Patterson Irrigation District

Capital Improvement Plan

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Capital Improvement Plan

1.1 Plan Description

The purpose of this Capital Improvement Plan (CIP or Plan) is to act as a guidance and planning tool for the Patterson Irrigation District (PID or District) for future major projects and improvements. The Plan was developed based upon interviews with District staff, field evaluations, data collection, and experience by the consultant Provost & Pritchard Consulting Group (P&P). The Plan is by no means a rigid template for the District, but more of a general guidance tool and prioritization program designed to be transparent to the stakeholders of PID and to provide the District's Board of Directors a sense of what projects may be the next or highest priority for the District. This plan is intended to be a living document that will be updated periodically as needs change and opportunities arise for the District. The publication of this document demonstrates only the potential projects and opportunities envisioned as of the publication date above. In addition, all projects identified have been prioritized based upon criteria that provides the highest level of benefit to the District and its stakeholders.

P&P has written this Plan for two purposes. The first is to provide the District with clear ideas and conceptual designs to improve their infrastructure in such a way that the District can prevent foreseeable problems and increase operational efficiency and capacity. The second is to provide cost estimates and a recommended prioritization of these projects to assist the District with budgeting and planning implementation of these projects. This Plan is intended to be considered as a menu of possible project opportunities as of November of 2019 and should be implemented on whatever scale and timeline suits the needs and available funding of the District.

P&P has developed, prioritized, and estimated costing for 23 individual improvement projects and project types. Each project developed for review by the District is presented at a conceptual level with a description, costing, and priority ranking that includes supporting details and explanations for each. Multiple design options for some of these projects are provided for the District's consideration. The projects have been listed by priority on page 1 of Appendix A, and a list of the 10 highest-priority projects are included in the main body of this document under the Project Scoring Criteria and Priority Listing heading.

These projects were prioritized overall according to the following criteria: the project should a) maximize the area serviced by the improvements, b) minimize costs, c) prevent failure or growing inefficiency of existing aging infrastructure, d) improve District water supply and storage opportunities, e) improve District efficiency in delivery and operations, and f) avoid negative environmental impact and/or permitting requirements. These will be explained in more detail in the next paragraph.

Projects were developed with a focus on preventing foreseeable issues with existing infrastructure and maximizing District operational efficiency and capacity by either improving or expanding upon existing infrastructure. However, many projects have been included that provide alternative benefits and are recommended for consideration despite their score in the scoring matrix. Project concepts, cost estimations, and next steps for construction of a groundwater recharge facility (Project 2) and water quality monitoring stations (Project 12) have been included with the understanding that, although the District does not currently experience issues with groundwater quality and sustainability, the implementation of SGMA in the coming years may influence the priority of groundwater projects in the future. Also included in this document are brief outlines of three opportunity projects and programs that could be implemented to benefit the District: 1) a new water treatment facility to service Disadvantaged Communities (DACs) and Severely Disadvantaged

Communities (SDACs), 2) a partnership with nearby agencies for groundwater recharge, and 3) expand the District's conveyance capacity to transfer water from the San Joaquin River to the Delta-Mendota Canal.

As noted above, P&P has included an engineer's opinion of probable costs at a conceptual level for each individual project (Appendix C). The costs were broken out in order to assist the District in planning their budget and creating an improvement schedule. All costs are in 2019 dollars. Formal design work, surveys/hydraulic analyses, and refined project calculations will be required for projects prior to implementation. As per the District's request, no analysis of the East-West Conveyance, Main Canal, or any structures not relevant to recommended improvements is included in the scope of this document. However, due to the importance of the Main Canal rehabilitation projects to the District, Main Canal Rehab Project Schedules B and C have been included in the scoring matrix.

1.2 Project Scoring Criteria and Priority Listing

Project Scoring Criteria

Each of the potential improvements/projects identified were scored and ranked using the scoring matrix provided in Appendix A. Projects were given a score ranging from 1 to 10 in six equally weighted categories. The method of determining the prioritization of each respective project was determined by summing the scores of each category, with a higher total score signifying a higher priority project for the District. To ensure simplicity in the evaluation process, no criterion had a greater weight than its counterparts. The six categories used to score each project are described in detail below:

A. **Acres Served / Area of Impacts to Growers** – Scoring for this criterion is based on the acreage or portion of the District that will benefit from the proposed improvements. Projects that impact the entire District score higher than those that impact smaller portions. It is assumed that District laterals serve the land to the east up to the next lateral. For example, it was assumed that all land between Laterals 2N and 3N is served by Lateral 3N. For the sake of simplicity, acreage impacts from interties and recirculation projects were not considered. Scores for this criterion are subjective and are not necessarily tied to an exact acreage (a score of 8 doesn't necessarily mean it impacts 80% of the District's irrigated lands).

B. **Estimated Capital Cost** – Scoring for this criterion is based on 2019 estimated construction costs for each project developed under the CIP. Note that the costs provided are budgetary numbers that represent the engineer's opinion of probable construction costs and will require refinement once the projects are authorized to move forward. Projects that have a lower estimated capital cost to the District are given a higher score than projects with higher estimated capital costs. Operational and maintenance costs were not included in the scoring of this criterion, and current costs were not inflated for future phasing. Scores in this category are generally relative to each project's estimated construction costs.

