System that have recently transitioned to drip irrigation. Therefore, Tulare Irrigation District proposes to redesign the entire pipeline system with several improvements to the current layout, namely (1) Separating the current single main line into two main lines, thereby increasing capacity and operational flexibility; (2) Installing new, more powerful, more efficient pumps for said main lines adjacent the canal, thereby increasing flow capacity and pressure; (3) Installing variable frequency drives on the pumps to improve energy efficiency and operational flexibility; (4) Situating the turnouts so that each turnout branches off of its respective main line at a separate point from the next turnout, thereby increasing operational flexibility; and (5) Installing new meters on each turnout to more accurately measure deliveries. Funds awarded through this grant combined with District funds will be used to design, permit, and construct a new Area 18 Pipeline distribution system that better meets the growers needs and provides water and energy savings.

Project Timeline

The District anticipates that this Project will take approximately 36 months to survey the existing system and proposed route of the new system; complete design of the pipelines, pump setups and connections to existing grower lines; and for the securing of a subcontractor for pipeline and structure work and the subsequent time required to complete pipeline and

[1] Data generated from Tulare Irrigation District delivery records for the years 2011-2020.

structure work. Some preliminary survey and design work has already been completed (see Sheet 2 "Design Plans" in **Appendix B**). The District anticipates that surveying and design work will begin immediately, once grant funds are available and the District has secured a contract with the U.S. Bureau of Reclamation (USBR).

Project Facilities

The proposed work will involve the construction of pipelines, diversion structures, and pump systems on the property of various growers, and some of which will be within existing TID easements. The District will not conduct any work on any federal property or facilities.

Background Data

Tulare Irrigation District Geographic Location

The District was formed on September 21, 1889 as one of the first of several irrigation districts formed under the Wright Act of 1887. The District provides service to approximately 70,000 acres within Tulare County, California and is situated in the southern San Joaquin Valley. The District is approximately 50 miles southeast of the City of Fresno and approximately 65 miles northwest of the City of Bakersfield. The City of Tulare is situated within the District and represents the largest urban community within the District boundary. Adjacent water agencies include the Kaweah Delta Water Conservation District, Corcoran Irrigation District, Kings County Water District and numerous private ditch companies. A location map for the District, including the location of the Area 18 Pipeline, is included as **Figure 1.**

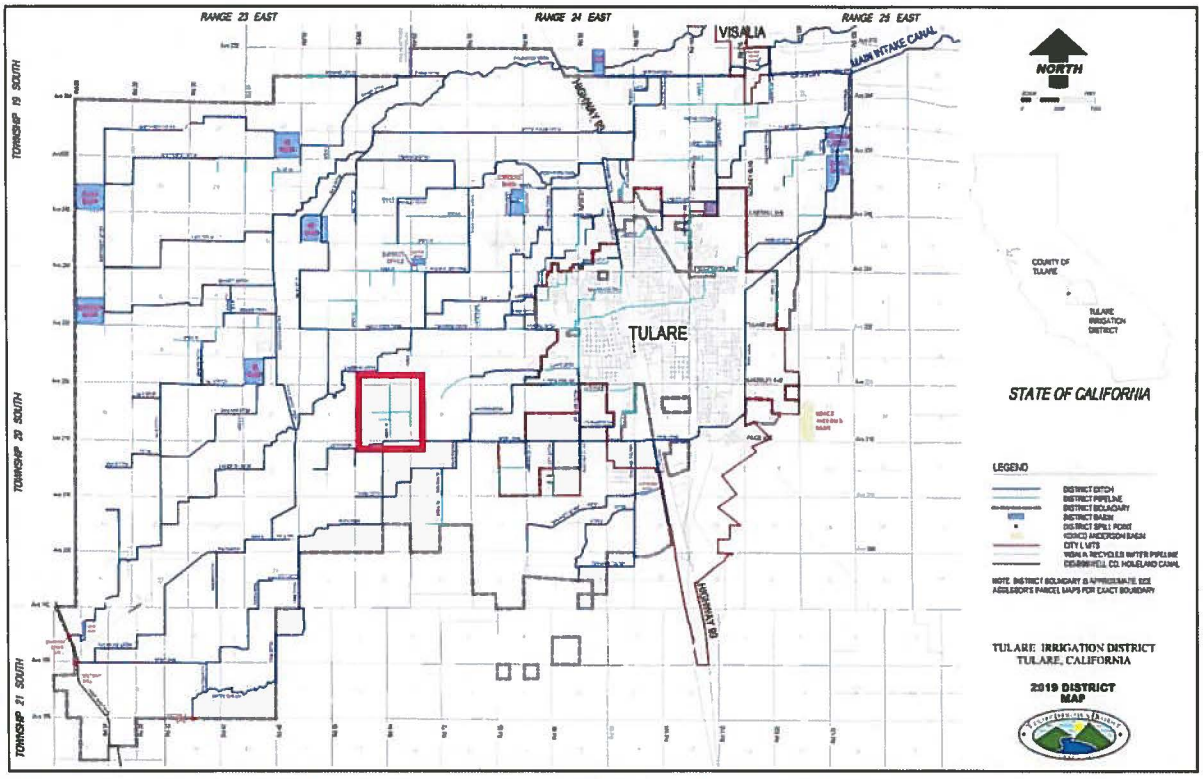

Figure 1. District Location Map. Area 18 Pipeline is shown with a red rectangle.

Water Supply and Demand

The Tulare Irrigation District is a Friant contractor with the U.S. Bureau of Reclamation (USBR) and holds surface water rights (pre-1914) on the Kaweah River. The District has a contract for 30,000 Acre-Feet (AF) of Class 1 water and 141,000 AF of Class 2 water from the CVP Friant Unit. The District also enters into annual contracts for Section 215 water (surplus CVP water) and has a contract for 11,000 AF of tertiary treated wastewater from the Visalia Wastewater Treatment Plant, which it exchanges for 5,500 AF of surplus surface water. Combined, the District has an average annual surface water supply of approximately 180,000[2] AF to meet grower demand and, in years of excess, recharge deliveries.

In order to utilize the highly variable surface water supplies that the District receives, which can range widely from approximately 15,000 AF to 350,000 AF, the District has developed over time a conjunctive use system by which irrigation demands not fully met by surface water are met with landowner deep wells. Over the last several decades, the District has observed a slow decline in groundwater elevations on the average of 24 inches per year, due to the heavy reliance that farmers have had to put on groundwater to meet crop consumption needs. The trend in groundwater levels has fluctuated largely as a function of wet and dry cycles; however, the long-term average trend has been downward. See **Figure 2** for a historical depth to groundwater chart showing the long-term downward trend of groundwater levels within the District. This downward trend is anticipated to continue and possibly increase due to various demands on groundwater in the area and due to the loss of water to the San Joaquin River Restoration Program (Restoration Program). The District estimates that an average of 20% of its CVP Friant supply will be redirected towards the San Joaquin River Restoration Program, which is anticipated, on average, to consist of approximately 2,000 AF of Class 1 water and 13,000 AF of Class 2 water annually[3].

[2] Average annual surface water supply generated from data for the period from water year 1950 to 2019.

[3] Based on analysis done by the District utilizing analyses prepared by the Friant Water Authority.

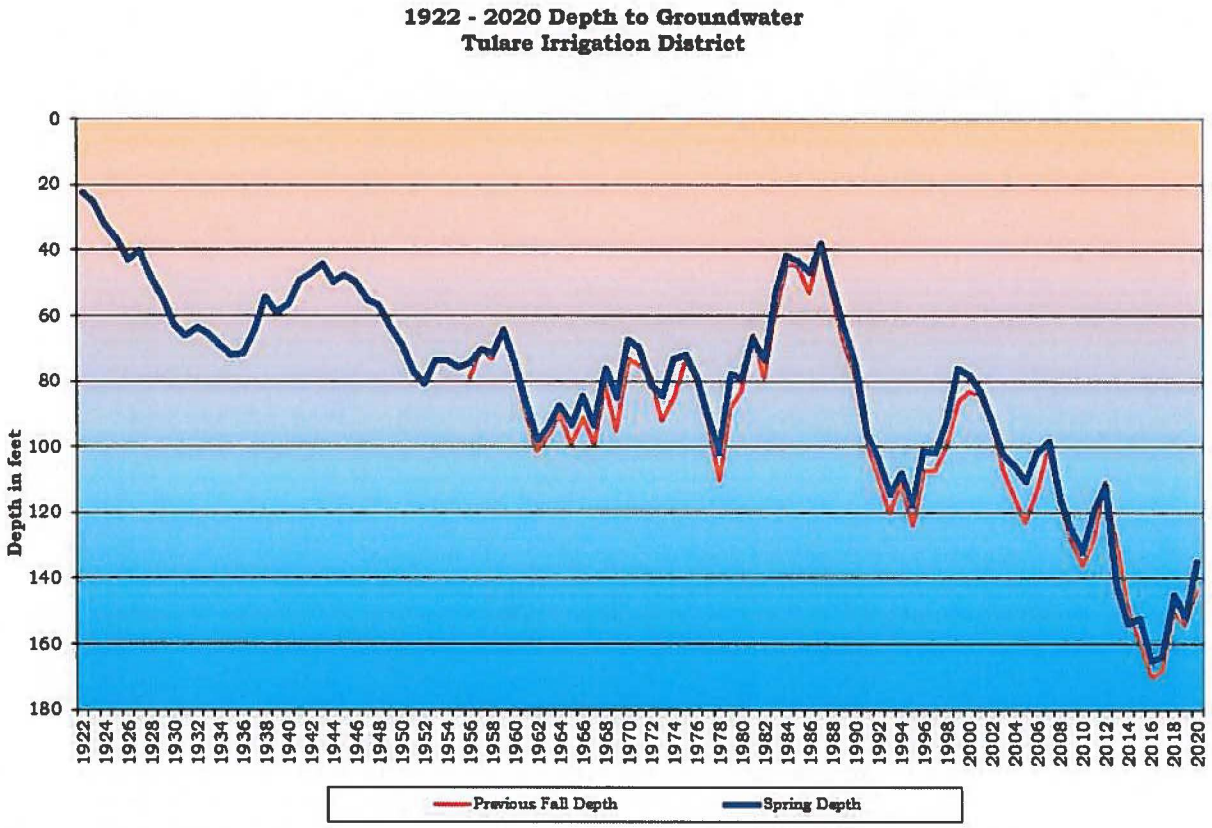

Figure 2. Historical Depth to Groundwater Readings for Tulare Irrigation District

The District delivers surface water to approximately 200 agricultural growers within the District growing a variety of agricultural commodities. The District does not serve any municipal, domestic or industrial uses within the Tulare area. The District utilizes approximately 300 miles of earthen canals and 30 miles of pipelines to deliver water to approximately 535 farm gate turnouts within the District. The District also utilizes approximately 1,300 acres of groundwater recharge ponds to carry out recharge activities. Please see **Figure 1** for a District Map showing the location of District canals, pipelines, aquifer recharge ponds, and other water-related facilities. The District also utilizes an extensive SCADA system to monitor and control key water management facilities within the District to facilitate efficient water management decisions.

The Growers within the District grow a variety of crops and the top five crops recorded during the 2018 crop survey are listed in **Table 1**. The District was once dominated by cotton; however, much of the District is now farmed to serve the large dairy industry in the Tulare area. Permanent crops such as pistachios, walnuts and almonds have also quickly gained popularity.

Table 1. List of Top 5 Crops Grown in Tulare Irrigation District- 2019

Crop	Acreage
Wheat	15,158
Alfalfa	10,158
Pistachios	8,336
Almonds	7,239
Field Corn	5,664

Bureau of Reclamation Working Relationship

The District has maintained a good working relationship with the USBR since the execution of its contract for a water supply from the Friant Unit of the CVP in 1949. In recent history (past 14 years) the District has also partnered with the USBR on several grant projects (nine in total) that have improved water conservation and water efficiency within the District. Six of the projects have been completed and were done within the anticipated schedule and budget. Below is a list of grants that the District has received and are currently in progress:

- **WaterSMART Grant – FY 2012**
  A $452,000 grant to construct new SCADA automated measuring structures and install SCADA automated gates on District canals. The project is currently ongoing and is currently on schedule with a no-cost time extension.
- **Part III Grant – FY 2013**
  A $1.9 million grant to conduct several water supply studies and construct a recharge basin to address current and future losses of Friant CVP supplies to the San Joaquin River Settlement. The project was recently completed on schedule with a no-cost time extension and within the budget allocated by USBR funds.
- **WaterSMART Grant – FY 2017**
  A $73,000 Grant to migrate District SCADA sites from the Lookout platform to the web-based Ignition platform, and to provide a large screen and tablets for staff and ditch tenders to access real-time monitoring data. This project was completed on schedule and under budget.

Project Description

The Area 18 Water and Energy Efficiency Modernization Project will improve water and energy efficiency for deliveries to the Area 18 service area by replacing the existing inefficient system with a new system that has fewer head losses, more efficient pumps, higher capacity and finer operational control. Additionally, by allowing TID's surface water supplies to be delivered more reliably to a larger number of growers simultaneously, the Project will effectively reduce groundwater pumping, thereby saving additional energy and water resources.

The Area 18 Pipeline is an area pipeline system consisting of approximately 12,400 feet of pipeline owned, operated, and maintained by the Tulare Irrigation District (see **Figure 3**). Water enters through a canal gate on the gravity-fed Main Canal (Intake) and then travels by gravity approximately 2,700 feet north through a 36-inch reinforced concrete pipeline to a box from

which a 20 hp pump (Pump Station) lifts the water horizontally into a standpipe. Also at the Pump Station is a 10 hp pump with its own separate box, and an outlet running over the top of the standpipe. The Pump Station includes an overflow consisting of a pipe running from near the top of the standpipe back into the 20 hp pump box, and a bypass with a gate that also runs back into the 20 hp pump box. From here, four (4) variously sized concrete pipelines emanate outward to the north, south, east, and west to serve the turnouts, with linegates and meters being placed immediately adjacent to the standpipe for the south and west running lines and closer to the delivery points for the north and east running lines (see **Figure 4** and Sheet 1 "Existing Plans" in **Appendix B**)

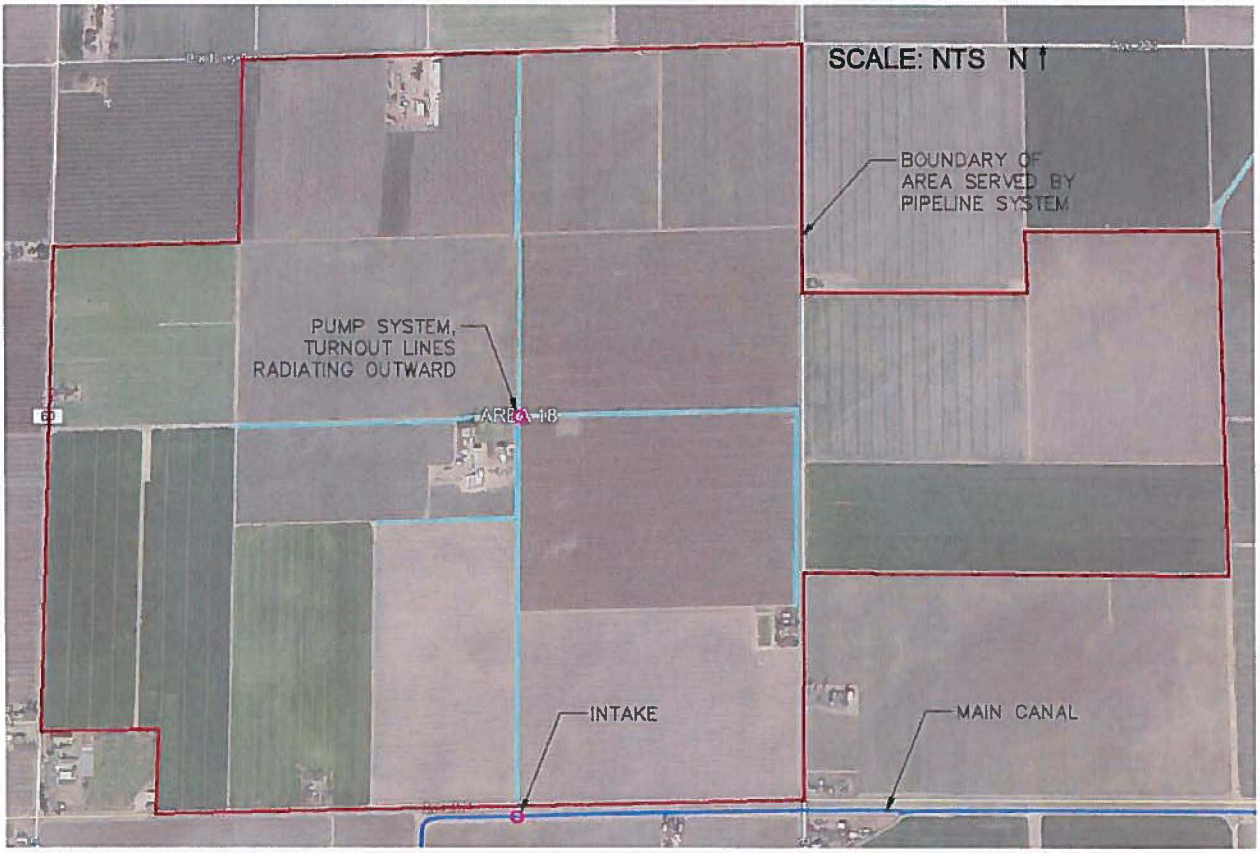

Figure 3. Area 18 Pipeline Existing Facilities and Layout. District existing open ditch shown in blue, existing pipeline shown in cyan, and boundary of Area Pipeline service area shown in red.

Figure 4. Area 18 Pipeline Existing Pump System, View from the South. The green pump is 20 hp while the blue pump is 10 hp.

The south line runs south 700 ft and connects to a grower standpipe, then runs west 1000 ft and terminates at another grower standpipe. This is collectively referred to as Turnout -1. The west line runs west 2000 ft and terminates at a grower standpipe; this is referred to as Turnout -2. The north line runs 1200 ft north then branches into a linegate and meter which is referred to as Turnout -5. It then continues another 1400 ft north to turnout -6 where the line connects directly into grower lines both to the east and west. The east line runs 1700 ft east at which point Turnout -4 branches off with a linegate and meter. Another linegate and meter, Turnout -3, leads into the remainder of the line which runs 300 ft east then 400 ft south, at which point it branches to connect to a grower line across Rd 68 80 ft to the east and also continues 1000 ft south to a grower standpipe.