C. **Need for Improvement / Age of Existing Infrastructure** – Scoring for this criterion is based on the age, condition, and estimated remaining life expectancy of the existing facility or infrastructure. Factors involved in scoring for this criterion include facilities that are: in serious disrepair, in danger of failure in the near future, undersized, operating with severe inefficiency, or would cause significant system shutdown due to facility failure. Projects with infrastructure in worse condition receive higher scores than projects with newer or non-compromised infrastructure. Projects to repair or replace damaged or failing facilities are generally scored higher than new infrastructure projects. Improvements or repairs to existing infrastructure that is in stable condition and does not pose major system shutdown risks from failure are scored lower than projects that pose major shutdown risks from infrastructure failure.

D. **Impacts to Water Storage and/or Supply** – Scoring for this criterion is based on the project's overall impact to the District's water storage and supply. Projects that increase water storage and/or supply throughout the District are scored higher than those that have little or no impact.

E. **Improvements to Operations** – Scoring for this criterion is based on the project's overall impact to the District operations and efficiencies. Projects that improve District operations or increase delivery efficiencies are scored higher than those that have little or no impact.

F. **Environmental Impact / Permitting Issues or Delays** – Scoring for this criterion is based on estimated permitting or regulatory issues, including environmental restrictions and permitting. Projects that are anticipated to require environmental or regulatory permitting that pose negative impacts to design and construction scheduling are scored lower.

Priority Listing

The 10 highest-priority projects according to the scoring matrix (Appendix A) are listed below in order of priority:

1. SSR Pump Station Relocation (Project 1)
2. North Side Recirculation System Expansion (Project 16)
3. Main Canal Rehab – Schedule C (Project 23)
4. Cast-in-Place Pipeline Replacement (Project 13)
5. Main Canal Rehab – Schedule B (Project 22)
6. Alleviate Lateral 2N Capacity Constraints – Culvert Replacement/Bypass Pipeline Options (Projects 6.1 and 6.2)
7. Alleviate M Lateral Capacity Constraint – Culvert Replacement Option/Bypass Pipeline Options (Projects 7.1 and 7.2)
8. Pipe Laterals Inside City Limits (Project 4)
9. Metering Project (Project 19)
10. Alleviate Lateral 3S Extension Capacity Restraint – Long Bypass Pipeline Option (Project 8.3)

1.3 Capital Improvement Plan – Projects Reviewed

A summary map of the projects reviewed as part of this CIP can be seen in Figure 1 of Appendix B.

1 South Side Reservoir Pump Station Relocation

1.1 Project Description

There is an existing recapture and recirculation system on the District's south side which captures and diverts tailwater, agricultural drainage water, and operational fluctuations into the 45 acre-foot South Side Reservoir (SSR) located at the intersection of Lateral 3 South (Lat 3S) and Marshall Rd. Captured water in the reservoir is used to meet irrigation demands downstream of the SSR on Lateral 3S Extension, which allows an existing 25 cfs pump station on Lateral 3S to recirculate water to Laterals 2S, 3S, and/or 4S. In its current location on Lateral 3S, directly upstream of the SSR on the north side of Marshall Rd, the pump station cannot be optimized regarding the recirculation and blending of the District's Marshall Rd

and Spanish Drain Return System. The capacity of Lateral 3S is inadequate for the pump station to run at full capacity, and the pump station is not capable of pulling water directly from the SSR.

This project involves constructing a new pump station inside the SSR and relocating the existing pumps as seen in Figure 2 in Appendix B. Relocating the pump station will significantly increase the benefits and efficiency of the reservoir, the south side recapture and recirculation system, and the pump station. The new pump station location would allow for recaptured water in the SSR to be more efficiently recirculated throughout the south side of the District for beneficial use as needed. Relocation of the pump station into the SSR greatly increases District water use efficiency by increasing the volume of water available for recirculation and combining the benefits of the SSR, the Lat 3S pump station, and the Marshall Rd and Spanish Drain Return System. Water stored in the SSR could be conveyed to meet demands in Laterals 2S, 3S, and 4S as opposed to having its use restricted to Lateral 3S Extension. Water from the SSR could be beneficially used by the farmers in-lieu of groundwater pumping, increasing regional groundwater self-reliance and preserving the region's groundwater basins.

Further analysis from an electrical engineer is required to determine the feasibility and associated costs of relocating the electrical components of the pump station, including the VFD and pump control panels and the telemetry equipment. This electrical analysis should explore the possibility and potential cost savings of leaving the electrical equipment in place and only relocating the pumps and motors. Note that this may require additional conduit extensions to the new pump station across Marshall Rd. It was assumed that power is readily available at the new pump station site due to its proximity to the original location. The discharge pipes from the new pump station will need to cross Marshall Rd and connect to the existing discharge pipeline that conveys water parallel to Lateral 3S in its upstream direction.

1.2 Cost Estimate

Construction costs for this project were developed using quotes from manufacturers and estimated and actual construction costs from similar projects. Estimated total project costs are estimated to be $626,000. Applying a -20% to +30% contingency gives an estimated project cost range of $501,000 to $814,000. The total estimated project cost of $626,000 includes $522,000 in construction costs and $104,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C. The costs to relocate and extend electrical components were approximated by P&P and will need revisions after an electrical analysis is performed.

1.3 Project Ranking

This project scored high in most categories. This project is anticipated to significantly improve the District's southside operations, water use efficiency, water storage, and delivery efficiencies. This facility needs to be replaced as the existing facilities are a constraint in the District's southside recirculation efforts. There is not expected to be any major environmental concerns as all construction (except the road crossing) will take place on existing District land. This should be one of the top priorities for the District.