Preliminary Design Layout Formulation

The Area 18 Water and Energy Efficiency Modernization Project (Project) aims to completely redesign the existing system due to the inherent inefficiencies of flow control by bypassing and certain lines running counter to the overall intended flow direction, as well as the inflexibility of

turnout lines all emanating from one standpipe. Therefore, a new layout will be established in which there are two (2) separate pump and pipeline systems, one with its intake at the site of the current intake (Main Stem/Main Stem Pump) which will serve turnouts -1, -2, -5 and -6, and another with its intake one-half mile to the east (East Stem/East Stem Pump) which will serve turnouts -3 and -4. Three (3) of the existing turnouts (Turnout -1, Turnout -3 and Turnout -6) will each be separated into two (2) separate turnouts. Each turnout will tee off of its respective Stem separately to maximize operational control. See **Figure 5** for a design layout and **Appendix B** for a more complete set of draft preliminary design plans. Note that these plans are preliminary and not for construction, and layout details and parts may change in the final design.

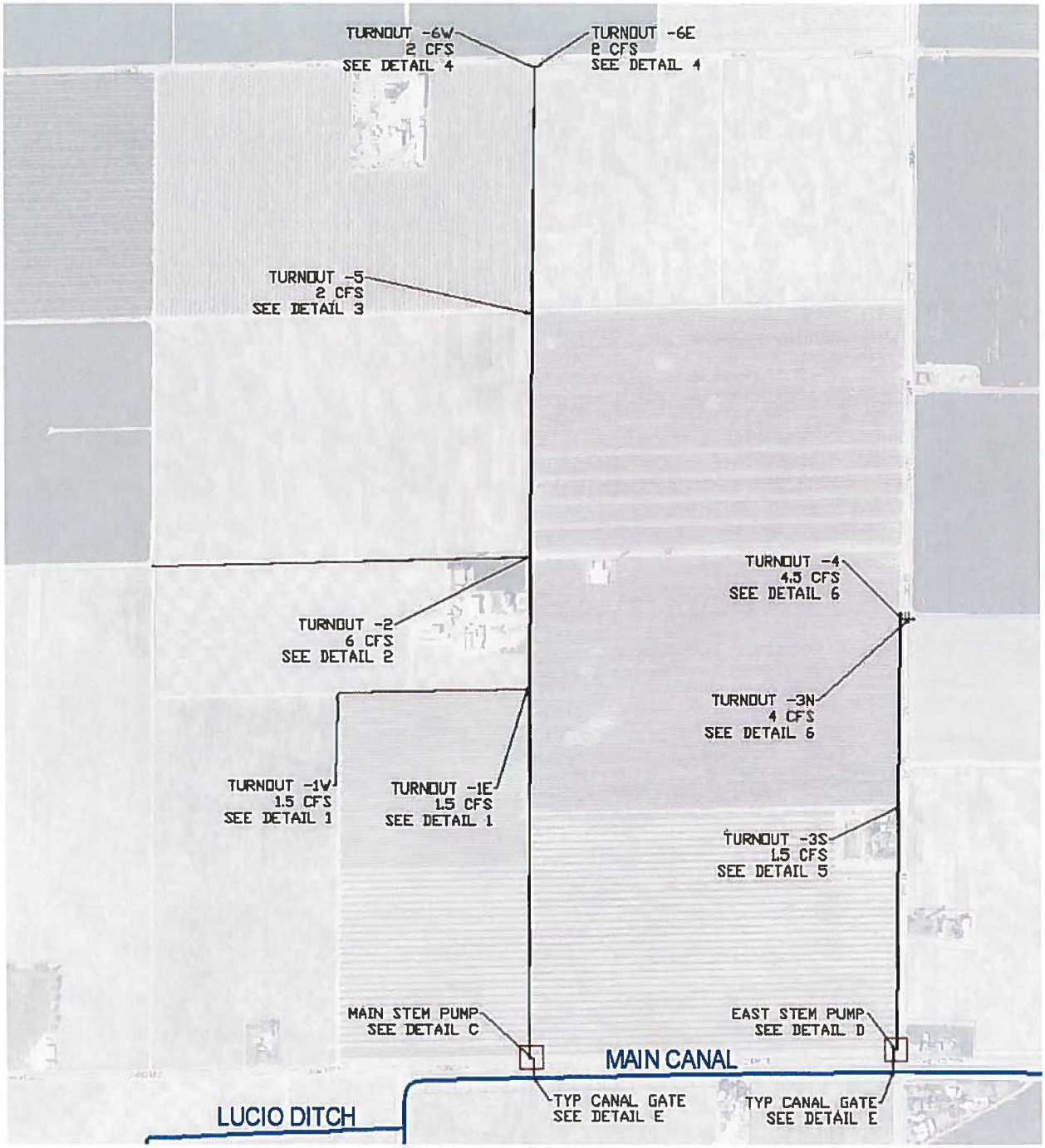

Figure 5. Area 18 Pipeline Design Layout (from Draft Preliminary Design Plans). See Design Plans in Appendix B for additional detail.

To size the pipelines and turnouts, a hydraulic analysis was performed in which minimum pipe size was determined based on flow and pressure needs at each turnout. See **Appendix C** Hydraulic Analysis. These needs were determined from the operating and by contacting the individual growers.

Generally speaking, the main lines were sized to keep velocity under 5 ft/s with all turnouts running at full capacity so as to keep head loss reasonable. The turnout pipes were sized so that velocity will stay under 5 ft/s with reasonable head loss while still being small enough that deliveries can be effectively throttled to roughly 3-4 ft pressure head by having the linegate ¼ open (assuming that minor loss for a linegate ¼ open= 24*velocity head).

Pump System Formulation

Pumps were chosen by flow and head needs. A total of 15 cfs and 20 ft added head from the canal are needed for the Main Stem while 10 cfs and 20 ft added head are needed for the East Stem, as estimated by the hydraulic analysis. To be conservative, these figures were rounded up to 15 cfs and 40 ft head for the Main Stem and 10 cfs and 40 ft head for the east stem.

Therefore, a 10 cfs vertical turbine pump and a 5 cfs vertical turbine pump with a variable frequency drive were chosen for the Main Stem, while a 10 cfs pump with a variable frequency drive was chosen for the East Stem. All pumps are model US Motors Premium-Efficient Motor 1780 rpm with a 14" wide, 14 ft long barrel. The 10 cfs model is the 75 hp variant while the 5 cfs model is the 60 hp variant. See **Appendix D** Pump Curves.

As the Main Canal, where the intakes are situated, is on the opposite side of Paige Ave from the service area and has limited bank space, the pump systems will be placed in boxes on the north side of Paige Ave, with a 42" RCP line running under the roadway from each intake to each box.

Guided by preliminary consultation with a pump vendor, each pump will be given a cross-section of 6 ft x 4 ft within its respective box. As the pumps require at least 5 ft submergence, the bottom of each box will be 10 ft below canal bottom with the top level with the ground surface.

Hydraulically controlled air/vacuum valves (a vacuum valve/surge valve combo) will be placed at the outlet of each pump both for filling/emptying and to control pressure surges and therefore protect the downstream pipelines. The size of each valve was calculated using expected outlet flow (5 cfs or 10 cfs) and an expected outlet head of 20 psi for each pump so that these valves will be able to handle all flow from each pump in the event of a pressure surge[4]. For the Main Stem, the two (2) pumps will be teed together. Downstream of this point on both Stems, a bypass will be placed consisting of a tee into a steel pipe leading into its own separate 4 ft x 6ft area of its respective box (to avoid additional turbulence at the pump inlet and accommodate the future installation of an additional pump if needed). A Fresno Valve 40B Linegate controls each bypass. An air release valve, butterfly shutoff valve and magnetic meter will be placed downstream of the bypass. From this point, the steel pipe leads into a pressure manhole which leads flow downward and into the north-running stem pipeline below. This manhole serves to allow the lines to be pumped out for maintenance. Both pump systems were

[4] APCO Hydraulically Controlled Air/Vacuum Valves.
http://apco.moreyellow.com/assets/apco_product_pages/catalogs/air_valves/7000.aspx.pdf

designed in an east-west configuration to conserve limited space as they will both be placed along the road shoulder opposite the canal and space will likely have to be purchased from adjacent growers who are currently growing pistachio trees in those locations.

Gate/Meter Selection for Turnouts

The Fresno Valve 40B was chosen for all linegates as this is the linegate that Fresno Valve recommends for placement along both PVC and steel pipelines. The McCrometer Ultra Mag was chosen preliminarily as the meter for all turnouts as magnetic meters are preferred for irrigation water, which may contain suspended objects that can damage other types of pipeline meters, such as propeller meters.

Air Release Valve Selection

The air release valve design was derived from the APCO air valve guide[5]. Recommended air valve orifice size increases with increasing flow and decreases with increasing pressure. Given a maximum expected system pressure for the main stem of roughly 20 psi with a maximum air flow (2% of total pipe flow volume) of roughly 15 cubic feet per minute, and a maximum expected system pressure for the secondary stem of roughly 15 psi with a maximum air flow of roughly 10 cubic feet per minute, the optimal orifice size for both pipelines is ¼ inch. Given this information, the recommended air release valve for both main lines is the APCO 200A compound lever which offers an orifice size of ¼ inch.

Recommended spacing is roughly one air release valve every 2,000 feet for long horizontal runs, however air release valves will be placed more frequently given the frequent occurrence of turnout gates. Air valves will be placed beside the dirt lanes and connected to the main pipelines by tees and smaller pipe so as to avoid posing an obstacle to traffic. See design plans.

A combination (air release plus air/vacuum) valve will also be placed immediately above each turnout gate so that the main lines may be emptied for service. Turnout capacities range from 1.5 to 7 cfs and a low pressure threshold is desired to open the air/vacuum component of the combination air valves given our use of PVC. Given this information, the recommended combination air valve for all turnouts is the APCO 145C which has an inlet and vacuum outlet size of 2 inches[6].

Task 1: CEQA and NEPA Review

It is expected that the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA) will apply to the proposed project. Tulare Irrigation District will prepare a negative declaration for CEQA compliance as the project does not have a potentially significant impact on any of the environmental factors listed in CEQA Appendix G.

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[5] APCO Air Valve Guide. http://www.dezurik.com/files/3313/5731/8371/apco-air-valve-guide-610.pdf

[6] APCO Combination Air Valves. https://www.dezurik.com/resources/apco-single-body-combination-air-valves-avc-avc-single-body-combination-air-valves--623.pdf

Tulare Irrigation District will need to file NEPA in the event of federal grant funding. A Finding of No Significant Impact is expected.

Task 2: Design and Permitting

Some preliminary survey and design work has already been completed, however the Project will require more detailed survey work for design and construction. In regard to surveying, this mainly includes a survey of the existing intake, existing pump system, canal at the proposed intake points, and existing delivery points (See sheet 1 "Existing Plans" in **Appendix B**). Survey information that is gathered will be used in the final design process. In regard to design, this mainly includes the layout of the proposed pump systems, pipeline systems, and connections to delivery points as informed by a Manning-based hydraulic analysis consultation with growers served by the Pipeline System and the operational needs of the District's Water Department (See Sheet 2 "Design Plans" in **Appendix B**). Upon receiving the grant award, the District Engineering department will complete a thorough survey of the existing pipeline; the route of the proposed pipeline; roadways in which the proposed pipeline will be places; and delivery points; to establish the horizontal and vertical placement of the proposed pipeline and pump systems and to decide in which locations the existing pipeline will be abandoned versus removed.

The District's engineering staff will then complete the majority of preliminary design work before contracting with a consultant engineer to finalize the plans and carry out additional surveying. During this stage, the District Assistant Engineer will prepare the preliminary plans with guidance from the General Manager, who is a registered Professional Engineer in California. The design plans will be elaborated with the incorporation of the new survey data to show specific horizontal and vertical placement of pump systems, pipeline and connections to delivery points. The consultant engineer will finalize and stamp the completed design plans with the approval of the District General Manager and Assistant Engineer. The finalized plans will then be submitted to the County of Tulare Resource Management Agency for an encroachment permit for the County road right-of-way crossings. Easement applications will also be filed to grant Tulare Irrigation District easements for the new pipeline routes.

Task 3: Construction Bidding and Award

The District will bid out the construction in its entirety to a contractor through the District's public bidding process and overseen by District Staff. It is envisioned that the contractor will hire a pump subcontractor for the pump installation and a separate electrical subcontractor for the variable frequency drive installation and connection to Southern California Edison's overhead power lines, which run along the north side of Paige Ave. The District will also separately hire a SCADA subcontractor to install SCADA equipment to measure level in the canal for pump protection, report flows from the meters on both the pumps and the turnouts, and remotely control the variable frequency drives for convenient control of pump flows and outlet pressure.

Task 4: Construction and Construction Administration

Upon the bidding and award, the Contractor shall complete all pipeline work and structure work as described in the final design plans. The District Engineering Staff shall provide construction administration and inspection of the work during construction.

Task 5: Grant Administration

District Engineering Staff shall provide the grant administration for this Project. The Grant Administration is anticipated to include bi-annual reporting to the Bureau of Reclamation, accounting of costs incurred by the project, financial reporting to the Bureau of Reclamation and correspondence with the Bureau of Reclamation regarding this Project.

Evaluation Criteria

E.1.1. Evaluation Criterion A—Quantifiable Water Savings (30 points)

Describe the amount of estimated water savings. For projects that conserve water, please state the estimated amount of water expected to be conserved (in acre-feet per year) as a direct result of this project.
Please include a specific quantifiable water savings estimate; do not include a range of potential water savings.

This project would save an estimated 935 acre-feet of water during a typical year in which water is delivered from May to July.

Describe current losses: Please explain where the water that will be conserved is currently going (e.g., back to the stream, spilled at the end of the ditch, seeping into the ground)?

Currently, losses from the existing system are being run down the San Joaquin River and into the Pacific Ocean. During wet years, the District and neighboring agencies are unable to distribute the full amount of imported supplies available from the Central Valley Project. For example, in the wet year of 2019, the District was only able to import 50% of its Class 2 Central Valley Project supplies. It is the District's goal to increase its distribution capacity to maximize the amount of surface water consumed when it is available, and therefore reduce the pumping of rapidly diminishing groundwater supplies. While the main form of losses occurs due to capacity limitations, the existing system is leaking and seeping water into the ground. This is problematic during dry years when surface water supplies are limited, and leaks contribute to energy inefficiencies, as the water lost to seepage will be pumped again by nearby wells.

Describe the support/documentation of estimated water savings: Please provide sufficient detail supporting how the estimate was determined, including all supporting calculations. Note: projects that do not provide sufficient supporting detail/calculations may not receive credit under this section. Please be sure to consider the questions associated with your project type (listed below) when determining the estimated water savings, along with the necessary support needed for a full review of your proposal. *In addition, please note that the use of visual observations alone to calculate water*

savings, without additional documentation/data, are not sufficient to receive credit under this section. Further, the water savings must be the result of reducing or eliminating a current, ongoing loss, not the result of an expected future loss.

Water savings during a typical year can be calculated by subtracting the system's current capacity from the overall demand. From 2011 through 2020 (excepting 2013-2015, drought years in which there were no surface water deliveries), the average annual deliveries through this system amounted to 689 acre-feet. In an average water year, the District's surface water deliveries last three months, May through July. In contrast, the crop demand for this service area is estimated to be roughly 1624 acre-feet over the same timeframe (May to July). The difference between the estimated crop demand and the water supplied over this timeframe is 935 acre-feet (this number is corrected for typical irrigation efficiencies within the District), all of which is pumped from the aquifer. During a typical year, this project would enable the district to meet the estimated demand of 1624 acre-feet and result in an average annual water savings of 935 acre-feet for a typical year.

This Project is being designed with a 50-year life. Over the design life of this project, with an average annual savings of 935 acre-feet, the Project will save approximately 47,000 acre-feet.

Water savings during a wet year can also be calculated by subtracting the system's current capacity by the overall demand. For example, during 2019, which was a wet year, water deliveries took place from January to August, the total deliveries through this system amounted to 1,165 acre-feet. In contrast, the crop demand for this service area is estimated to be roughly 2,622 acre-feet over the same timeframe (January to August). The difference between the estimated crop demand and the water supplied over this timeframe was 1,457 acre-feet, all of which was pumped from the aquifer. During a wet year like 2019, the estimated water savings from this Project would have been 1,457 acre-feet. An added benefit of this system is that during exceptionally wet years growers within the service area will be afforded the option to carry out groundwater recharge projects. These projects may be done on fallow land or on orchards with dormant trees during winter months. Not only would this Project provide the aforementioned water savings by reducing reliance on groundwater pumping, but it would facilitate groundwater recharge to offset pumping during dry years. Groundwater recharge would be a form of additional water savings during wet years, as the alternative is spilling excess water to the ocean.

Estimated water demand was calculated by examining the current water demand due to crop evapotranspiration (ET) and assumed irrigation efficiencies for individual systems within the service area. According to the Food and Agricultural Organization of the United Nations, the typical on-farm irrigation efficiency for surface systems is roughly 60%, while the on-farm irrigation efficiency for drip systems is roughly 90%[7]. Demand due to crop evapotranspiration was found using published data from the California Department of Water Resources CIMIS ETo

[7] Food and Agricultural Organization of the United Nations, "Irrigation Water Management: Irrigation Scheduling" http://www.fao.org/3/t7202e/t7202e08.htm#TopOfPage

Zone 12 from the Irrigation Training and Research Center at the California Polytechnic State University in San Luis Obispo[8]. To calculate overall demand, the demand due to ET was divided by the typical irrigation efficiency for the given system type (surface or drip). Finally, the demand in feet per month was summed and multiplied by the corresponding acreage within the service area. In all reality, the demand is likely slightly higher due to imperfect distribution uniformity and errors in irrigation scheduling. The full calculations and tables used to determine demand and water savings resulting from this project can be found in **Appendix E.**

(1) **Canal Lining/Piping:** Canal lining/piping projects can provide water savings when irrigation delivery systems experience significant losses due to canal seepage. Applicants proposing lining/piping projects should address the following:
a. How has the estimated average annual water savings that will result from the project been determined? Please provide all relevant calculations, assumptions, and supporting data.

Estimated water savings resulting from this project have been calculated by subtracting the water deliveries within the service area from crop demand due to evapotranspiration and corresponding irrigation system efficiencies over a defined timeframe. The difference between crop demand and actual deliveries must all be pumped as groundwater. This project would eliminate the system inefficiencies that prevent the irrigation district from supplying enough water to meet crop demand.

Crop demand due to evapotranspiration (ET) was calculated using published data from the Irrigation Training and Research Center (ITRC) at the California Polytechnic State University in San Luis Obispo. District staff conducted a crop survey to find the acreage of each crop and the corresponding irrigation system type within the service area. Based on the Food and Agricultural Organization of the United Nations publication, "Irrigation Water Management: Irrigation Scheduling", an irrigation efficiency of 90% was assumed for drip systems and an efficiency of 60% was assumed for surface systems. These efficiencies were factored into the evapotranspiration data, and an annual crop demand was calculated based on the number of acres of each crop within the service area.

For a typical year the irrigation district makes water deliveries from May to July. The crop demand within the service area is estimated to be 1624 acre-feet over that same timeframe (May to July). In contrast the district delivers an average of 689 acre feet to this service area during a typical year. This results in 935 acre-feet of water that must be pumped from the aquifer to meet crop demand. This project would eliminate the system inefficiencies that prevent the irrigation district from delivering the additional 935 acre-feet of water during a typical year, better utilizing district water supplies.

During a wet year the irrigation district makes water deliveries from January to August. The crop demand within the service area is estimated to be 2622 acre-feet over that same

[8] Irrigation Training & Research Center, "California Evapotranspiration Data" http://www.fao.org/3/t7202e/t7202e08.htm#TopOfPage

timeframe (January to August). In contrast the irrigation district delivers an average of 1165 acre-feet to this service area over the same timeframe. This results in 1457 acre-feet of water that must be pumped from the aquifer to meet crop demand. This project would eliminate inefficiencies and increase system capacity so the irrigation district could deliver enough water to meet crop demand.

See **Appendix E** for a tabulated outline of the estimated demand calculations based on evapotranspiration and irrigation system efficiencies.

While losses due to capacity limitations and system inefficiencies are the primary focus of this Project, the losses due to leakage would also be addressed. On average, the existing system leaks to the point that water pools and flows at ground level 2-3 times per year. Often times, these leaks cannot be patched until water deliveries end in late summer as the losses due to the shutting down the system would be far greater than the losses due to the leak. Anecdotal evidence from the District Superintendent, Watermaster, and Ditchtenders suggest that such leaks amount to approximately 1% of total water deliveries through the system. This would amount to approximately 6.89 acre-feet of seepage during an average year, but could be as much as 11.65 acre-feet of seepage during a wet year. It's important to note that the aforementioned leaks are only those which result in visible damage (i.e. water pooling at ground level). Due to the age and deteriorating condition of the existing system, there are likely a multitude of smaller fractures and leaks in the pipeline and joints that result in even more subsurface leakage.

b. How have average annual canal seepage losses been determined? Have ponding and/or inflow/outflow tests been conducted to determine seepage rates under varying conditions? If so, please provide detailed descriptions of testing methods and all results. If not, please provide an explanation of the method(s) used to calculate seepage losses. All estimates should be supported with multiple sets of data/measurements from representative sections of canals.

Tulare Irrigation District has no concrete estimates of seepage loss from the existing pipeline because there are meters at the turnouts but not at the intake of the system. However, leaks have been physically witnessed in the form of saturation or ponding above the pipeline. There have historically been about 2-3 visible leaks in the pipeline per year. Given that the existing system is entirely composed of concrete pipe installed in 1962, it is safe to assume that there is a significant amount of leakage that goes unwitnessed.

c. What are the expected post-project seepage/leakage losses and how were these estimates determined (e.g., can data specific to the type of material being used in the project be provided)?

Unlike the existing system, the new system will provide a means for the District to calculate leakage losses. This Project will include the installation of magmeters at each of the pump stands. In addition to measuring water deliveries at the individual user turnouts, the District can take the difference between the magmeter measurements and the total deliveries to calculate leakage losses.

While the goal of this Project is to eliminate as many inefficiencies as possible—it is inevitable that even the new system will encounter some leaks over its 50-year life. While the District may not be able to forecast future leaks in the system, they will undoubtedly be far less significant than the inefficiencies of the existing system.

The system's Main Stem will consist of 2,700 linear feet of new reinforced concrete pipe with the remainder being new PVC pipe and the East Stem will consist entirely of PVC pipe. A new pipeline network will eliminate losses due to leakage in the existing system and improve system efficiency and operations and maintenance.

d. What are the anticipated annual transit loss reductions in terms of acre-feet per mile for the overall project and for each section of canal included in the project?

There will be virtually no transit loss in the proposed system so whatever is the current transit loss, the new transit loss will be virtually nonexistent.

e. How will actual canal loss seepage reductions be verified?

This Project would include the installation of magmeters at each of the pump outlets. In conjunction with metering at the individual user turnouts, installation of magmeters would enable the District to calculate system losses by taking the difference between water pumped and the amount of water delivered to the users.

The District considers such improvements in measuring capability to be a serious benefit for operations and maintenance as well as monitoring system efficiency. Installing magmeters and Supervisory Control and Data Acquisition (SCADA) as components of this project gives the District greater control, which, in-turn, provides greater flexibility for growers and greater system efficiency.

f. Include a detailed description of the materials being used.

Reinforced concrete pipe will be used for 2,740 feet of the Main Stem while the remainder will be PVC. PVC will be used entirely for the East Stem.

E.1.2. Evaluation Criterion B—Water Supply Reliability (18 points)

Please address how the project will increase water supply reliability. Proposals that will address more significant water supply shortfalls benefitting multiple sectors and multiple water users, will be prioritized. General water supply reliability benefits (e.g., proposals that will increase resiliency to drought) will also be considered. Please provide sufficient explanation of the project benefits and their significance. These benefits may include, but are not limited to, the following:
1. Will the project address a specific water reliability concern? Please address the following:

- Explain and provide detail of the specific issue(s) in the area that is impacting water reliability, such as shortages due to drought, increased demand, or reduced deliveries. Will the project directly

address a heightened competition for finite water supplies and over-allocation (e.g., population growth)?

Under the Sustainable Groundwater Management Act, groundwater pumping within the Kaweah Subbasin will be limited to a balanced input and output by 2040. Based upon early estimations, the Kaweah Subbasin is approximately 77,600 AF in groundwater overdraft per year according to data from 1997-2017[9]. Contributing to this overdraft in the future is the reduction in surface water to the Tulare Irrigation District and other CVP Friant users in the Kaweah Subbasin to comply with the San Joaquin River Settlement, which diverts water from the CVP Friant system to establish a salmon fishery on the San Joaquin River.

- Describe how the project will address the water reliability concern? In your response, please address where the conserved water will go and how it will be used, including whether the conserved water will be used to offset groundwater pumping, used to reduce diversions, used to address shortages that impact diversions or reduce deliveries, made available for transfer, left in the river system, or used to meet another intended use.

Water conserved as a result of this project will be used to offset groundwater pumping. During a typical year this project will eliminate 935 acre-feet of groundwater pumping, as the district would have the capacity to deliver enough water to meet crop demands.

- Provide a description of the mechanism that will be used, if necessary, to put the conserved water to the intended use.

Water will be delivered to the service area through a network of pressurized pipelines that draw from the district's canals. Conserved groundwater will be used during dry years when the district supplies little water.

- Indicate the quantity of conserved water that will be used for the intended purpose.

An average of 935 acre-feet of water will be conserved during a typical year, with more water being conserved during a wet year and less water being conserved during a dry year. The water conserved as a result of this project will be utilized by growers, municipal well owners, and nearby disadvantaged communities that rely on groundwater.

2. Will the project make water available to achieve multiple benefits or to benefit multiple water users? Consider the following:

- Will the project benefit multiple sectors and/or users (e.g., agriculture, municipal and industrial, environmental, recreation, or others)?

This project will benefit agricultural users, adjacent rural domestic users, and nearby disadvantaged communities that are completely dependent on groundwater pumping for their domestic supply. Implementation of this project will reduce the need to pump groundwater,

[9] Kaweah Subbasin Setting Components- Preliminary Draft, Page 108.

with an estimated 935 acre-feet of groundwater savings during a typical year. Optimizing the utilization of surface water when it is available reduces the burden placed on the aquifer and improves the region's resiliency to droughts.

In addition to providing the serviced area with additional surface water resources when available, this project will have several other positive financial and environmental impacts. The construction of this new system would reduce reliance on groundwater resulting in significant energy savings in the form of eliminated groundwater pumping. This would reduce energy demand, especially during peak summer months, and it will be of financial benefit to those who formerly relied heavily on groundwater pumping for their water supplies.

- Will the project benefit species (e.g., federally threatened or endangered, a federally recognized candidate species, a state listed species, or a species of particular recreational, or economic importance)? Please describe the relationship of the species to the water supply, and whether the species is adversely affected by a Reclamation project.

N/A

- Will the project benefit a larger initiative to address water reliability?

Yes, the replacement of the Area 18 Pipeline was identified as a priority to increase the District's capacity and therefore ability to bring in wet year water and improve groundwater conditions as part of a System Optimization Review conducted from 2010-2013.

- Will the project benefit Indian tribes?

N/A

- Will the project benefit rural or economically disadvantaged communities?

Yes, the Project will benefit adjacent rural households and rural disadvantaged communities which depend on groundwater for their domestic water supply as the Project will reduce groundwater pumping across 704 acres of agricultural land. The nearest disadvantaged communities are Okieville-Highland Acres and the City of Tulare.

- Describe how the project will help to achieve these multiple benefits. In your response, please address where the conserved water will go and where it will be used, including whether the conserved water will be used to offset groundwater pumping, used to reduce diversions, used to address shortages that impact diversions or reduce deliveries, made available for transfer, left in the river system, or used to meet another intended use.

This project will improve system efficiency and increase system capacity allowing the district to deliver enough surface water to meet crop demand. The existing system simply does not have the capacity to meet annual crop demands, forcing users within the service area to rely on groundwater for roughly 57.5% of their total water needs in a typical year. This project will allow the irrigation district to deliver enough surface water to meet crop demands during a

typical year. A reduction in annual pumping of groundwater is beneficial to local growers who rely on groundwater during dry years, but also to nearby rural households and disadvantaged communities that rely entirely on groundwater for their water supply.

3. Does the project promote and encourage collaboration among parties in a way that helps increase the reliability of the water supply?

- Is there widespread support for the project?

The Project is enthusiastically supported by the growers who rely on the Area Pipeline for their surface water deliveries given the System's current unreliability. Kaweah Delta Water Conservation District also supports the Project as they support efforts to bring more surface water into the Subbasin to enhance groundwater conditions.

- What is the significance of the collaboration/support?

See Kaweah Delta Water Conservation District's Letter of Support in **Appendix G**.

- Is the possibility of future water conservation improvements by other water users enhanced by completion of this project?

The increased capacity, frequency, and pressure with which water will be delivered upon completion of this project would make the serviced fields more suitable for drip irrigation systems. Drip irrigation systems improve on-farm irrigation efficiency and reduce the amount of energy needed to pump water lost to deep percolation within the basin. In the year 2000 none of the land serviced by this pipeline consisted of tree crops. By 2020 roughly 42% of this land was used for tree crops (pistachios, walnuts, and cherries), the majority of which is irrigated using drip systems. The district anticipates the trend away from row crops and towards tree crops to continue in the years to come—this means the potential for water conservation improvements will only continue to grow in this area.

This project is also complemented by the implementation of the Water Marketing Strategy for the Kaweah subbasin, which is another grant project funded by the USBR. The increased capacity that this project will supply to serviced fields will improve the district's ability to carry out on-farm groundwater recharge during exceptionally wet years. Groundwater recharge is an exceedingly important practice within the District and Subbasin to mitigate the decline in groundwater levels and maintain subsurface water storage for use by the growers and disadvantaged communities that rely on it.

- Will the project help to prevent a water-related crisis or conflict? Is there frequently tension or litigation over water in the basin?

Yes. The Kaweah Subbasin, which the Tulare Irrigation District is within, has been identified as a high priority groundwater subbasin by the California Department of Water Resources and has experienced an annual groundwater overdraft of 77,600 acre. The Subbasin therefore is subject

to the State's Sustainable Groundwater Management Act, which mandates that the Subbasin eliminate this annual overdraft by 2040. Therefore, the District and neighboring agencies have been set on increasing conveyance capacity to bring more wet year water into the Subbasin to offset this imbalance.

- Describe the roles of any partners in the process. Please attach any relevant supporting documents.

The work will be solely carried out by the District and its contractors; however, the Project is supported by Kaweah Delta Water Conservation District. See their letter of Support in **Appendix G**.

4. Will the project address water supply reliability in other ways not described above?

Yes, the Project will provide additional water supply reliability to the individual growers of the Area 18 service area as it will make it possible to deliver water to a larger number of these growers at one time.

E.1.3. Evaluation Criterion C—Implementing Hydropower (18 points)

N/A

E.1.4. Evaluation Criterion D—Complementing On-Farm Irrigation Improvements (10 points)

If the proposed project will complement an on-farm improvement eligible for NRCS assistance, please address the following:

• Describe any planned or ongoing projects by farmers/ranchers that receive water from the applicant to improve on-farm efficiencies.

See **Figure 6**, which depicts irrigation methods for each field in the Area 18 Service Area. There is a 25 acre field in the middle of the service area planted with pistachios where installation of drip irrigation is planned ("PLANNED DRIP" written in red).

- Provide a detailed description of the on-farm efficiency improvements.

Over the past 20 years roughly 29% of the land within the service area has undergone a change from surface irrigation to drip irrigation. This shift towards drip irrigation has largely coincided with a shift towards tree crops and away from row and silage crops. Farms with drip irrigation systems typically have higher irrigation efficiencies than those with surface irrigation.

- Have the farmers requested technical or financial assistance from NRCS for the on-farm efficiency projects, or do they plan to in the future?

Yes, the grower owning the 25 acre field where drip installation is planned recently applied for NRCS assistance

o If available, provide documentation that the on-farm projects are eligible for NRCS assistance, that such assistance has or will be requested, and the number or percentage of farms that plan to participate in available NRCS programs.

The application for the 25 acre field to install drip irrigation is included in **Appendix F.**

o Applicants should provide letters of intent from farmers/ranchers in the affected project areas.

See **Appendix F.**

• Describe how the proposed WaterSMART project would complement any ongoing or planned on-farm improvement.

The Project will make it possible to deliver water to growers at a higher pressure than the current system allows. The current system is limited by low pressure pumps, low pressure pipeline and the use of a standpipe to regulate head. Drip Irrigation is already used by some of the growers and so the Project would make it possible to lower equipment and energy costs for those growers as they will not have to raise the pressure as much.

o Will the proposed WaterSMART project directly facilitate the on-farm improvement? If so, how? For example, installation of a pressurized pipe through WaterSMART can help support efficient on-farm irrigation practices, such as drip-irrigation.

Yes, the proposed WaterSMART project will directly facilitate the transition from surface irrigation to drip irrigation within the service area. This project would improve water delivery reliability, improve system capacity, and deliver water with a higher head—all of which make the serviced areas more suitable for drip irrigation systems. Figure 6 below illustrates the existing cropping patterns, parcel acreage, and corresponding irrigation systems within the service area. A small majority of the land within the service area remains as row crops and silage. The district anticipates a continued shift towards tree crops, which further increases the suitability of drip irrigation.

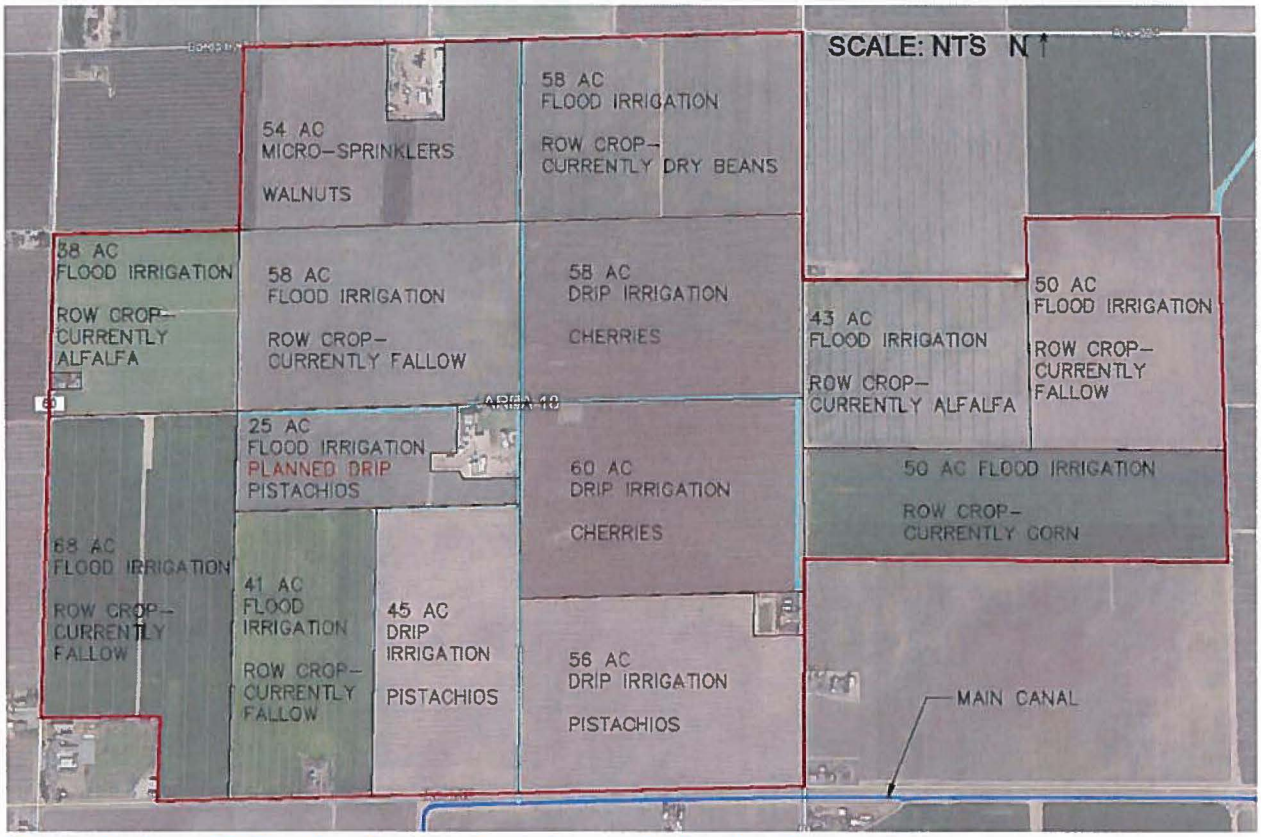


Figure 6. Area 18 Pipeline Current Cropping and Irrigation System Map

• Describe the on-farm water conservation or water use efficiency benefits that are expected to result from any on-farm work.

The installation of drip irrigation is expected to increase the efficiency from 60% for flood to 90% for drip.

o Estimate the potential on-farm water savings that could result in acre-feet per year. Include support or backup documentation for any calculations or assumptions.