2 Groundwater Bank Feasibility Study and Construction

2.1 Project Description

Patterson Irrigation District does not currently own or operate any groundwater recharge facilities or programs. While the District's proximity to the San Joaquin River (SJR) and their strong water rights help alleviate critical overdraft of the local aquifer, securing sources of groundwater recharge and a dry-year water supply could greatly benefit the District in the future. In addition, recharge facilities can promote

groundwater basin sustainability, minimize the negative impacts from storms and flooding, enhance groundwater quality, and increase operational flexibilities.

Much of the District experiences shallow groundwater, especially in regions close to the San Joaquin River. It was noted during conversations with District staff that in general the recharge-favorable soils are found at the northern end of the District. A USDA NRCS Web Soil Survey of the District and the nearby area displaying hydrologic soil groups of the PID and surrounding region (shown in Appendix D) confirms this.

The District should conduct a groundwater bank feasibility study to explore the possibility of constructing recharge facilities within the district. If found to be feasible, excess surface and flood flows could be diverted from the SJR or Delta-Mendota Canal (DMC) for recharge by the District, which could be stored in the aquifer and extracted for later use. This extra water source could be used or exchanged by the District in dry years when surface water supplies are limited.

The feasibility study would evaluate potential recharge sites with lands in the northwestern region of the District and in areas near Del Puerto Creek where soils more conducive to groundwater recharge are likely to be found. Based on hydrologic soil class, a good conceptual location of a 100-acre recharge basin is near the tail end of Laterals 3N, 4N, and M Lateral. It should be located such that an inlet connection from Lateral 3N is feasible and cost effective as Lat 3N has the largest conveyance capacity. Assuming an inlet flow rate of 30 cfs (approximate Lateral 3N capacity), a basin could be filled at a rate of approximately 60 acre-feet per day. Note that this does not account for groundwater recharge or evaporation during basin filling. Land availability and environmental regulations will likely dictate the location of recharge facilities, and recharge rates and basin filling times need be considered when designing the basin capacity and selecting a location.

The feasibility study would also explore the potential of using the District's existing storage reservoirs for recharge by turning off the subsurface drainage systems when the reservoirs are not being used to meet irrigation demands. The District has monitoring wells located along Lateral 2S near Prune Ave (MW1) and along Lateral 1N near Olive Ave (MW2). Historical data supplied by the District from 2012-2017 provides depth to water readings taken twice each year approximately 6 months apart to capture seasonal highs and lows. Depth to groundwater at MW1 ranged from 19-65 feet below ground surface, with seasonal averages of 25 and 50 feet. Average depth to groundwater at MW2 ranged from 12-28 feet below ground surface. Depth to water at MW2 does not fluctuate much based on the available data, and thus seasonal and annual averages at MW2 are approximately 22 feet below ground surface. This data indicates that the high water table may prevent recharge in the NSR from being feasible or efficient. It was assumed that depth to water at MW1 and MW2 is representative of depth to water at the SSR and NSR, respectively.

2.2 Project Cost Estimate

The cost to perform a groundwater bank feasibility study is estimated to be $30,000, but the price will be dependent on the final scope of the study. This cost is based on similar studies performed by P&P located in the general geographic vicinity of PID.

Costs for a conceptual 100-acre recharge facility were generated to give the District a rough idea of costs for an operation of this magnitude, if proven to be feasible. Actual construction costs will vary significantly based on final site location, basin size and capacity, proposed infrastructure, land acquisition costs, availability of land, and environmental permitting and compliance. Construction costs for the conceptual basin were developed using quotes from manufacturers and construction costs from similar projects.

2.3 Project Ranking

This project scored low to medium in most categories. This project should be a lower priority to the District in large part because there is not a high need for a groundwater bank at this time. However, as SGMA becomes implemented the priority of recharge projects may increase. Groundwater banks are prone to environmental permitting issues as well, and while a groundwater bank would greatly increase water storage and supply it will not necessarily impact growers directly.

3 Concrete Lining of Laterals

3.1 Project Description

Large sections of the District's lateral system are unlined or have severely damaged concrete lining. District staff identified approximately 50,000 linear feet of laterals that would greatly benefit from concrete lining (Table 1). Eroding banks can pose maintenance and safety issues to District staff and the public and in some cases may negatively impact delivery operations. Figure 3 in Appendix B depicts the approximate extents of the proposed lining of each identified lateral. Priority for lining should be given to the laterals with the highest capacities and demands, such as Laterals 2N and 3N. Lining the laterals will limit potential system seepage losses, prevent canal embankment erosion, increase the safety of District and maintenance staff, and may improve channel capacity by lowering the Manning's n value.

Table 1 - Linear Feet of Concrete Lining by Lateral

LATERAL	LF OF CANAL TO BE LINED
2N	7,300
3N	6,300
4N	8,000
M LAT	16,500
1S	3,700
2S	8,600

3.2 Project Cost Estimate

Quantities for concrete lining were estimated using Google Earth to quantify linear feet of canal reaches in need of lining based on field observations, conversations with PID, and maps marked by District staff. Costs to repair channel geometry and construct concrete lining are based on approximate costs supplied to the District by McElvany, Inc. These costs assume the District will be responsible for the demo of existing lining and the replacement of all turnouts. The cost estimate assumes minimal channel cleanup will be required prior to lining construction, and that any demolished lining will be used as rip rap elsewhere in the District (such as on the side slopes of new or existing reservoirs). The limits of lining removal, if any, are unknown at this time and are not included in the cost estimate.

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects. Estimated total project costs are estimated to be $2,213,000. Applying a -20% to +30% contingency gives an estimated project cost range of $1,770,000 to $2,877,000. The total estimated project cost of $2,213,000 includes $2,011,000 in construction costs and $202,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C, which includes a breakdown by lateral. In general, costs for this project are estimated to range between $35 and $57 per linear foot of canal (See Appendix C for cost assumptions).

3.3 Project Ranking

This project scored low to medium in most categories but is anticipated to have little to no environmental restrictions to hinder implementation. Concrete lining projects of this magnitude are costly to implement. Small areas where the lack of lining poses a safety threat or areas where broken-up lining is negatively impacting operations as determined by the District may be a higher priority to the District than the overall project score implies.

4 Pipe Laterals Inside City Limits

4.1 Project Description

There are open channel segments of Lateral 4N and M Lateral within the City of Patterson. These open channel sections pose safety risks to the public and maintenance issues for the District due to urban encroachment. Under this project approximately 7,500 linear feet of Lateral 4N and 8,000 linear feet of M Lateral will be converted from open channel ditches to reinforced concrete pipelines with an assumed minimum inside diameter of 48 inches. Lateral 4N needs to be piped from Orange Ave to Olive Ave. M Lateral needs to be piped from Hwy 33 to Sperry Ave and from Ward Ave to Cliff Swallow Dr. The proposed pipelines will tie into existing headwalls at road crossings to reduce construction costs unless the crossings are determined to be a flow constriction at the time of design, or the headwall integrity is deemed insufficient to support the improvements. Existing turnouts will need to be reconstructed and/or retrofitted with a tee connection to be compatible with the new pipeline. The number of turnouts included in the cost estimate are based on records and maps supplied by the District, but it is possible that there are additional turnouts and connections that are not accounted for in the cost estimate. For the sake of this evaluation, it was assumed that there is an additional 10% of turnouts along both alignments in addition to what was communicated by the District. If required along the piped sections, flow measurement could be achieved with propeller meters or magmeters (not included in cost estimate). Converting the channels to buried pipelines will reduce District liability by eliminating fall and drowning risks from pedestrian foot traffic along the canal banks. Replacing approximately 15,500 linear feet of open channels with pipelines will also reduce annual District maintenance and improve delivery operations by preventing the public from dumping trash and debris into PID's delivery system. The M Lateral crossing at American Eagle Rd (Project 7) should be replaced prior to or in tandem with construction of this project.

4.2 Project Cost Estimate

It was assumed that turnouts could be constructed by teeing off the new 48-inch diameter pipeline with a pipe stub. A gate or butterfly valve could be attached to the pipe stub, and a coupler could be used to connect the stub and gate to the existing pipeline. Connections to culverts and road crossings could be made by doweling the proposed pipelines into existing headwalls. Closure collars could also be cast-in-place for connections to headwalls with different sized culverts than the proposed pipelines. Air vents will be installed at a minimum of every quarter mile along the proposed pipelines. The cost estimate also assumes that demolished lining will be used as rip rap elsewhere in the District, such as on the side slopes of new or existing reservoirs.

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects. Estimated total project costs are estimated to be $8,264,000. Applying a -20% to +30% contingency gives an estimated project cost range of $6,612,000 to $10,744,000. The total estimated project cost of $8,264,000 includes $6,886,000 in construction costs and $1,378,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C, which includes a breakdown by lateral. Construction costs to pipe Lateral 4N and M Lateral are approximately $183 and

$207 per linear foot of canal, respectively. Note that these costs do not include General and Non-Construction Items (See Appendix C).

4.3 Project Ranking

This project scored medium to high in most categories and should be a high priority for the District. Open channels in City limits pose potential threats to public safety and create District maintenance issues. This project will improve District operations by eliminating delivery issues related to trash and debris build-up. Little to no environmental restrictions or permitting issues are anticipated in the implementation of this project.

5 Concrete Lining of Sublaterals

5.1 Project Description

Many of the District's sublaterals are unlined open ditches. District staff identified approximately 20,000 linear feet of earth-lined sublaterals that could benefit from concrete lining from a maintenance, operational, and visual aspect (Table 2). These sublaterals pose maintenance and safety issues, and in some cases may negatively impact delivery operations. Figure 4 in Appendix B depicts the approximate extents of the proposed concrete lining. Priority for lining should fall on the sublaterals with the highest demands as determined by District staff. Lining the sublaterals will prevent canal embankment erosion, may increase delivery operations, and will increase the safety of District staff. In general, projects that improve laterals or interties should be given higher priority than projects that improve sublaterals. Improvements to larger sublaterals should also be given priority over smaller sublaterals.

Table 2 - Linear Feet of Concrete Lining by Sublateral

SUBLATERAL	LF OF CANAL TO BE LINED
2N-21	1,000
3N-12	700
3N-27	2,400
2S-2	3,100
3S-18	2,600
3S-22	1,700
4S-1	1,000
4S-4	3,400
4S-25	3,400
5S-5	1,100
5S-12	400

5.2 Project Cost Estimate

Quantities for concrete lining were estimated using Google Earth to estimate linear feet of each sublateral that requires lining based on field observations and maps marked by District staff. Costs to construct concrete lining are based on approximate costs supplied to the District by McElvany, Inc. to repair canal geometry and construct concrete lining for PID's laterals, and these costs were scaled down from the Concrete Lining of Laterals project (Project 3). The capacity and geometry of the sublaterals is significantly smaller than that of the main laterals, and concrete lining costs were reduced by 33% to reflect this. The 33% doesn't reflect the relative percentage of capacity and geometry reduction between most laterals and sublaterals; it was selected to reflect the probable difficulty of access for equipment along the small sublaterals. The cost estimate assumes minimal sublateral cleanup will be required prior to lining construction. The costs provided by McElvany, Inc. assume the District will be responsible for the

demo of existing lining and the replacement of all turnouts. The cost estimate assumes minimal channel cleanup will be required prior to lining construction, and that any demolished lining will be used as rip rap elsewhere in the District (such as on the side slopes of new or existing reservoirs).