Utilizing the same methodology presented in Evaluation Criteria A, on a typical year the installation of drip irrigation on this single field would save 43 acre-feet per year. This is because pistachios in Zone 12 of California have an evapotranspiration of 37.53 inches per year. Multiplied across 25 acres, this corresponds to 78.2 acre-feet per year. The drip installation would increase the efficiency from 60% to 90%.

• Please provide a map of your water service area boundaries. If your project is selected for funding under this FOA, this information will help NRCS identify the irrigated lands that may be approved for NRCS funding and technical assistance to complement funded WaterSMART projects.

See **Figure 3**.

E.1.5. Evaluation Criterion E—Department of the Interior and Bureau of Reclamation Priorities (10 points)

Department Priorities

1. *Creating a conservation stewardship legacy second only to Teddy Roosevelt*

Theodore Roosevelt once said, "The conservation of natural resources is the fundamental problem. Unless we solve that problem it will avail us little to solve all others." The significance of that quotation is more important than ever—California faces extreme challenges when it comes to the conservation and management of its water resources. This project is one of many that must be carried out to modernize water infrastructure and improve efficiency throughout the state. This project improves water reliability and efficiency, and that, in turn, supports a larger agricultural industry upon which countless livelihoods depend. Meeting the demand of our growers in a flexible and efficient manner with surface water reduces the reliance of our growers on groundwater and also provides return flows to groundwater aquifers for future use during dry years.

a. Utilize science to identify best practices to manage land and water resources and adapt to changes in the environment;

A hydraulic analysis based on Manning's Equation was used to develop the pump system and pipeline layout so as to increase energy efficiency of the system while being able to supply pressure to drip irrigation systems. This new system will be more adaptive to drought-friendly crops and irrigation practices.

b. Examine land use planning processes and land use designations that govern public use and access;

N/A.

c. Revise and streamline the environmental and regulatory review process while maintaining environmental standards;

N/A.

d. Review Department water storage, transportation, and distribution systems to identify opportunities to resolve conflicts and expand capacity;

The Project will expand capacity for deliveries to agricultural users on a system largely supplied by Central Valley Project water and by doing so will reduce conflicts over groundwater.

e. Foster relationships with conservation organizations advocating for balanced stewardship and use of public lands;

N/A.

f. Identify and implement initiatives to expand access to Department lands for hunting and fishing;

N/A.

g. Shift the balance towards providing greater public access to public lands over restrictions to access.

N/A.

2. *Utilizing our natural resources*
a. Ensure American Energy is available to meet our security and economic needs;

The Project will reduce energy use by installing more efficient pumps with variable frequency drives to replace the current system which utilizes a bypass to specify flows; installing a pipeline system with fewer head losses; and allowing for the delivery of pressurized water to drip systems.

More specifically, this project is estimated to save approximately 159,963 KwH of electricity during a typical year in which water is delivered from May to July. This figure is derived based on the estimated water savings over the same period (May to July) that would occur as a direct result of this project. This Project is estimated to reduce groundwater pumping within the service area by 935 acre-feet during a typical year. This water must be lifted approximately 152 feet, as that is the average depth to groundwater within the service area[10]. Assuming pump efficiencies of 70% for the local growers' wells, this amounts to 207,815 KwH used for pumping during a typical year. Alternatively, this project would only require 47,852 KwH during an average year, as it would pump the same amount of water (935 acre-feet), but only to 40' of head, and at a higher efficiency (80%). The resulting energy savings are 159,963 KwH over a typical year. Please refer to **Table 2** for more detailed energy savings calculations.

Table 2. Calculated Energy Savings

Groundwater Pumping Energy Use in a Typical Year						
Acre-Feet	Gallons	Lbs Water	Feet of Lift	Pump Eff.	Ft-Lb	KwH
935	304670685	2540953513	152	70%	5.5175E+11	207815

Surface Water Pumping Energy Use in a Typical Year						
Acre-Feet	Gallons	Lbs Water	Feet of Lift	Pump Eff.	Ft-Lb	KwH
935	304670685	2540953513	40	80%	1.27048E+11	47852

Estimate Energy Savings in a Typical Year (KwH)
159963

[10] Tulare Irrigation District 2019-2020 Depth to Groundwater Data

b. Ensure access to mineral resources, especially the critical and rare earth minerals needed for scientific, technological, or military applications;

N/A.

c. Refocus timber programs to embrace the entire 'healthy forests' lifecycle;

N/A.

d. Manage competition for grazing resources.

N/A.

3. *Restoring trust with local communities*
a. Be a better neighbor with those closest to our resources by improving dialogue and relationships with persons and entities bordering our lands;

Adding to local groundwater supplies will enhance relations with adjacent growers and agencies who will be competing for limited groundwater allocations under the Sustainable Groundwater Management Act, which mandates that the entire Subbasin eliminate its overdraft by 2040.

b. Expand the lines of communication with Governors, state natural resource offices, Fish and Wildlife offices, water authorities, county commissioners, Tribes, and local communities.

N/A.

4. *Striking a regulatory balance*
a. Reduce the administrative and regulatory burden imposed on U.S. industry and the public;

The passage and implementation of the Sustainable Groundwater Management Act (SGMA) will inevitably lead to restrictions on groundwater pumping within the Kaweah Subbasin. Due to the inefficiencies in the current Area 18 system, the district cannot supply enough water to meet crop demands within the service area. As a result, growers within this service area rely on groundwater pumping to make up the difference. Such a reliance on groundwater may prove to be damaging when SGMA regulations are put into effect. This project will reduce reliance on groundwater within this service area as the district would have the capacity to supply enough water to meet crop demand.

b. Ensure that Endangered Species Act decisions are based on strong science and thorough analysis.

N/A.

5. *Modernizing our infrastructure*
a. Support the White House Public/Private Partnership Initiative to modernize U.S. infrastructure;

The Project modernizes water delivery infrastructure to be more energy efficient, have greater automation and operational flexibility, and be more accommodating of irrigation technologies such as drip systems.

This project meets several of the White House Public/Private Partnership Initiative priorities. This project would be an investment in rural America and would benefit rural users and disadvantaged communities alike. This project is heavily integrated with local government, as it would be designed and implemented by a special district governed by a publicly elected board of directors (Tulare Irrigation District). Finally, this project strengthens and supports the local agricultural industry which is facing unprecedented challenges when it comes to the availability of water.

This project intends to use the latest technology in pumping practices including Variable Frequency Drives (VFD) to increase efficiency and the implementation of Supervisory Control and Data Acquisition (SCADA) equipment to monitor and control the pumping stations from the District's administrative office. The District also has the capabilities for our operators to remotely control SCADA equipment via tablets and smart phones, which adds increased monitoring control. Lastly, the system will be designed to meet grower needs using technology; the Pumping Station, meters, and other equipment will help meet the demand requested by growers without supplying too much or too little water at any given moment. This will maximize both system efficiency and on-farm irrigation efficiencies.

b. Remove impediments to infrastructure development and facilitate private sector efforts to construct infrastructure projects serving American needs;

The Project makes it more physically and economically feasible for private-sector agricultural growers to install drip irrigation. Wider implementation of drip irrigation conserves limited Central Valley surface water and groundwater resources and increases plant productivity to enable growers to continue producing food for the American public.

c. Prioritize Department infrastructure needs to highlight:

1. Construction of infrastructure;

This Project involves the construction of water infrastructure that will improve water access, reliability, and delivery efficiency within the service area. The construction of this water infrastructure will improve regional resiliency to drought while implementing modern science and technology to improve both water and energy efficiency.

2. Cyclical maintenance;
This Project aligns with the Departmental infrastructure needs to carry out cyclical maintenance, as the existing system is 58 years old and was designed for a 50 year lifespan. The District prioritized the replacement and modernization of its area pipelines in the System Optimization Review (SOR) carried out in 2013.

3. Deferred maintenance.

As previously mentioned, the existing system is 58 years old and its projected lifespan was 50 years. The construction of a new system has been deferred for 8 years past the existing system's projected lifespan. The existing system poses significant operational and maintenance problems for the District, and its many inefficiencies result in higher than necessary energy usage and avoidable water losses.

Reclamation Priorities

1. *Increase Water Supplies, Storage, and Reliability under WIIN and other Authorities*

The Area 18 Water and Energy Efficiency Modernization Project falls in line with the priorities of the WIIN Act by enhancing the District's capacity to deliver surface water supplies during average and wet years. Increased surface water supplies reduce the need to pump groundwater during average and wet years, leaving more groundwater for pumping during dry years—this results in increased regional water security and resiliency to drought. This Project will also increase the amount of recharge capacity the District will have and allow for a greater amount of groundwater to be stored during wet year events.

2. *Streamline Regulatory Processes and Remove Unnecessary Burdens to Provide More Water and Power Supply Reliability*

This project will improve water supply reliability for the growers within this service area. The irrigation district cannot supply enough water to meet crop demand under the existing system, forcing growers to rely on groundwater to make up the difference. Under the new system, growers would have increased scheduling flexibility and their water supply would be more reliable.

Allowing growers to have more access to surface water also reduces their regulatory burden under SGMA, which will limit the amount of groundwater available to irrigation.

3. *Leverage Science and Technology to Improve Water Supply Reliability to Communities*

The design of this project utilizes modern scientific, technological, and engineering practices to improve system efficiency and groundwater supply reliability and quality for surrounding rural disadvantaged communities and rural domestic well users. Thorough hydraulic analysis was carried out and incorporated in the design, and an emphasis was placed on improving pumping plant efficiencies while increasing capacity and improving water supply reliability to those serviced by the system.

4. *Address Ongoing Drought*

As of September 2020 this project is located in an area considered by the US Drought Monitor to be abnormally dry. As a direct result of this Project, growers will have increased access to

surface water in average and wet years, which will allow for more groundwater availability in dry years.

5. *Improve the Value of Hydropower to Reclamation Power Customers*

N/A

6. *Improve Water Supplies for Tribal and Rural Communities*

The implementation of this project improves the water supply of rural communities on several fronts. First, this project would enhance the reliability, frequency, and efficiency of water deliveries to existing users within the serviced area. Second, the groundwater recharge and water marketing potential complemented by this project would not only improve the quantity but also the quality of groundwater available to neighboring rural and disadvantaged communities.

7. *Implementation of new Title Transfer authority pursuant to P.L. 116-9*

N/A

E.1.6. Evaluation Criterion F—Implementation and Results (6 points)

E.1.6.1. Subcriterion F.1— Project Planning

Points may be awarded for proposals with planning efforts that provide support for the proposed project.

Does the applicant have a Water Conservation Plan and/or System Optimization Review (SOR) in place? Please self-certify or provide copies of these plans where appropriate to verify that such a plan is in place.

Provide the following information regarding project planning:

(1) Identify any district-wide, or system-wide, planning that provides support for the proposed project. This could include a Water Conservation Plan, SOR, Drought Contingency Plan or other planning efforts done to determine the priority of this project in relation to other potential projects.

Tulare Irrigation District has both a Drought Contingency Plan and has conducted a System Optimization Review (SOR) consistent with Bureau of Reclamation grants administered through the WaterSMART program. The SOR was conducted between 2010 – 2013 and specifically identifies the District's Area Pipelines as priorities for rehabilitation, modification or replacement[11].

(2) Describe how the project conforms to and meets the goals of any applicable planning efforts and identify any aspect of the project that implements a feature of an existing water plan(s).

Section 10.2.2 of the SOR specifically outlines the goals for the Area 18 pipeline replacement, and speaks to the advantage of increasing system capacity to serve all users at once.

[11] Tulare Irrigation District 2013 System Optimization Review

E.1.6.2. Subcriterion F.2— Performance Measures

Points may be awarded based on the description and development of performance measures to quantify actual project benefits upon completion of the project.

Provide a brief summary describing the performance measure that will be used to quantify actual benefits upon completion of the project (e.g., water saved or better managed, energy generated or saved). For more information calculating performance measure, see *Appendix A: Benefit Quantification and Performance Measure Guidance.*

All Water and Energy Efficiency Grants applicants are required to propose a "performance measure" (a method of quantifying the actual benefits of their project once it is completed). A provision will be included in all assistance agreements with Water and Energy Efficiency Grants recipients describing the performance measure and requiring the recipient to quantify the actual project benefits in their final report to Reclamation upon completion of the project. If information regarding project benefits is not available immediately upon completion of the project, the financial assistance agreement may be modified to remain open until such information is available and until a Final Report is submitted. Quantifying project benefits is an important means to determine the relative effectiveness of various water management efforts, as well as the overall effectiveness of Water and Energy Efficiency Grants.

Note: program funding may be used to install necessary equipment to monitor progress. However, program funding may not be used to measure performance after project construction is complete (these costs are considered normal operation and maintenance costs and are the responsibility of the applicant).

The performance measure chosen will be the portion of Area 18 Service Area demand that is provided by the new system (over the course of the soonest irrigation run) as compared to the portion provided by the old system. As described in Evaluation Criteria A, the current system has supplied 689 acre-feet on an average irrigation year in which the demand over the course of the irrigation run (May-July) is 1624 AF. This represents a portion of demand satisfied by surface water delivery of 42.4%. The performance of the new system will be measured by how much higher the surface water delivery portion of demand is relative to this. However, there is no guarantee that there will be a significant irrigation run (at least one (1) month) soon after the completion of the project. Therefore, the performance measure will have to be evaluated upon the soonest significant irrigation run.

E.1.6.3. Subcriterion F.3— Readiness to Proceed

Points may be awarded based upon the extent to which the proposed project is capable of proceeding upon entering into a financial assistance agreement. Please note, if your project is selected, responses provided in this section will be used to develop the scope of work that will be included in the financial assistance agreement.

Applications that include a detailed project implementation plan (e.g., estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones, and dates) will receive the most points under this criterion.

• Identify and provide a summary description of the major tasks necessary to complete the project. Note: please do not repeat the more detailed technical project description provided in Section D.2.2.4.; this section should be focused on a summary of the major tasks to be accomplished as part of the project.

Task 1: CEQA and NEPA Review
Tulare Irrigation District will file CEQA and NEPA to cover environmental permitting.

Task 2: Design and Permitting
Tulare Irrigation District will complete the draft preliminary design plans and submit them to an engineering consultant for a more detailed survey and design. The District will also file for an encroachment permit with the County of Tulare for the county road crossings.

Task 3: Construction Bidding and Award
Tulare Irrigation District will bid out the final design through the District's public bidding process.

Task 4: Construction and Construction Administration
The Contractor will complete structure work and pipeline work under the supervision of the District's Engineering Department. The Contractor will subcontract for pump installation and electrical work.

Task 5: Grant Administration
The Tulare Irrigation District Engineering Department will complete financial and progress reporting to the Bureau of Reclamation.

• Describe any permits that will be required, along with the process for obtaining such permits.

It is expected that the California Environmental Quality Act (CEQA) and the National Environmental Protection Act (NEPA) will apply to the proposed project. Tulare Irrigation District will prepare a negative declaration for CEQA compliance as the project does not have a potentially significant impact on any of the environmental factors listed in CEQA Appendix G. Tulare Irrigation District will need to file NEPA in the event of federal grant funding. A Finding of No Significant Impact is expected. Additionally, Tulare Irrigation District will have to apply for an encroachment permit from the County of Tulare Resource Management Agency to bore and jack under county roadways. The District has done this many times before.

• Identify and describe any engineering or design work performed specifically in support of the proposed project.

Draft preliminary design plans have been prepared for the project. See **Appendix B**. Hydraulic calculations have also been prepared and pump curves solicited to support the design. See **Appendix C** and **Appendix D**.

• Describe any new policies or administrative actions required to implement the project.

No new policies or administrative actions are required to implement the Project. It should actually reduce administrative burden on the District's Water Department as delivery scheduling will be simpler.

Please also include an estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones, and dates. Milestones may include, but are not limited to, the following: complete environmental and cultural compliance; mobilization; begin construction/installation; construction/installation (50% complete); and construction/installation (100% complete)

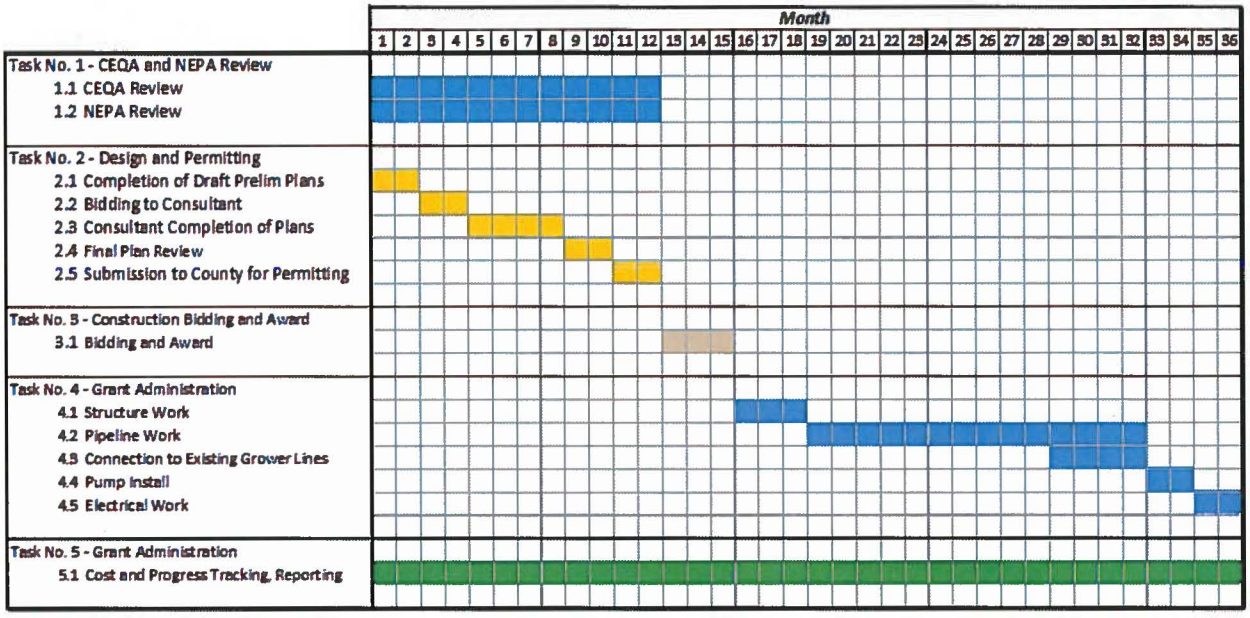


Figure 7. Project Schedule

E.1.7. Evaluation Criterion G—Nexus to Reclamation Project Activities (6 points)

• Is the proposed project connected to Reclamation project activities? If so, how? Please consider the following:

- Does the applicant receive Reclamation project water?