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects. Total project costs are estimated to be $658,000. Applying a -20% to +30% contingency gives an estimated project cost range of $527,000 to $856,000. The total estimated project cost of $658,000 includes $558,000 in construction costs and $100,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C, which includes a breakdown by lateral. In general, costs for this project are estimated to be between $29 and $37 per linear foot of sublateral (See Appendix C for cost assumptions).

5.3 Project Ranking

This project scored low in most categories but is anticipated to have little to no environmental restrictions to hinder implementation. Concrete lining projects of this magnitude are costly to implement and don't increase the storage or supply of the District's water. In addition, the lining of sublaterals will only impact the small portions of the District that they feed. Constructing concrete lining in sublaterals is a low priority to the District unless safety or significant delivery issues caused by the lack of lining arise.

6 Alleviate Lateral 2N Capacity Constraints

6.1 Project Description

District staff identified canal capacity constraints on Lateral 2N at its intersection with Las Palmas Ave, Walnut Ave, Olive Ave, and Lemon Ave. According to District staff, these constrictions have reduced the capacity of Lateral 2N. The existing culvert diameters are as follows: 54-inches at Las Palmas and Walnut Aves, 48-inches at Olive Ave, and 36-inches at Lemon Ave. To rectify the capacity constraints at each of the identified intersections, two options were explored by P&P: the culverts could be demolished and replaced with a larger diameter pipe to allow for more flow, or a turnout and bypass pipeline could be constructed to add additional capacity to the crossing.

The presence of existing utilities and their conflicts with the proposed improvements were not explored as part of this project but may dictate which option is selected. Evidence of multiple utilities and possible utilities were observed at each crossing, including sanitary and storm drain manholes, telephone and electrical boxes, power and telephone and lines, water valves, and adjacent housing developments. A conceptual layout of the bypass option can be seen in Figure 5 in Appendix B. These improvements are meant to bring the Laterals back to their original design capacity, as opposed to increasing the Laterals' total capacity. Note that canal operations on the lateral will need to be suspended or bypassed throughout construction if not completed during the District's shutdown period.

6.1.1 Total Replacement Option

Total culvert replacement will require the demolition of the existing culverts, roadway, some canal lining, and existing headwalls. All existing utilities will need to be protected in place or relocated, and traffic control will be required during construction. Canal crossings should be upsized to at least the following diameters to increase their capacity: 60-inches at Las Palmas and Walnut Aves, 54-inches at Olive Ave, and 42-inches at Lemon Ave. The preliminary proposed diameters were sized by comparing upstream and downstream culvert diameters supplied by the District. Proposed diameters are at least six inches greater than the existing diameters to increase capacity and must not be smaller than the upstream crossing. An in-depth hydraulic analysis will be required along Lateral 2N to determine final crossing sizes.

6.1.2 Bypass Option

The bypass pipeline option will require demolition of the existing roadway for pipeline trenching but the existing headwalls and culvert will remain in place. A precast turnout structure and 24-inch C900 PVC bypass pipeline will be constructed upstream of the crossings. The bypass pipeline will be located on the side of the lateral with the drive bank. This option has a significantly smaller construction footprint and schedule than the culvert replacement option. All existing utilities will need to be protected in place or relocated, and traffic control will be required during construction. An in-depth hydraulic analysis will be required along Lateral 2N to determine final bypass pipeline sizes. Bypass pipelines will discharge upstream of any check structures located downstream of the road crossings.

It is assumed that existing turnouts and infrastructure will be protected in place for both project options.

It should be noted that in April of 2019 District staff noticed excessive sediment deposits in the Lateral 2N Olive Ave culvert during their shutdown period. To alleviate the constriction the District had the sediment removed via a vacuum truck. The impacts of this action need to be monitored over the next irrigation season to see if cleaning out the culvert resolved the capacity constraint. If so, this effort should be repeated at the other culvert crossings in order to potentially solve the capacity issues without any major construction.

6.2 Project Cost Estimate

This cost estimate does not consider costs to locate, protect in place, and/or relocate existing utilities. Culvert replacement costs assume that precast RGRCP will be used for the culvert crossings. The bypass pipeline option assumes that the turnout structures will be precast and will not be equipped with any gates or flow control/measurement devices. Bypass pipelines will discharge directly into the lateral on a concrete-lined section of canal to eliminate the need for a discharge structure. It is assumed that there is adequate space and clearance available for both options and that the purchase of additional right of way by PID will not be required.

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects.