The District receives surface water supplies from the Friant Division of the Central Valley Project. The District has a Friant Contract for Class I and Class II supplies, which are utilized to support the conjunctive operations of the District.

- Is the project on Reclamation project lands or involving Reclamation facilities?

No, the Project will take place on land primarily owned by various growers, some of which is within Tulare Irrigation District easements. The project does not take place on any Reclamation lands or facilities; however, the Project will be used on lands that are within the place of use for the CVP.

- Is the project in the same basin as a Reclamation project or activity?

The Area 18 Water and Energy Efficiency Modernization Project is located in the Kaweah Sub-basin of the Tulare Lake Groundwater Basin. The Friant-Kern Canal traverses these basins to supply surface water to agricultural and municipal users.

- Will the proposed work contribute water to a basin where a Reclamation project is located?

The Friant Division of the CVP extends from Fresno County southerly to Kern County. Sections of the Friant-Kern Canal and its service area lie within Tulare County. The water that will be better managed by the Area 18 Water and Energy Efficiency Modernization Project will be located within the Tulare Irrigation District service area, which lies within with the Friant Division service area. Therefore, the District believes that the water better managed by this Project will contribute to a basin where a Reclamation project is located.

- Will the project benefit any tribe(s)?

No, there are no tribal groups within Tulare Irrigation District's service area.

E.1.8. Evaluation Criterion H—Additional Non-Federal Funding (4 points)

Tulare Irrigation District will provide 51.61% of the total funding.

Environmental and Cultural Resources Compliance

The Area 18 Water and Energy Efficiency Modernization Project involves the installation of roughly 10,800 linear feet of new pipeline and construction of new water control structures. Therefore, the District will need to comply with Federal and State environmental programs for execution of the Project. The District anticipates that compliance with NEPA will include an Environmental Assessment (EA) and the subsequent outcome. Based on similar projects and history, the District anticipates that the EA will conclude in a Finding of No Significant Impact. However, if the EA determines there to be potential for environmental impacts then a full Environmental Impact Statement shall be pursued. The District will also file for a CEQA (California Environmental Quality Act) assessment and expects to receive a negative declaration. The District was formed in 1889, which from a historical perspective means that some of the features in the District can be over a century old. Based on previous analyses the District has found that although many District facilities are old, they do not retain any historical significance. The District has also not encountered any archeological sites within the its boundaries.

Required Permits or Approvals

The Area 18 Water and Energy Efficiency Modernization Project will necessitate that the District file for NEPA, CEQA (California Environmental Quality Act) and an encroachment permit through the County of Tulare for the pipeline road crossings.

Official Resolution

The District has already approved a resolution as required by the grant at the regular Tulare Irrigation District Board of Directors meeting on September 8, 2020 and which can be found in **Appendix A**.

Project Budget

The District proposes the costs of the Area 18 Water and Energy Efficiency Modernization Project that are not being requested under this grant application will be contributed from the Tulare Irrigation District.

The District has not incurred any costs for the Area 18 Water and Energy Efficiency Modernization Project to date and anticipates that the Project will begin once funding is awarded and made available. The District has not sought any other federal, state or other funding for this Project at this time. In the event that additional other funding becomes available, other than federal funding, the District will notify the Bureau of Reclamation immediately. Presented in **Table 3** is a summary of the funding requested and supplied as a part of the Project.

Table 3. Funding Sources for Resiliency Project

FUNDING SOURCES	AMOUNT
Non-Federal Entities	
1. Tulare Irrigation District	$1,279,680.00
Other Federal Entities	
1. N/A	$0.00
REQUESTED RECLAMATION FUNDING	$1,200,000.00

Budget Proposal

Budget Item/Description	Computation $/Unit	Unit	Quantity	Recipient Funding	Reclamation Funding	Total Cost
1. Salaries and Wages						
District General Manager	$ 87.00	Hour (HR)	200	$ 8,700.00	$ 8,700.00	$ 17,400.00
District O&M Superintendent	$ 43.00	HR	800	$ 17,200.00	$ 17,200.00	$ 34,400.00
District Assistant Engineer	$ 29.00	HR	1,500	$ 21,750.00	$ 21,750.00	$ 43,500.00
2. Fringe Benefits						
District General Manager	$ 52.20	HR	200	$ 5,220.00	$ 5,220.00	$ 10,440.00
District O&M Superintendent	$ 25.80	HR	800	$ 10,320.00	$ 10,320.00	$ 20,640.00
District Assistant Engineer	$ 17.40	HR	1,500	$ 13,050.00	$ 13,050.00	$ 26,100.00
3. Consultant / Contractor						
Construction Contractor	$1,772,200.00	Each	1	$ 925,940.00	$ 846,260.00	$ 1,772,200.00
Engineering Consultant- Survey	$ 20,000.00	Each	1	$ 10,000.00	$ 10,000.00	$ 20,000.00
Engineering Consultant- Design	$ 50,000.00	Each	1	$ 25,000.00	$ 25,000.00	$ 50,000.00
Pump Contractor- Pump Install	$ 20,000.00	Each	3	$ 30,000.00	$ 30,000.00	$ 60,000.00
Electrician- 10 cfs VFD	$ 10,000.00	Each	1	$ 5,000.00	$ 5,000.00	$ 10,000.00
Electrician- 5 cfs VFD	$ 5,000.00	Each	1	$ 2,500.00	$ 2,500.00	$ 5,000.00
Electrician- New Connection	$ 5,000.00	Each	2	$ 5,000.00	$ 5,000.00	$ 10,000.00
SCADA Contractor- SCADA Inst	$ 100,000.00	Each	2	$ 100,000.00	$ 100,000.00	$ 200,000.00
4. Other						
NEPA/CEQA	$ 150,000.00	Each	1	$ 75,000.00	$ 75,000.00	$ 150,000.00
SC Edison- New Connection	$ 50,000.00	Each	1	$ 25,000.00	$ 25,000.00	$ 50,000.00
TOTAL PROJECT COSTS				**$ 1,279,680.00**	**$ 1,200,000.00**	**$ 2,479,680.00**
PERCENTAGE OF COSTS				**51.61%**	**48.39%**	

Budget Narrative

Salaries and Wages

The Program Manager that is assigned to the project is Jeremy Barroll, who is employed as the Assistant Engineer. Mr. Barroll will be responsible for the administration of the grant along with completing and submitting the draft preliminary plans to the engineering consultant and providing construction administration. The General Manager will provide project oversight. The District O&M Superintendent will provide secondary construction oversight.

Fringe Benefits

The fringe benefits for District employees involved in the Enhancement Project total about 60% of the average hourly rate per employee. Fringe benefits that are available to District employees and will be used on this Project are included in **Table 4**.

Table 4. District Fringe Benefits as a Percentage of Wages.

Description	Percentage (%) of Wages
FICA	6.20%
Medicare	1.45%
ETT/SUI	0.48%
Workers Compensation Insurance	4.34%
Health Insurance	34.40%
Dental Insurance	2.29%
Vision Insurance	0.33%
Life Insurance	0.60%
Long-Term Life Insurance	0.67%
Retirement	8.15%
Employee Equipment	0.63%
Total	59.54%*

**The total fringe benefits represent an average for all employees. Benefits vary based upon retirement contributions and health benefit plans chosen by each employee. The fringe benefits are those that are paid by the District. Costs/benefits that are paid by individual employees are not included in the fringe benefits.*

Equipment

Equipment, including the vertical turbine pumps, will not be purchased by the District, it will be purchased by the construction contractor. See **Table 5** for a cost breakdown of the construction contract.

Materials and Supplies

Materials and supplies, including pipe, reinforced concrete and various valves, will not be purchased by the District, they will be purchased by the construction contractor. See **Table 5** for a cost breakdown of the construction contract.

Contractual/Construction

A contractor, as chosen by the District's required bidding process of soliciting bids from three (3) separate contractors, will complete the required construction work including the pipeline systems and pump/intake structures. Costs for the structures were estimated by the cubic yardage of the structures, while costs for the pipe and valves come from recent experience and costs for the pumps come from a preliminary estimate from a nearby pump company. All materials costs were added and then labor cost was estimated as 100% of the materials costs. See **Table 5**. The Contractor will also subcontract for pump installation, variable frequency drive installation and connection to the adjacent Southern California Edison Lines. The District will separately subcontract to a SCADA contractor for SCADA installation.

The District will also hire an engineering consultant to provide more detailed survey work for the pipeline alignments and to create a final design plan which will build on the current draft preliminary plan.

Table 5. Cost Estimate for Construction Contract.

Budget Item/Description	Computation $/Unit	Unit	Quantity	Total Cost
1. Salaries and Wages				
Labor TOTAL= 100% Supplies, Materials & Equipment	$886,100.00	#	1	$ 886,100.00
2. Equipment				
US Motors Premium Efficient 1780 rpm motor- 75 hp	$20,000.00	#	2	$ 40,000.00
US Motors Premium Efficient 1780 rpm motor- 60 hp	$18,000.00	#	1	$ 18,000.00
Variable Frequency Drive- 10 cfs	$10,000.00	#	1	$ 10,000.00
Variable Frequency Drive- 5 cfs	$5,000.00	#	1	$ 5,000.00
Magnetic Meter- 24"	$10,000.00	#	1	$ 10,000.00
Magnetic Meter- 21"	$9,000.00	#	1	$ 9,000.00
Magnetic Meter- 15"	$8,000.00	#	2	$ 16,000.00
Magnetic Meter- 14"	$8,000.00	#	1	$ 8,000.00
Magnetic Meter- 12"	$5,000.00	#	2	$ 10,000.00
Magnetic Meter- 10"	$4,000.00	#	2	$ 8,000.00
Magnetic Meter- 8"	$3,000.00	#	2	$ 6,000.00
3. Supplies & Materials				
Main Gate Box (10'X10'X14')- Reinforced Concrete	$1,000.00	CY	14	$ 14,000.00
East Gate Box (10'X10'X14')- Reinforced Concrete	$1,000.00	CY	14	$ 14,000.00
Main Pump Box (14'x6'x16')- Reinforced Concrete	$1,000.00	CY	18	$ 18,000.00
East Pump Box (8'x5'x15')- Reinforced Concrete	$1,000.00	CY	13	$ 13,000.00
48" Reinforced Concrete Pipe	$180.00	LF	50	$ 9,000.00
42" Reinforced Concrete Pipe	$150.00	LF	200	$ 30,000.00
36" Reinforced Concrete Pipe	$120.00	LF	2650	$ 318,000.00
24" PVC Pipe	$22.00	LF	2250	$ 49,500.00
21" PVC Pipe	$20.00	LF	4600	$ 92,000.00
15" PVC Pipe	$16.00	LF	100	$ 1,600.00
12" PVC Pipe	$14.00	LF	50	$ 700.00
10" PVC	$12.00	LF	1050	$ 12,600.00
8" PVC	$10.00	LF	100	$ 1,000.00
24" Steel Pipe	$40.00	LF	50	$ 2,000.00
14" Steel Pipe	$20.00	LF	50	$ 1,000.00
APCO 200A Air Release Valve	$2,000.00	#	24	$ 48,000.00
APCO 1600 Combination Valve	$2,000.00	#	9	$ 18,000.00
APCO 7008.1 Hyd Contr Vacuum Valve	$4,000.00	#	2	$ 8,000.00
APCO 7006.1 Hyd Contr Vacuum Valve	$4,000.00	#	1	$ 4,000.00
Fresno Valve 8500 Grayline Butterfly- 12"	$4,000.00	#	1	$ 4,000.00
Fresno Valve 8500 Grayline Butterfly- 24"	$8,000.00	#	1	$ 8,000.00
Fresno Valve 4200 42"	$5,000.00	#	2	$ 10,000.00
Fresno Valve 408 21"	$1,500.00	#	1	$ 1,500.00
Fresno Valve 408 18"	$1,200.00	#	1	$ 1,200.00
Fresno Valve 408 15"	$1,000.00	#	2	$ 2,000.00
Fresno Valve 408 12"	$1,000.00	#	3	$ 3,000.00
Fresno Valve 408 10"	$1,000.00	#	2	$ 2,000.00
Fresno Valve 408 8"	$1,000.00	#	2	$ 2,000.00
US Motors Premium Efficient 1780 rpm motor- 75 hp	$20,000.00	#	2	$ 40,000.00
US Motors Premium Efficient 1780 rpm motor- 60 hp	$18,000.00	#	1	$ 18,000.00
Construction Contractor Total				$1,772,200.00

Environmental and Regulatory Compliance Costs

Filing for NEPA and filing for CEQA will collectively cost roughly $150,000 from experience with similar projects.

Indirect Costs

The District does not have an Indirect Cost Agreement and will not be seeking any reimbursements for this item.

Unique Entity Identifier and SAM

The District is currently registered with SAM and our Unique Entity Identifier is 441J3.

Appendix A

Tulare Irrigation District Resolution 20-10 Support for the Area 18 Water and Energy Efficiency Modernization Project

TULARE IRRIGATION DISTRICT

RESOLUTION NO. 20-10

WHEREAS, the Tulare Irrigation District ("District") proposes to redesign Area 18 Pipeline so as to reconfigure the layout of the pump systems, pipeline network and turnouts, said project being named the Area 18 Water and Energy Efficiency Modernization Project ("Project"); and

WHEREAS, the Board of Directors of the District support the Project and the additional operational flexibility and additional surface water supply delivery capacity with corresponding reduction of groundwater pumping afforded thereby; and

WHEREAS, the District desires to apply for and secure funds that may be made available thereto from the U.S. Bureau of Reclamation (USBR) from its WaterSMART Grants: Water and Energy Efficiency Grants for Fiscal Year 2021 (Grant Program) for said Project; and

WHEREAS, said Project will consist of installing two new separate pump systems with variable frequency drives adjacent the source canal, one at the site of the current intake and another approximately one-half mile to the east; installing new pipeline mains running north from each respective pump system; and installing new turnout lines, gates and meters emanating from the pipeline mains; all of which will make it possible to conserve energy, improve operational flexibility, improve capacity and reliability and therefore decrease groundwater pumping; and can be completed within the time frame as may be determined by USBR; and

WHEREAS, the District pledges to cooperate with USBR in meeting deadlines established thereby for the purpose of entering into a Cooperative Agreement therewith.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Tulare Irrigation District that it (a) has reviewed and supports the proposed Project and (b) that the District has in its possession sufficient funds and can furnish in-kind contributions to fulfill its funding requirements as identified in the Project Funding Plan.

BE IT FURTHER RESOLVED that, if selected by USBR for a grant from the Grant Program, the President of the District is hereby authorized to execute a Cooperative Agreement therewith and the District shall cooperate with USBR to ensure timely execution of said Agreement.

THE FOREGOING RESOLUTION WAS ADOPTED upon motion of Director Borges, seconded by Director Martin, at a regular meeting of the Board of Directors of the Tulare Irrigation District held on September 8, 2020, by the following vote:

Ayes: Directors Bixler, Borges and Martin

Noes: None

Abstain: None

Absent: Directors Rogers and Thomas

ATTEST:

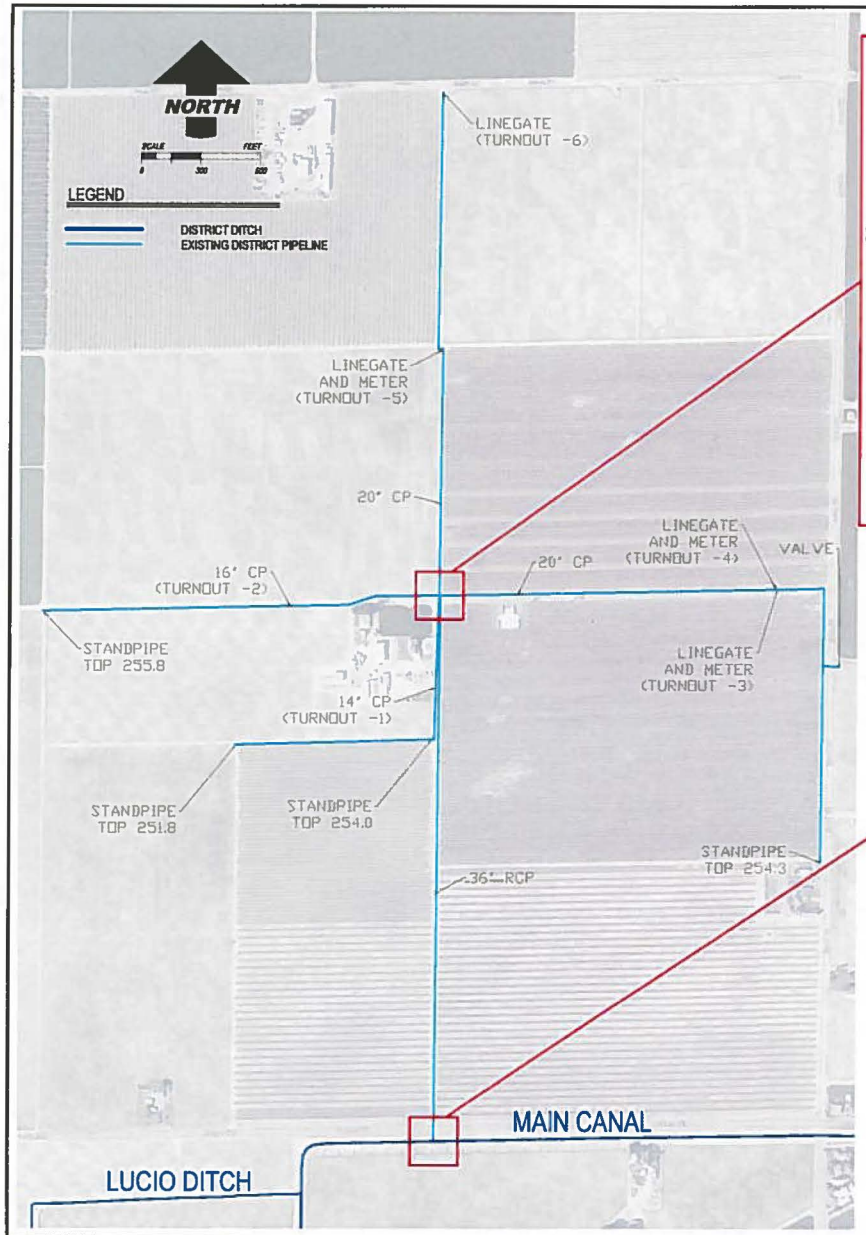
David G. Bixler

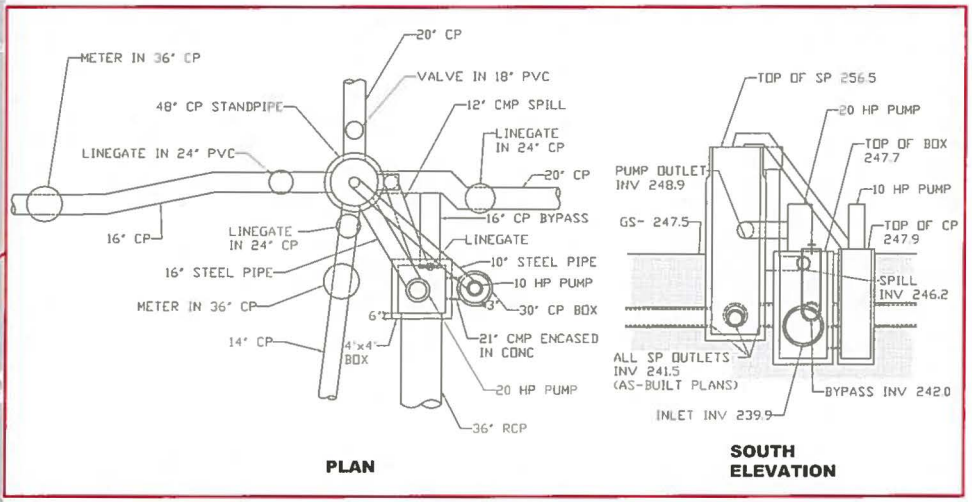
David G. Bixler, President

Appendix B

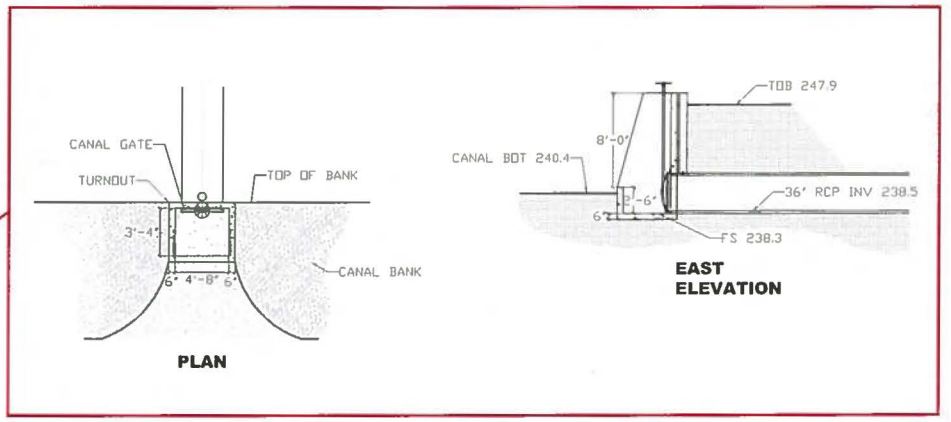
Draft Preliminary Design Plans

*Note these are preliminary plans and are not meant to be used for construction
**Preliminary layout details and part specifications are subject to change in the final design





DETAIL A: (E) SYSTEM PUMP **SCALE=1"=12'**



DETAIL B: (E) SYSTEM GATE **SCALE=1"=12'**

NOTES:

1. PIPELINE ROUTES INEXACT AS DERIVED FROM AS-BUILT PLANS AND STRUCTURE SURVEY.
2. ALL ELEVATIONS FROM SURVEY EXCEPT WHERE NOTED OTHERWISE.

PLOT DATE: JAB APR 24 2020
DRAWING NO:
DRAWING NAME: EXISTING
SHEET 1 OF 5

REVISIONS

DATE	BY	DESCRIPTION

APPROVED BY DATE

DISTRICT ENGINEER

AREA 18 PROJECT
AREA 18 EXISTING LAYOUT
30% PLANS NOT FOR CONSTRUCTION

6826 AVE 240
TULARE, CA 93274
TEL: (559) 686-3425
FAX: (559) 686-3673
WEB: www.tulare.org

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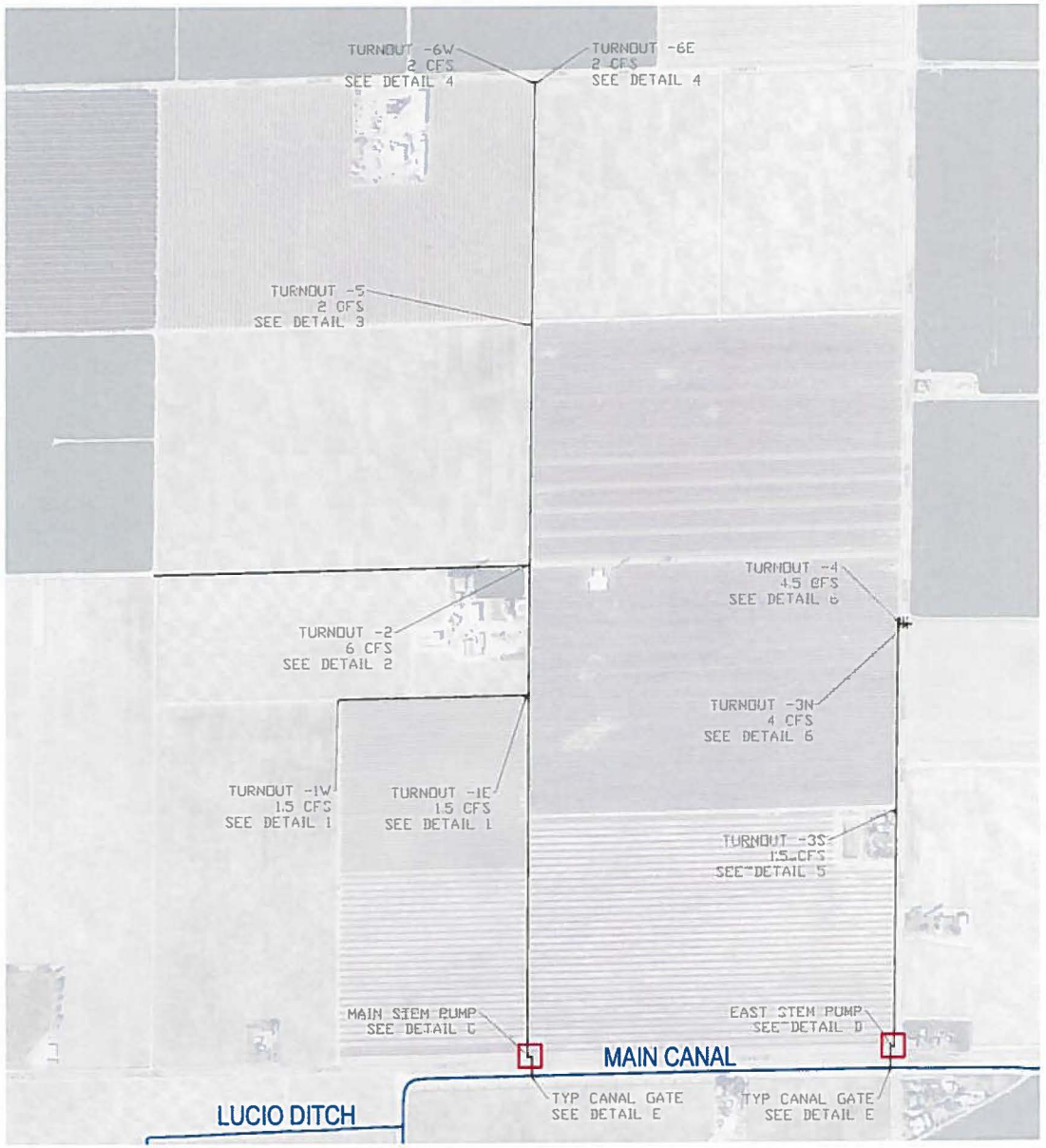

Notes:

1. ALL BURIED PIPE TO HAVE MIN. 3 FT COVER. COMPACT BACKFILL, COVER AND 1 FT SUBGRADE TO 95% MAXIMUM DRY DENSITY.
2. ALL AIR RELEASE VALVES TO BE APCO 200A COMPOUND LEVER WITH 1/4" ORIFICE OR APPROVED EQUAL. PLACE EVERY 500 FT ALONG PIPELINE. SEE DETAIL 6.
3. CONTACT US AID BEFORE EXCAVATING.
4. CONTACT COUNTY OF TULARE FOR ROAD RIGHT OF WAY LOCATIONS.

PLOT DATE: JAB APR 24 2020
DRAWING NO:
DRAWING NAME: EXISTING
SHEET 2 OF 5

REVISIONS

DATE	BY	DESCRIPTION

APPROVED BY

DISTRICT ENGINEER DATE

AREA 18 PROJECT
AREA 18 DESIGN LAYOUT
30% PLANS NOT FOR CONSTRUCTION

TULARE IRRIGATION DISTRICT
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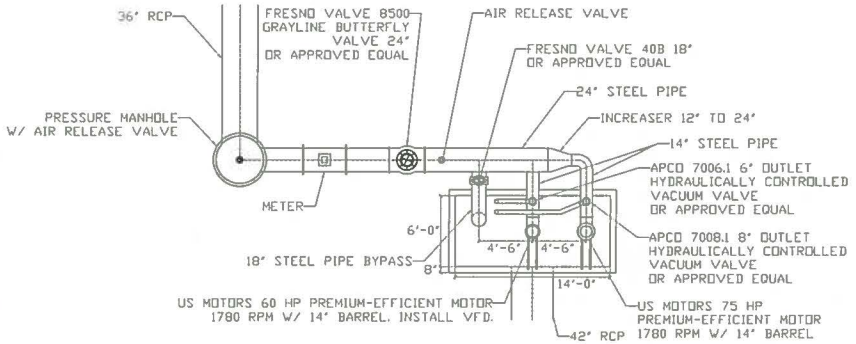
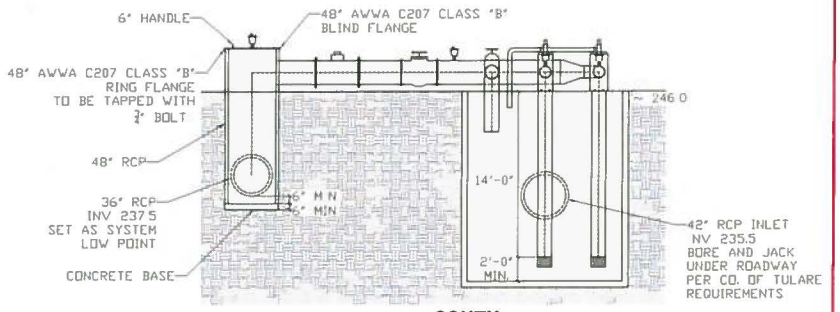
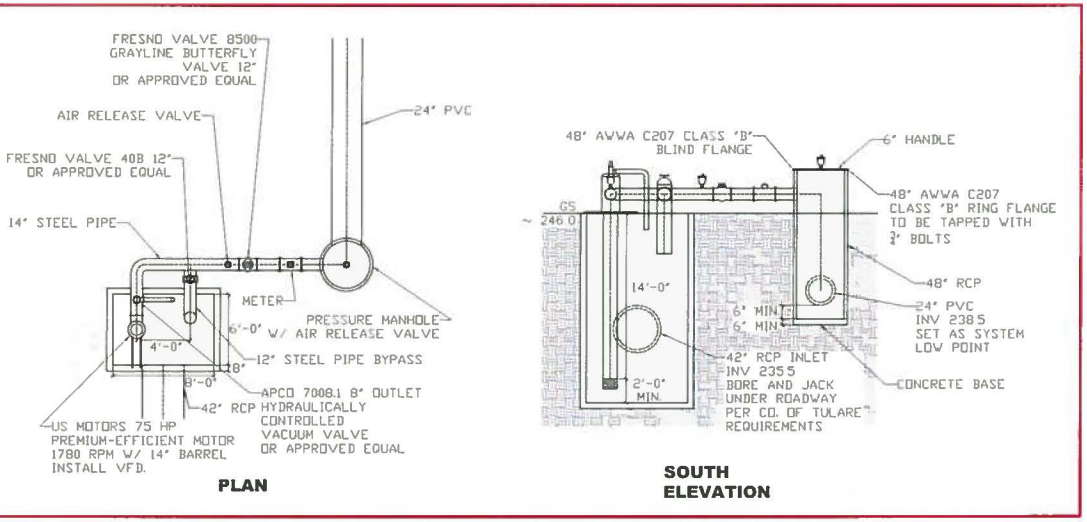
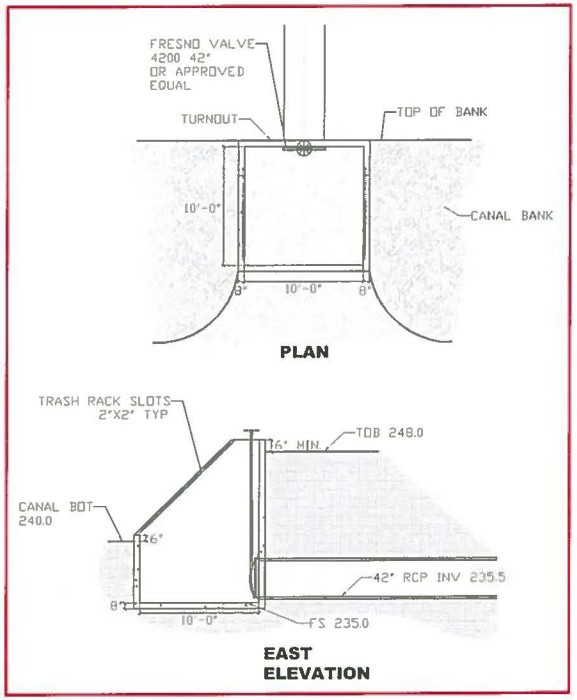




DETAIL C: MAIN STEM PUMP SCALE=1"=10'



DETAIL D: EAST STEM PUMP SCALE=1"=10'



DETAIL E: TYP CANAL GATE SCALE=1"=10'

NORTH

Notes:

1. ALL BURIED PIPE TO HAVE MIN. 3 FT COVER. COMPACT BACKFILL, COVER AND 1 FT SUBGRADE TO 95% MAXIMUM DRY DENSITY.
2. ALL AIR RELEASE VALVES TO BE APCO 200A COMPOUND LEVER WITH 1/4" ORIFICE OR APPROVED EQUAL. PLACE EVERY 500 FT ALONG PIPELINE. SEE DETAIL 6.
3. CONTACT US AID BEFORE EXCAVATING.
4. CONTACT COUNTY OF TULARE FOR ROAD RIGHT OF WAY LOCATIONS.
5. ALL METERS TO BE McCROMETER ULTRA MAG OR APPROVED EQUAL WITH DIAMETER CORRESPONDING TO PIPE DIAMETER. METERS MUST HAVE 5D OF STRAIGHT PIPE UPSTREAM AND DOWNSTREAM.

PLOT DATE: JAB APR 24, 2020
DRAWING NO:
DRAWING NAME: DESIGN
SHEET 3 OF 5

REVISIONS			
		DATE	BY

APPROVED BY
DISTRICT ENGINEER DATE

AREA 18 PROJECT
AREA 18 INTAKES DETAILS
30% PLANS NOT FOR CONSTRUCTION

TULARE IRRIGATION DISTRICT
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TULARE, CA 93274
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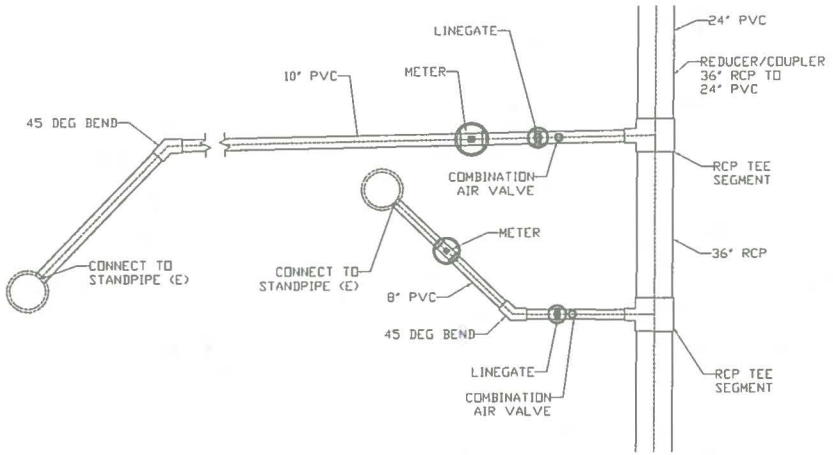
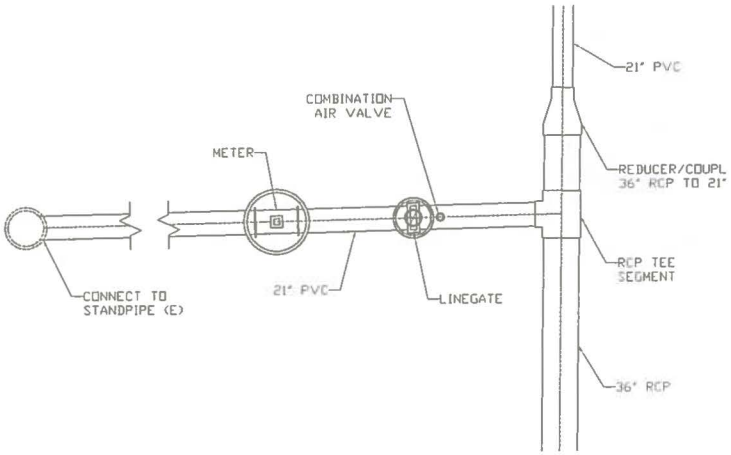
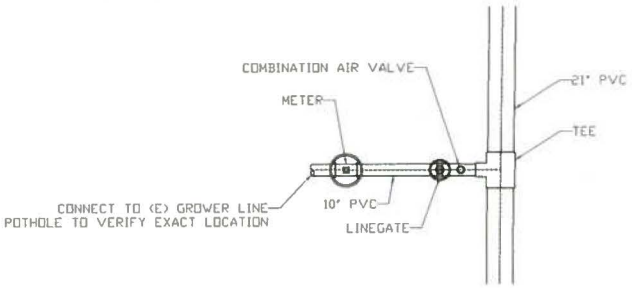
NORTH



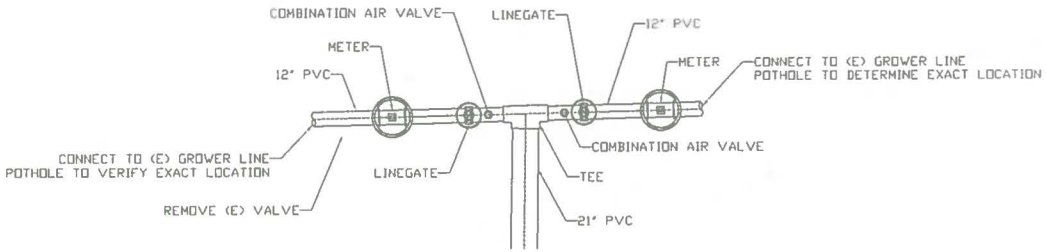
DETAIL 1: TURNOUTS -1E AND -1W **SCALE: 1"=10'**



DETAIL 2: TURNOUT -2 **SCALE: 1"=10'**



DETAIL 3: TURNOUT -5 **SCALE: 1"=10'**



DETAIL 4: TURNOUTS -6W AND -6E **SCALE: 1"=10'**

NOTES:

1. ALL PVC PIPE TO BE 125 PSI PIP.
2. ALL LINEGATES TO BE FRESNO VALVE 40B WITH DIAMETER CORRESPONDING TO PIPE DIAMETER OR APPROVED EQUAL.
3. ALL AIR RELEASE VALVES TO BE APCO 200A COMPOUND LEVER WITH 1/4" ORIFICE OR APPROVED EQUAL.
4. ALL COMBINATION AIR VALVES TO BE APCO 145C OR APPROVED EQUAL. PLACE IMMEDIATELY UPSTREAM OF ALL LINEGATES.
5. ALL METERS TO BE McCROMETER ULTRA MAG OR APPROVED EQUAL WITH DIAMETER CORRESPONDING TO PIPE DIAMETER. METERS MUST HAVE 5D OF STRAIGHT PIPE UPSTREAM AND DOWNSTREAM.
6. PLACE ALL LINEGATES AND METERS INSIDE APPROPRIATELY SIZED PVC STANDPIPES WITH LIDS FOR ACCESS. PLACE OUT OF ROADWAY.
7. CONTACT US AID BEFORE EXCAVATING.
8. CONTACT COUNTY OF TULARE FOR ROAD RIGHT OF WAY LOCATIONS.