6.2.1 Culvert Replacement Option Cost Estimate

Estimated total project costs for the culvert replacement option are estimated to be $541,000. Applying a -20% to +30% contingency gives an estimated project cost range of $433,000 to $703,000. The total estimated project cost of $541,000 includes $457,000 in construction costs and $84,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

6.2.2 Bypass Pipeline Option Cost Estimate

Estimated total project costs for the bypass pipeline option are estimated to be $245,000. Applying a -20% to +30% contingency gives an estimated project cost range of $196,000 to $319,000. The total estimated project cost of $245,000 includes $165,000 in construction costs and $80,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

6.3 Project Ranking

This project scored high in most categories due to its immediate improvements to District operations and delivery efficiency and should be a high priority for the District. The existing facilities require improvement to operate efficiently. Restoring the canal to its original capacity is a necessity to the District and will reduce the chances of canal overtopping and increase its ability to handle flow fluctuations. The

increased capacity will greatly improve recirculation and intertie efficiencies by allowing more water to be moved throughout the District.

7 Alleviate M Lateral Capacity Constraint (American Eagle Rd)

7.1 Project Description

District staff identified a canal capacity constraint on M Lateral at its intersection with American Eagle Rd. The existing culvert diameter of 36-inches is insufficient to pass desired flows. To rectify the capacity constraints two options were explored by P&P: the culvert could be demolished and replaced with a larger diameter pipe to allow for more flow, or a turnout and bypass pipeline could be constructed to add additional capacity to the crossing. The presence of existing utilities and their conflicts with the proposed improvements were not explored as part of this project but may dictate what option is selected. Evidence of multiple utilities or possible utilities were observed at each crossing, including sanitary and storm drain manholes, telephone and electrical boxes, power and telephone and lines, water valves, and adjacent housing developments. These improvements are meant to bring the Lateral back to its original design capacity as opposed to increasing the Lateral's total capacity. Note that canal operations on the lateral will need to be suspended or bypassed throughout construction if not completed during the District's winter shutdown period.

It may be possible to alleviate this capacity constraint by increasing the available head at the crossing by raising the headwalls and upstream banks. A hydraulic model and topographic survey would be required to quantify the extents of bank and headwall improvements, as well as ensure there is adequate head to push the full capacity through the culvert. This crossing would more than likely be replaced as part of Project 4 – Pipe Laterals Inside City Limits.

7.1.1 Culvert Replacement Option

The culvert could be demolished and reconstructed with a larger diameter pipe to allow for more flow. Total culvert replacement will require the demolition of the existing American Eagle Rd culvert, roadway, some canal lining, and existing headwalls. The diameter of the new culvert should be upsized to a minimum of 54-inches. The preliminary proposed diameter was selected by comparing upstream and downstream culvert diameters supplied by the District. The proposed diameter is at least six inches greater than the existing diameter to increase capacity and must not be smaller than the crossing directly upstream. All existing utilities will need to be protected in place or relocated, and traffic control will be required during construction. An in-depth hydraulic analysis will be required at the crossing to determine the necessary final diameter.

7.1.2 Bypass Pipeline Option

A turnout and bypass pipeline could be constructed to add additional capacity to the crossing. The bypass pipeline option will require demolition of the existing roadway for pipeline trenching, but the existing headwalls and culvert will remain in place. A precast turnout structure and 36-inch RGRCP bypass pipeline will be constructed upstream of the crossing. The bypass pipeline will be located on the side of the lateral with the drive bank. This option has a significantly smaller construction footprint and schedule than the culvert replacement option. All existing utilities will need to be protected in place or relocated, and traffic control will be required during construction. A conceptual layout of the bypass option can be seen in Figure 5 in Appendix B. An in-depth hydraulic analysis will be required at the crossing to determine final bypass pipeline size.

7.2 Project Cost Estimate

This cost estimate does not consider costs to locate, protect in place, and/or relocate existing utilities. Culvert replacement costs assume that precast RGRCP will be used for the crossing. The bypass pipeline option assumes that the turnout structure will be precast and will not be equipped with any gates or control devices. The bypass pipeline will discharge directly into the lateral on a concrete lined section of canal to eliminate the need for a discharge structure. It is assumed that there is adequate space and clearance available for both options and the purchase of additional right of way by PID will not be required.

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects.

7.2.1 Culvert Replacement Option Cost Estimate

Estimated total project costs for the culvert replacement option are estimated to be $187,000. Applying a -20% to +30% contingency gives an estimated project cost range of $150,000 to $244,000. The total estimated project cost of $187,000 includes $139,000 in construction costs and $48,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

7.2.2 Bypass Pipeline Option Cost Estimate

Estimated total project costs for the bypass pipeline option are estimated to be $87,000. Applying a -20% to +30% contingency gives an estimated project cost range of $70,000 to $114,000. The total estimated project cost of $87,000 includes $73,000 in construction costs and $14,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

7.3 Project Ranking

This project scored high in most categories due to its immediate improvements to District operations and delivery efficiency and should be a high priority project for the District. The existing facilities require improvement to operate efficiently. Restoring the canal to its original capacity is a necessity to the District and will reduce the chances of canal overtopping and increase the canal's ability to handle flow fluctuations. The increased capacity will improve delivery and intertie efficiencies by allowing more water to be moved throughout the District. This capacity constraint project should be of lower priority than resolving similar constraint issues on larger laterals.

8 Alleviate Lateral 3S Extension Capacity Constraint

8.1 Project Description

District staff identified a canal capacity constraint on the Lateral 3S Extension, directly downstream of the SSR. PID wishes to convey approximately 20 cfs through this reach but are currently limited to roughly 14 cfs according to District staff. The existing culvert diameter of 42-inches at Armstrong Rd and the open channel reach downstream is unable to convey the desired flows. To rectify the capacity constraints, three options were explored by P&P: culvert replacement, a short bypass pipeline, and a long bypass pipeline.