PLOT DATE: JAB APR 24, 2020
DRAWING NO:
DRAWING NAME: DETAILS 1
SHEET 4 OF 5

REVISIONS			
DATE	BY	DESCRIPTION	

APPROVED BY: DISTRICT ENGINEER DATE

AREA 18 PROJECT
AREA 18 MAIN STEM DETAILS
30% PLANS NOT FOR CONSTRUCTION

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WEB: www.tularetid.org

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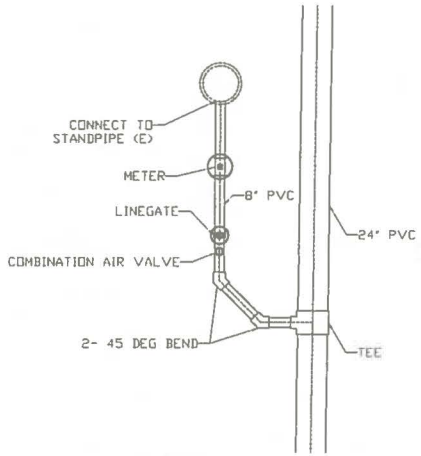
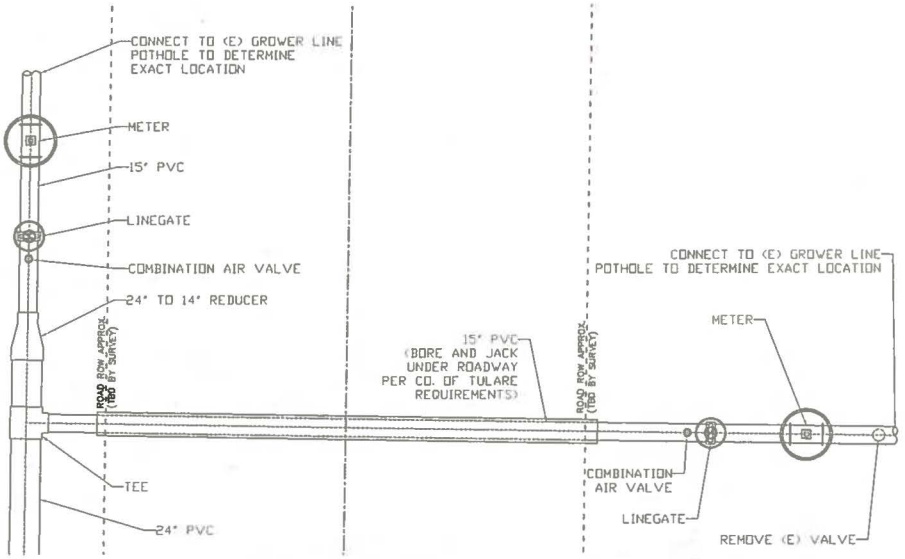
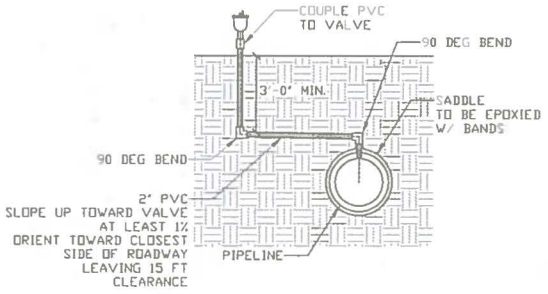


DETAIL 5: TURNOUT -3S SCALE: 1"=10'



DETAIL 6: TURNOUTS -3N AND -4 SCALE: 1"=10'



DETAIL 7: AIR RELEASE VALVE CONFIGURATION FOR PIPELINES IN ROADWAYS (TYP) SCALE: 1"=5'

NOTES:

1. ALL PVC PIPE TO BE 125 PSI PIP.
2. ALL LINEGATES TO BE FRESNO VALVE 40B WITH DIAMETER CORRESPONDING TO PIPE DIAMETER OR APPROVED EQUAL.
3. ALL AIR RELEASE VALVES TO BE APCO 200A COMPOUND LEVER WITH 1/4" ORIFICE OR APPROVED EQUAL.
4. ALL COMBINATION AIR VALVES TO BE APCO 145C OR APPROVED EQUAL. PLACE IMMEDIATELY UPSTREAM OF ALL LINEGATES.
5. ALL METERS TO BE McCROMETER ULTRA MAG OR APPROVED EQUAL WITH DIAMETER CORRESPONDING TO PIPE DIAMETER. METERS MUST HAVE 5D OF STRAIGHT PIPE UPSTREAM AND DOWNSTREAM.
6. PLACE ALL LINEGATES AND METERS INSIDE APPROPRIATELY SIZED PVC STANDPIPES WITH LIDS FOR ACCESS. PLACE OUT OF ROADWAY.
7. CONTACT US AID BEFORE EXCAVATING.
8. CONTACT COUNTY OF TULARE FOR ROAD RIGHT OF WAY LOCATIONS.

PLOT DATE: JAB APR 24, 2020
DRAWING NO:
DRAWING NAME: DETAILS 2
SHEET: 5 OF 5

REVISIONS			
DATE	BY	DESCRIPTION	

APPROVED BY: DISTRICT ENGINEER DATE

AREA 18 PROJECT
AREA 18 EAST STEM DETAILS
30% PLANS NOT FOR CONSTRUCTION

6826 AVE 240
TULARE, CA 93274
TEL: (559) 686-3425
FAX: (559) 686-3673
WEB www.tularid.org

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Appendix C

Hydraulic Analysis

TULARE IRRIGATION DISTRICT
Hydraulic Calculations for Area 18 Design

Notes: Calculate losses for all turnouts running. Magmeter will be used so will not incur loss if same pipe size. Min 3 ft head above field level at each turnout. Assume linegates will be used to throttle flow so design head to accomodate.
Design for high point of field on Turnout -6E, ~250

MAIN STEM (W PUMP TO TURNOUTS -6)

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
G	Canal Gate	14	0	+	0	80.0	14.0	42	0.014	0.22	1.46	0.03	0.02	0.03				0.00		0.02	0.07	265.00	247.90	17.10	7.4
P	Pump (10 cfs)	10	0	+	80	20.0	10.0	14	0.012	29.50	9.35	1.36	0.68		3.26		0.34			0.59	4.87	264.93	247.90	17.03	7.4
E	Enlarger/Second Pump	15	1	+	0	20.0	15.0	24	0.012	3.75	4.77	0.35		0.35						0.07	0.43	260.06	247.90	12.16	5.3
M	Manhole	15.0	1	+	20	1,940.0	15.0	36	0.014	0.59	2.12	0.07	0.03							1.14	1.17	259.63	247.90	11.73	5.1
T1E	Tee- Turnout -1E	15.0	20	+	60	20.0	13.5	36	0.014	0.48	1.91	0.06				0.04				0.01	0.05	258.46	246.00	12.46	5.4
T1W	Tee- Turnout -1W	13.5	20	+	80	680.0	12.0	36	0.014	0.38	1.70	0.04				0.03	0.01			0.26	0.30	258.41	246.00	12.41	5.4
T2	Tee- Turnout -2	12.0	27	+	60	1,380.0	6.0	21	0.012	1.22	2.49	0.10				0.03	0.02			1.69	1.74	258.11	247.50	10.61	4.6
T5	Tee- Turnout -5	6.0	41	+	40	1,200.0	4.0	21	0.012	0.54	1.66	0.04				0.06				0.65	0.71	256.37	247.50	8.87	3.8
T6	Tee- Turnouts -6W, -6E	4.0	53	+	40																	256.37	248.00	8.37	3.6

TURNOUT -1E OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T1E	Tee- Turnout -1E	1.5	0	+	0	30.0	1.5	8	0.012	13.13	4.30	0.29		0.29	0.09	0.52		0.34		0.39	1.63	258.46	246.00	12.46	5.4
D1E	Delivery Point -1E	1.5	0	+	30																	256.83	246.00	10.83	4.7

TURNOUT -1E THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T1E	Tee- Turnout -1E	1.5	0	+	0	30.0	1.5	8	0.012	13.13	4.30	0.29		0.29	0.09	0.52		6.88		0.39	8.16	258.46	246.00	12.46	5.4
D1E	Delivery Point -1E	1.5	0	+	30																	250.29	246.00	4.29	1.9

TURNOUT -1W OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T1W	Tee- Turnout -1W	1.5	0	+	0	1,020.0	1.5	10	0.012	3.99	2.75	0.12		0.12	0.04	0.21		0.14		4.07	4.58	258.41	246.00	12.41	5.4
D1W	Delivery Point -1W	1.5	10	+	20																	253.83	246.00	7.83	3.4

TURNOUT -1W THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T1W	Tee- Turnout -1W	1.5	0	+	0	1,020.0	1.5	10	0.012	3.99	2.75	0.12		0.12	0.04	0.21		2.82		4.07	7.26	258.41	246.00	12.41	5.4
D1W	Delivery -1W	1.5	10	+	20																	251.15	246.00	5.15	2.2

TURNOUT -2 OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T2	Tee- Turnout -2	6.0	0	+	0	1,980.0	6.0	21	0.012	1.22	2.49	0.10		0.10	0.03	0.17		0.12		2.42	2.83	258.11	247.50	10.61	4.6
D2	Delivery Point -2	6.0	19	+	80																	255.27	245.50	9.77	4.2

TURNOUT -2 THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T2	Tee- Turnout -2	6.0	0	+	0	1,980.0	6.0	21	0.012	1.22	2.49	0.10		0.10	0.03	0.17		2.32		2.42	5.04	258.11	247.50	10.61	4.6
D2	Delivery -2	6.0	19	+	80																	253.07	245.50	7.57	3.3

TURNOUT -5 OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T5	Tee- Turnout -2	2.0	0	+	0	20.0	2.0	10	0.012	7.10	3.67	0.21		0.21	0.06	0.38		0.25		0.14	1.04	256.37	247.50	8.87	3.8
D5	Delivery Point -2	2.0	0	+	20																	255.33	247.50	7.83	3.4

TURNOUT -5 THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T5	Tee- Turnout -2	2.0	0	+	0	20.0	2.0	10	0.012	7.10	3.67	0.21		0.21	0.06	0.38		5.01		0.14	5.80	256.37	247.50	8.87	3.8
D5	Delivery -2	2.0	0	+	20																	250.57	247.50	3.07	1.3

TURNOUT -6W OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T6	Tee- Turnout -6W, -6E	2.0	0	+	0	20.0	2.0	12	0.012	2.69	2.55	0.10		0.10	0.03	0.18		0.12		0.05	0.49	256.37	248.00	8.37	3.6
D6	Delivery Point -6W	2.0	0	+	20																	255.88	248.00	7.88	3.4

TURNOUT -6W THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T6	Tee- Turnout -6W, -6E	2.0	0	+	0	20.0	2.0	12	0.012	2.69	2.55	0.10		0.10	0.03	0.18		2.42		0.05	2.78	256.37	248.00	8.37	3.6
D6	Delivery Point -6W	2.0	0	+	20																	253.59	248.00	5.59	2.4

TURNOUT -6E OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T6	Tee- Turnout -6W, -6E	2.0	0	+	0	20.0	2.0	12	0.012	2.69	2.55	0.10		0.10	0.03	0.18		0.12		0.05	0.49	256.37	248.00	8.37	3.6
D6	Delivery Point -6W	2.0	0	+	20																	255.88	248.00	7.88	3.4

TURNOUT -6E THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T6	Tee- Turnout -6W, -6E	2.0	0	+	0	20.0	2.0	12	0.012	2.69	2.55	0.10		0.10	0.03	0.18		2.42		0.05	2.78	256.37	248.00	8.37	3.6
D6	Delivery Point -6W	2.0	0	+	20																	253.59	248.00	5.59	2.4

EAST STEM (E PUMP TO TURNOUT -4)

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
G	Canal Gate	10	0	+	0	80.0	10.0	42	0.014	0.11	1.04	0.02	0.01	0.02				0.00		0.01	0.04	265.00	248.00	17.00	7.4
P	Pump	10	0	+	80	20.0	10.0	14	0.012	29.50	9.35	1.36	0.68	1.36	3.26			0.27		0.59	6.16	264.96	246.00	18.96	8.2
M	Manhole	10.0	1	+	0	1,280.0	10.0	24	0.012	1.66	3.18	0.16	0.08							2.13	2.21	258.80	248.00	10.80	4.7
T3S	Tee- Turnout -13S	8.0	13	+	80	940.0	8.0	24	0.012	1.07	2.55	0.10				0.09				1.00	1.10	256.59	247.00	9.59	4.2
T4	Tee- Turnout -3N, -4	6.0	23	+	20																	255.50	247.00	8.50	3.7

TURNOUT -3S OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T3S	Tee- Turnout -3S	1.5	0	+	0	20.0	1.5	8	0.012	13.13	4.30	0.29		0.29	0.34	0.52		0.34		0.26	1.75	256.59	247.00	9.59	4.2
D3S	Delivery Point -3S	1.5	0	+	20																	254.84	247.00	7.84	3.4

TURNOUT -3S THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T3S	Tee- Turnout -3S	1.5	0	+	0	20.0	1.5	8	0.012	13.13	4.30	0.29		0.29	0.34	0.52		6.88		0.26	8.29	256.59	247.00	9.59	4.2
D3S	Delivery Point -3S	1.5	0	+	20																	248.30	247.00	1.30	0.6

TURNOUT -3N OPEN

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T4	Tee- Turnout -3N, -4	4.0	0	+	0	80.0	4.0	15	0.012	3.27	3.26	0.16		0.16		0.30		0.20		0.26	0.92	255.50	247.00	8.50	3.7
D3N	Delivery Point -3N	4.0	0	+	80																	254.57	247.00	7.57	3.3

TURNOUT -3N THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T4	Tee- Turnout -3N, -4	4.0	0	+	0	80.0	4.0	15	0.012	3.27	3.26	0.16		0.16		0.30		3.96		0.26	4.68	255.50	247.00	8.50	3.7
D3N	Delivery Point -3N	4.0	0	+	80																	250.81	247.00	3.81	1.7

TURNOUT -4 OPEN

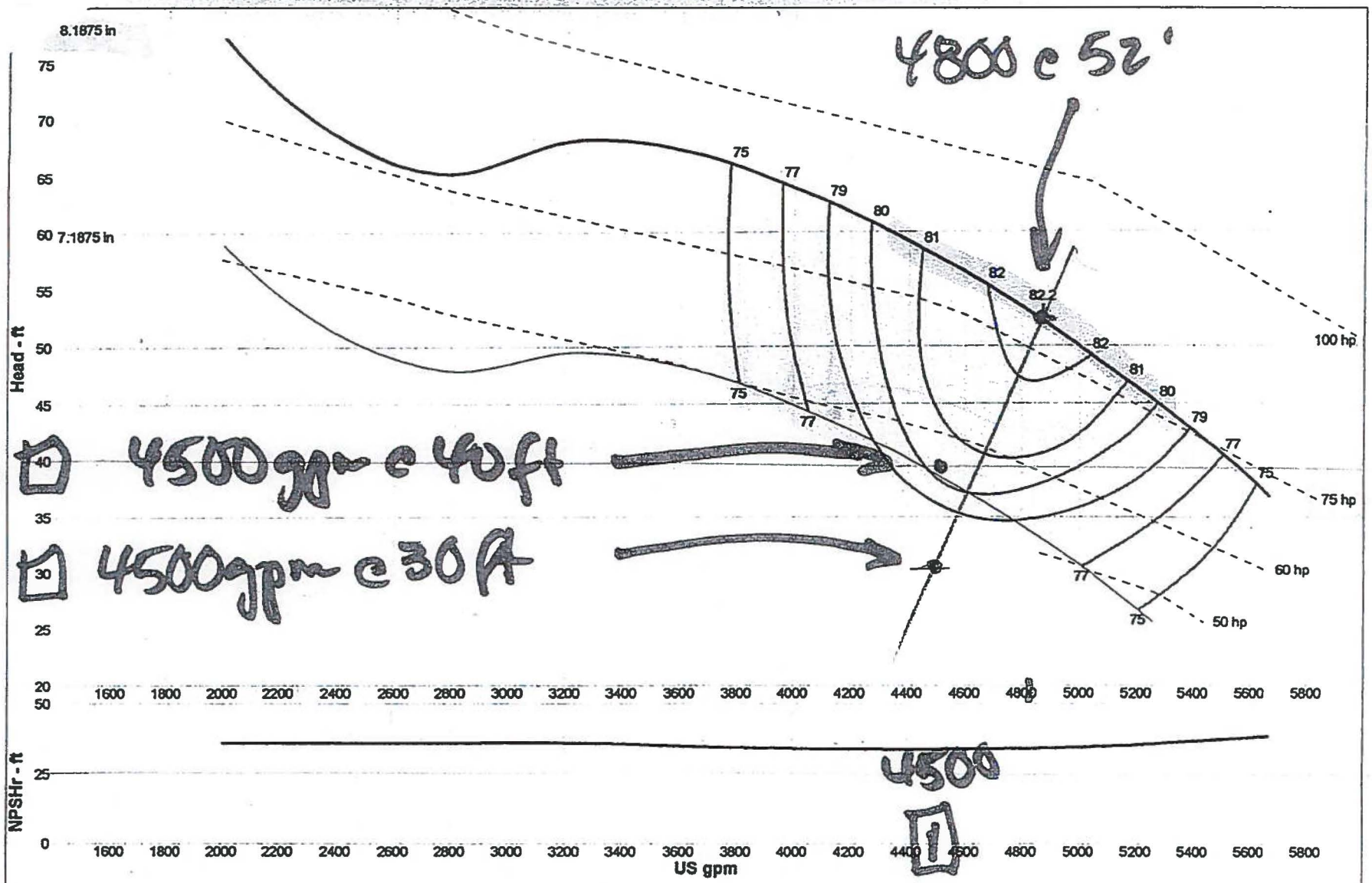
Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T4	Tee- Turnout -3N, -4	4.5	0	+	0	20.0	4.5	15	0.012	4.13	3.67	0.21		0.21		0.13	0.05	0.25		0.08	0.72	255.50	247.00	8.50	3.7
D4	Delivery Point -4	4.5	0	+	20																	254.78	247.00	7.78	3.4