The presence of existing utilities and their conflicts with the proposed improvements were not explored as part of this project but may dictate what option is selected. Evidence of multiple utilities or possible utilities were observed at the crossing, including telephone and power lines, irrigation facilities, and adjacent housing. These improvements are meant to bring the Lateral back to its original design capacity as opposed to increasing the Lateral's total capacity. Canal operations on the lateral will need to be

suspended or bypassed throughout construction if not completed during the District's winter shutdown period. This project should be constructed in tandem with or prior to construction of Project 1 – SSR Pump Station Relocation to maximize delivery operations and the benefits of Project 1.

8.1.1 Culvert Replacement

The culvert reconstruction option includes removing and reconstructing the existing culvert with a larger diameter pipe to reduce headloss and increase conveyance capacity. This option also includes increasing the capacity of the canal from downstream of Armstrong Rd to Pear Ave by widening it. The widening earthwork may be limited to the left canal bank due to the presence of existing structures and developments along the right bank. Replacing the culvert will require the demolition of the existing Armstrong Rd culvert, roadway, some canal lining, and existing headwalls. The new culvert should be upsized to a minimum of 48-inches. The preliminary proposed diameter was sized by comparing upstream and downstream culvert diameters supplied by the District. The proposed diameter should be at least six inches greater than the existing diameter to effectively increase capacity and must not be smaller than the crossing upstream. All existing utilities and turnouts will need to be protected in place or relocated, and traffic control will be required during construction. An in-depth hydraulic analysis will be required at the crossing to determine final crossing size.

8.1.2 Short Bypass Pipeline

A turnout and short bypass pipeline parallel to the crossing could be constructed to add additional capacity, as well as widening the canal from downstream of Armstrong Rd to Pear Ave to increase its capacity. A conceptual layout of this option can be seen in Figure 5 of Appendix B. The widening earthwork may be limited to the left canal bank due to the presence of existing structures and developments along the right bank. This option will require demolition of the existing roadway for pipeline trenching, but the existing headwalls and 42-inch diameter culvert will remain in place. A precast turnout structure and 24-inch C900 PVC bypass pipeline will be constructed upstream of the crossing. The bypass pipeline will be located on the side of the lateral with the drive bank. This option has a significantly smaller construction footprint and schedule than the culvert replacement and long bypass pipeline options. All existing utilities will need to be protected-in-place or relocated, and traffic control will be required during construction. An in-depth hydraulic analysis will be required at the crossing to determine final bypass diameter.

8.1.3 Long Bypass Pipeline

A turnout and long bypass pipeline to Pear Rd could be constructed upstream of the crossing. The bypass pipeline would originate upstream of the south headwall and run parallel to Armstrong Rd until it intersects Pear Rd, where it would cross Armstrong Rd and connect to the lateral upstream of the existing 42-inch gate. This option bypasses the constricted culvert and the lateral directly downstream. A conceptual layout of the bypass options can be seen in Figure 6 of Appendix B. This option will require demolition of the existing roadway for pipeline trenching, but the existing headwalls and 42-inch diameter culvert will remain in place. A precast turnout structure and 24-inch C900 PVC bypass pipeline will be constructed upstream of the crossing. The bypass pipeline will be located on the eastern side of the lateral. All existing utilities will need to be protected-in-place or relocated, and traffic control will be required during construction. An in-depth hydraulic analysis will be required at the crossing to determine final bypass diameter.

8.2 Project Cost Estimate

This cost estimate does not consider costs to locate, protect in place, and/or relocate existing utilities. Culvert replacement costs assume that precast RGRCP will be used for the crossing. The bypass pipeline options assume that the turnout structure will be precast and will not be equipped with any gates or control devices. Bypass pipelines will discharge directly into the lateral on a concrete-lined section of

canal to eliminate the need for a discharge structure. It is assumed that there is adequate space and clearance available for all options and the purchase of additional right of way by PID will not be required.

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects.

8.2.1 Culvert Replacement Option Cost Estimate

Estimated total project costs for the culvert replacement option are estimated to be $280,000. Applying a -20% to +30% contingency gives an estimated project cost range of $224,000 to $364,000. The total estimated project cost of $280,000 includes $234,000 in construction costs and $46,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

8.2.2 Short Bypass Pipeline Option Cost Estimate

Estimated total project costs for the short bypass pipeline option are estimated to be $195,000. Applying a -20% to +30% contingency gives an estimated project cost range of $156,000 to $254,000. The total estimated project cost of $195,000 includes $163,000 in construction costs and $32,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

8.2.3 Long Bypass Pipeline Option Cost Estimate

Estimated total project costs for the long bypass pipeline option are estimated to be $208,000. Applying a -20% to +30% contingency gives an estimated project cost range of $167,000 to $271,000. The total estimated project cost of $208,000 includes $164,000 in construction costs and $44,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

8.3 Project Ranking

This project scored high in most categories due to its immediate improvements to District operations and delivery efficiency and should be a high priority project for the District. The existing facilities require improvement to operate efficiently. Restoring the canal to its original capacity is a necessity to the District and will reduce the chances of canal overtopping and increase its ability to handle flow fluctuations. The capacity restoration will greatly improve recirculation and intertie efficiencies by allowing more water to be moved throughout the District. This capacity constraint project is also a high priority because resolving it may increase the operational efficiency of the South Side Reservoir.