TURNOUT -4 THROTTLED

Node	Description	Q through Node (cfs)	Station			Length (ft)	Q (cfs)	D (in)	n	HGLS (ft/1000ft)	V (ft/s)	Hv (ft)	Minor Losses							F (ft)	Total (ft)	W.S. El.	G.S. El.	Head (ft)	Head (psi)
													Entr.	Exit	Bend	Tee	Increase/ Reducer	Line Valve	Misc.						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
T4	Tee- Turnout -3N, -4	4.5	0	+	0	20.0	4.5	15	0.012	4.13	3.67	0.21		0.21		0.13		5.01		0.08	5.43	255.50	247.00	8.50	3.7
D4	Delivery Point -4	4.5	0	+	20																	250.07	247.00	3.07	1.3

Appendix D

Pump Curves

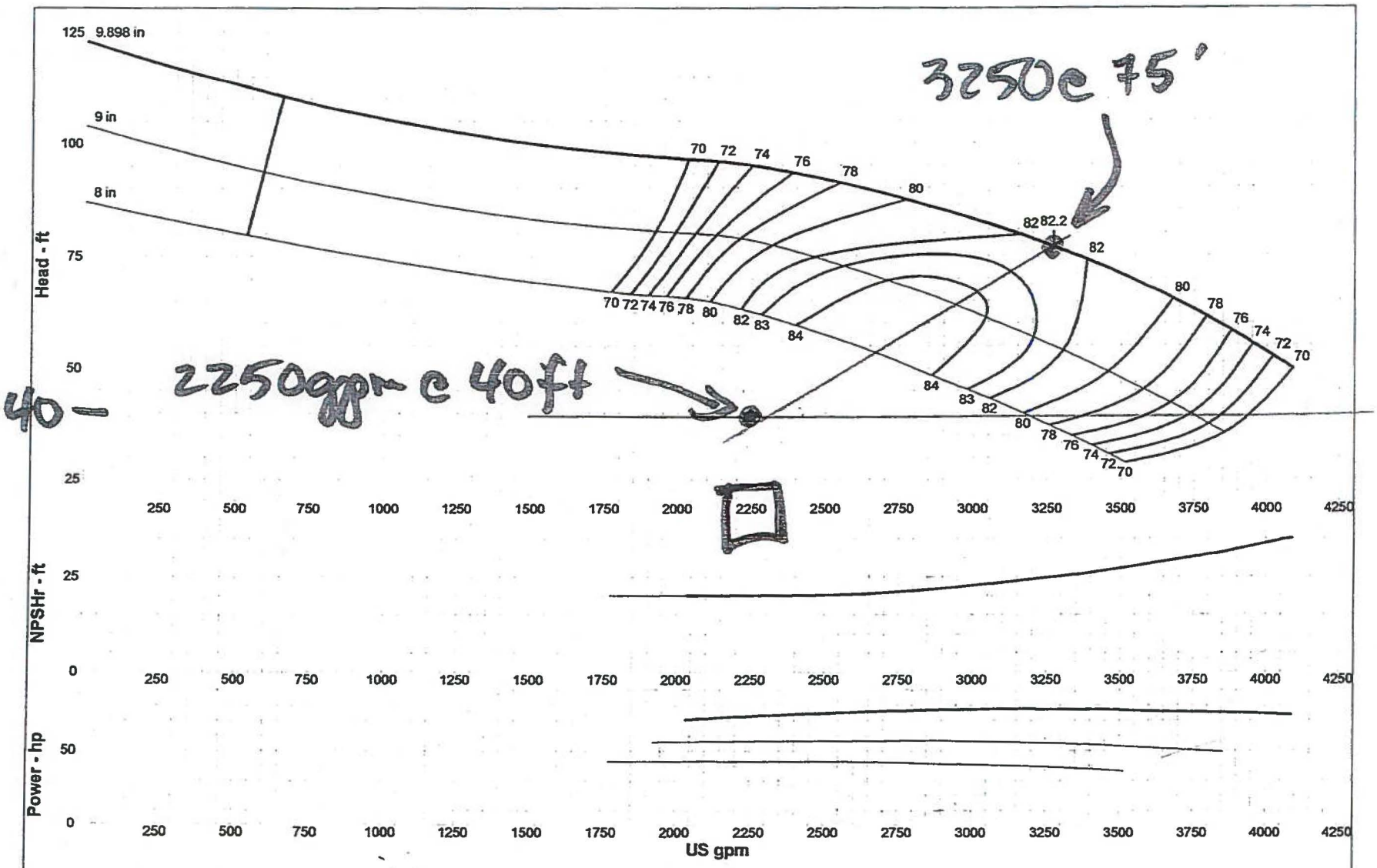


Company: Hydroflo Pumps
Name: Mix Flow
10/31/2011

Hydroflo Pumps USA, Inc.
Catalog: hydroflo mix-axial flow.60, Vers 070111
MixFlow - 1800

Size: H12MMF
Speed: 1760 rpm
Dia: 8.1875 in
Curve: HP-0834
Impeller: 6964

Hydroflo pumps



Hydroflo pumps

"THE POWER OF STAINLESS"

Hydroflo Pumps USA, Inc.
Catalog: Hydroflo V&S Pumps 60Hz 122211, Vers 17
Vertical - 1800

Size: 14HL
Speed: 1770 rpm
Dia: 9.898 in
Curve: 122211
Impeller: 14HL ENCL SS

REV 11.1.11

Appendix E

Water Demand and Savings Calculations

Typical Year Water Demand											
Crop Type	Irrigation System	Acreage	Crop Demand due to ET by Month (Acre-Feet)			ET Demand (acre-feet)	Assumed Efficiency	Total Demand (acre-feet)	Total Estimated Demand for Service Area	Average Water Delivered to Service Area (acre-feet)	Estimated Savings (acre-feet)
			May	June	July						
Cherry	Drip	116	63.12	70.08	73.66	206.87	90%	229.85			
Pistachio	Drip	101	22.30	50.75	71.71	144.77	90%	160.85			
Pistachio	Surface	25	5.46	12.50	17.23	35.19	60%	58.65			
Walnuts	Drip	55	26.58	38.04	35.48	100.10	90%	111.22	1624.41	689.00	935.41
Alfalfa	Surface	150	83.50	87.75	89.88	261.13	60%	435.21			
Corn	Surface	199	42.62	115.59	134.82	293.03	60%	488.38			
Beans	Surface	58	12.33	34.41	37.41	84.15	60%	140.25			

Wet Year Water Demand															
Crop Type	Irrigation System	Acreage	Crop Demand due to ET by Month (Acre-Feet)								ET Demand (acre-feet)	Assumed Efficiency	Total Demand (acre-feet)	Total Estimated Demand for Service Area (acre-	Average Water Delivered to Service Area (acre-feet)	Estimated Savings (acre-feet)
			January	February	March	April	May	June	July	August						
Cherry	Drip	116	3.96	8.70	23.20	35.57	43.98	62.06	67.76	63.61	308.85	90%	343.17			
Pistachio	Drip	101	3.45	7.58	18.52	22.89	27.61	46.80	67.59	63.55	257.97	90%	286.63			
Pistachio	Surface	25	0.85	1.88	4.58	5.69	6.83	11.40	16.00	15.08	62.31	60%	103.85			
Walnuts	Drip	55	1.88	4.08	11.28	14.48	20.49	32.45	37.08	34.79	156.52	90%	173.91	2622.94	1165.00	2622.94
Alfalfa	Surface	150	5.63	11.88	40.38	61.00	60.75	80.13	84.13	78.00	421.88	60%	703.13			
Corn	Surface	199	7.46	15.75	44.28	44.44	52.90	98.17	127.36	92.04	482.41	60%	804.02			
Beans	Surface	58	2.18	4.59	12.91	12.95	15.42	29.73	34.56	12.62	124.94	60%	208.24			

Appendix F

NRCS On-Farm Efficiency Application for 25 acre field

US DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

NRCS-CPA-1200
03/2019

CONSERVATION PROGRAM APPLICATION

Name: RS Borges Farming	**Application Number:** 749104200TQ
Address: 22003 C Rd 68 Tulare, CA 93274	**Application Date:** 5/7/19
Email: rick_borges@aol.com	**County and State:** Tulare, CA
Telephone: 559-688-1948 off. 559-280-7210 cell	**Watershed:**
	Subaccount:
Location (Legal Description or Farm and Tract Number): F:23098 T:9863	

1. ☒ Yes ☐ No **Do you have farm records established with the appropriate USDA Service Center Agency?**

   If no, you must establish them with the appropriate USDA Service Center Agency prior to submitting this application.

2. **This is an application to participate in the:**

☐ **Agricultural Management Assistance (AMA)**	☒ **Environmental Quality Incentives Program (EQIP)**
☐ **Conservation Stewardship Program (CSP)** ☐ **CSP Renewal**	☐ **Agriculture Conservation Easement Program (ACEP) - Wetland Reserve Easements (WRE)**
☐ **Regional Conservation Partnership Program (RCPP)** ☐ **EQIP** ☐ **CSP**	☐ **Regional Conservation Partnership Program (RCPP)** ☐ **ACEP- (WRE)** ☐ **Healthy Forest Reserve Program (HFRP)**

3. **Are you applying to participate in a conservation program as an (check one of the following):**

~~X~~ ~~☒ **Individual**~~ RB.

a) Please enter your legal name and tax identification number:
Name: RS Borges Farming **Tax Number:** 81-1032254

☒ **Entity** (Corporation, Limited Partnership, Trust, Estate, etc.)

a) Please enter entity legal name and tax identification number:
Name: RS Borges Farming **Tax Number:** 81-1032254

b) ☑ **Yes** ☐ **No** Do you have appropriate documents including proof to sign for the entity?

☐ **Joint Operation** (General Partnership, Joint Venture)

a) Please enter joint operation legal name and tax identification number:
Name: **Tax Number:**

b) ☐ **Yes** ☐ **No** Do you have appropriate documents including proof to sign for the joint operation?

4. Is the land being offered for enrollment used for crop (including forest-related) or livestock production?

☒ **Crop Production** **Crop Type:** Cotton
☐ **Livestock Production** **Livestock Type:**

5. The land offered under this application is (check all that apply):

☒ **Private Land**
☐ **Public Land (Federal, State, or Local Government)**
☐ **Tribal, Allotted, Ceded or Indian Land**

6. You certify that Certification of control of the land offered under the application is evidenced by:

X RB ☒ **~~Deed~~ or other evidence of land ownership (required for all ACEP-WRE applications)**
☑ **Written lease agreement**
Years of control are 2021 through 2023
☐ **Other agreement or legal conveyance (describe):**
Years of control are through

7. ☐ Yes ☒ No Is the land offered under this application enrolled in any other conservation program?

8. Do you meet the criteria for any of the following categories? (mark all that apply)

☐ **Limited Resource Farmer or Rancher**
☐ **Beginning Farmer or Rancher**
☐ **Socially Disadvantaged Farmer or Rancher**
☐ **Veteran Farmer or Rancher**
☒ **Not Applicable**

If you wish to apply in any of these categories, you must meet the self-certification requirements. Definitions are provided below. For more information please go to this website: https://lrftool.sc.egov.usda.gov/

Limited Resource Farmer or Rancher – The term "Limited Resource Farmer or Rancher" means a participant:

- With direct or indirect gross farm sales not more than the current indexed value in each of the previous two years, and
- Who has a total household income at or below the national poverty level for a family of four, or less than 50 percent of county median household income in each of the previous two years.

A legal entity or joint operation can be a Limited Resource Farmer or Rancher only if all individual members independently qualify. A Self-Determination Tool is available to the public and may be completed on-line or printed and completed hardcopy at: https://lrftool.sc.egov.usda.gov/

Beginning Farmer or Rancher– The term "Beginning Farmer or Rancher" means a participant who:

- Has not operated a farm or ranch, or who has operated a farm or ranch for not more than 10 consecutive years. This requirement applies to all members of a legal entity, and who
- Will materially and substantially participate in the operation of the farm or ranch.

In the case of a contract with an individual, individually or with the immediate family, material and substantial participation requires that the individual provide substantial day-to-day labor and management of the farm or ranch, consistent with the practices in the county or State where the farm is located.

In the case of a contract made with a legal entity, all members must materially and substantially participate in the operation of the farm or ranch. Material and substantial participation requires that the members provide some amount of the management, or labor and management necessary for day-to-day activities, such that if the members did not provide these inputs, operation of the farm or ranch would be seriously impaired.

Socially Disadvantaged Farmer or Rancher- The term "Socially Disadvantaged" means an individual or entity who is a member of a socially disadvantaged group. For an entity, at least 50 percent ownership in the farm business must be held by socially disadvantaged individuals. A socially disadvantaged group is a group whose members have been subject to racial or ethnic prejudice because of their identity as members of a group without regard to their individual qualities. These groups consist of the following:

- American Indians or Alaskan Natives
- Asians
- Blacks or African Americans
- Native Hawaiians or other Pacific Islanders
- Hispanics.

Note: Gender alone is not a covered group for the purposes of NRCS conservation programs. The term entities reflect a broad interpretation to include partnerships, couples, legal entities, etc.

Veteran Farmer or Rancher- The term "Veteran Farmer or Rancher" means a producer who served in the United States Army, Navy, Marine Corps, Air Force, or Coast Guard, including the reserve components thereof; was released from the service under conditions other than dishonorable; and--

- has not operated a farm or ranch, or has operated a farm or ranch for not more than 10 years; or
- who first obtained status as a veteran during the most recent 10-year period.

A legal entity or joint operation can be a Veteran Farmer or Rancher only if all individual members independently qualify.

9. **Is any of the land offered for enrollment under this application:**
   - ☐ **Certified Organic by the National Organic Program (NOP)**
   - ☐ **Transitioning to become Certified Organic by the NOP**
   - ☐ **Exempt from Organic Certification as defined by the NOP**
   - ☒ **Not Applicable**

   Certification in any of these categories is to assist with planning and will not automatically result in the application being considered in any initiatives made available for organic-related production. Applicants must specifically request to participate in an organic initiative. Note that the EQIP Organic Initiative has a lower payment limitation ($140,000 over the period of fiscal years 2019-2023 per person or legal entity) than payments made to a person or legal entity under General EQIP.

On the farm(s) identified above, the Applicant agrees to participate in the identified program if the offer is accepted by the NRCS. The undersigned shall hereafter be referred to as the "Participant." The participant understands that starting a practice prior to contract approval causes the practice to be ineligible for program financial assistance. The participant will provide written authorization to install structural or vegetative practices. The Participant agrees not to start any financially assisted practice or activity or engage the reimbursable services of a certified Technical Service Provider before a Contract is executed by CCC. The Participant may request, in writing, a waiver of this requirement for financially assisted practices by the NRCS State Conservationist.

All participants that certify land control or certify eligibility as Limited Resource Farmer or Rancher, Beginning Farmer or Rancher, or Veteran Farmer or Rancher, will provide all records necessary to justify their claim as requested by a NRCS representative. It is the responsibility of the Participant to provide accurate information to support all items addressed in this application at the request of NRCS. False certifications are subject to criminal and civil fraud statutes.

The Participant acknowledges that highly erodible land conservation/wetland conservation, adjusted gross income certifications, and member information for entities and joint operations are on file with the FSA.

10. ☒ Yes ☐ No I have received a copy of the applicable conservation program contract appendix.

Applicant Signature	Date
RS Boggs Farming By Ruff Boggs	5-7-19

NON-DISCRIMINATION STATEMENT

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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Appendix G

Letter of Support- Kaweah Delta Water Conservation District

KAWEAH DELTA
Water Conservation DISTRICT

September 15, 2020

Bureau of Reclamation
Attn: Mr. Ned Weakland
Denver Federal Center
Bldg. 67 Rm. 152
6th Avenue and Kipling Street
Denver, Colorado 80225

Subject: Area 18 Water and Energy Efficiency Modernization Project

Dear Mr. Reichert,

This letter is to confirm that the Kaweah Delta Water Conservation District (KDWCD) supports the proposed Tulare Irrigation District (TID) Area 18 Water and Energy Efficiency Modernization Project. The proposed improvements are scheduled to be completed in a 3-year window once contracts with the Bureau are executed.

KDWCD is organized under the Water Conservation Act of 1927 and its jurisdiction encompasses approximately 340,000 acres of Tulare and Kings County, of which TID is wholly within KDWCD. TID maintains its own Groundwater Management Plan within the KDWCD Groundwater Management Plan, which requires coordination efforts to monitor and track groundwater data. As a part of the relationship between the two agencies, KDWCD and TID share a common goal to increase groundwater recharge capacity and to enhance surface water supplies to the benefit of the groundwater basin. Therefore, KDWCD supports the efforts of TID in their pursuit of a WaterSMART Water and Energy Efficiency grant for fiscal year 2021 to expand the surface water delivery capacity of the Area 18 System.

If you have any questions or comments, please do not hesitate to contact me regarding this information.

Respectfully,

Mark Larsen
General Manager

2975 N. Farmersville Blvd., Farmersville, CA 93223 P 559-747-5601 F 559-747-1989 www.kdwcd.com