9 North Side Storage Basin

9.1 Project Description

Currently, the only source of water storage on the District's north side is the 40-acre-foot North Side Reservoir. Additional storage capabilities on the north side are requested by the District to increase recirculation efficiencies. Constructing a 30-acre-foot regulating reservoir on Lateral 3N near Olive Ave could allow District staff to operate the District's north side more efficiently while improving delivery flexibility and efficiency. The 30 acre-feet capacity increase was selected based on conversations with District staff. Having additional storage on the Lateral 3N could reduce and possibly eliminate any excess operational fluctuations or collected tail water that would normally drain to Del Puerto Creek. It is assumed that the reservoir would have a pumped inlet and gravity outlet from/to Lateral 3N to match operations of other District reservoirs.

9.2 Project Cost Estimate

This cost estimate assumes that land will be available for purchase near the tail end of Lateral 3N. It also assumes that rip rap will be placed on the basin's side slopes. Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects. Estimated total project costs are estimated to be $1,212,000. Applying a -20% to +30% contingency gives an estimated project cost range of $970,000 to $1,576,000. The total estimated project cost of $1,212,000 includes $676,000 in construction costs and $536,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

9.3 Project Ranking

This project should be of medium importance to the District, even though there are operational benefits of additional storage on the north side. While it would significantly improve water storage and supplies, its area of impact would be limited to the north side of the District. Storage facilities of this magnitude may be subject to environmental restrictions and permitting issues and are often driven by land availability.

10 2S-9 Parallel Pipeline

10.1 Project Description

Sublateral 2S-9 conveys irrigation water to growers and collects and conveys drainage water to the San Joaquin River. The pipeline's 20-inch diameter is a constriction and prevents the sublateral from optimally executing its dual delivery and drainage operations. Replacing the existing pipeline with a single, larger pipeline to handle both deliveries and drainage was initially considered but a parallel pipeline was requested by the District. The existing pipeline should be supplemented with a parallel 24-inch diameter C900 PVC pipeline. The existing 20-inch pipeline will exclusively handle deliveries to turnouts and the new 24-inch diameter pipeline will be used exclusively for drainage. If it is determined that the existing pipeline needs additional capacity, it could be replaced with a new 24-inch C900 PVC pipeline. This would require replacing the existing turnout boxes and connections.

The different existing individual diameter field connection configurations to Sublateral 2S-9 were not accessible during site visits as they are located on private property. Based on aerial imagery and conversations with District staff, it was assumed that all field connections to the pipeline are made with pipeline tees to precast irrigation boxes. Drainage tail water from fields is conveyed to 2S-9 through piped connections to field drains on the east side of the delivery boxes. The proposed 24-inch diameter pipeline should be constructed to the east of the existing 2S-9 pipeline to make re-establishing drainage connections easier. Existing drainage connections to the turnout boxes will be disconnected and capped off.

10.2 Project Cost Estimate

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects. Estimated total project costs are estimated to be $623,000. Applying a -20% to +30% contingency gives an estimated project cost range of $499,000 to $810,000. The total estimated project cost of $623,000 includes $519,000 in construction costs and $104,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

10.3 Project Ranking

This project is ranked as a low priority project based on the scoring criteria but is a high priority project according to District staff. The existing facilities require improvement to efficiently drain and deliver water to growers. No environmental or permitting issues are anticipated in implementation of the project.

11 Increase Lateral Capacities

11.1 Project Description

The District must ensure its lateral system has adequate capacity to make accurate and reliable deliveries to its growers. Table 3 identifies current and desired lateral capacities according to District staff and an analysis of the District's cropping pattern and water demand by lateral. From the table it can be seen that Laterals 2S, 4S, 5S, 2N, and 3N require improvements to increase their respective capacities to those shown in Table 3.

Table 3 - Current and Desired Lateral Capacities

Approximate Lateral Capacities, CFS		
Lateral	*Current Capacity*	*Desired Capacity*
1S	*10*	*10*
2S	*20*	*25*
3S	*23*	*23*
4S	*16*	*20*
5S	*12*	*15*
1N	*18*	*18*
2N	*27*	*30*
3N	*25*	*30*
4N	*18*	*18*
5N	*6*	*6*
M Lat	*14*	*14*

Part of the capacity deficiencies identified are due to changing cropping patterns that reflect a shift from row crops to trees. Permanent crops are typically irrigated using drip or micro irrigation systems as opposed to surface irrigation. Drip and micro irrigation systems apply water at lower flow rates than surface irrigation, but for longer periods of time. The District's delivery system was designed for surface irrigation systems where growers divert water at higher flow rates for much shorter durations.

Although logic would indicate that this shift in irrigation scheduling would allow for more room to have more fields on, the issue is the transition. The transition from surface to drip is putting a strain on the operators and the system in such a way that the surface irrigated fields may take all of the capacity in short spurts once every few weeks whereas a micro system needs a small amount on a more frequent basis, putting the surface and micro fields at odds. Most of the laterals requiring additional capacities show significant increases in permanent cropping acreages based on cropping data supplied by PID from 2013 through 2017. The percentage of almond and pistachio acreage served by each lateral increased by approximately 30% in the laterals identified as needing additional capacities.

The increase in desired capacity for the identified laterals ranges from 3-5 cfs. Approximate lateral cross-sectional geometry gathered during site visits, Google Earth topography, and plans and maps supplied by the District were used to estimate what improvements may be required to achieve the increase in lateral

capacity. Manning's equation was used to approximate lateral improvements required to reach the desired flows using conservative values for lateral slopes (0.0001-0.00011) and Manning's n values (0.017-0.022). The results show that raising the canal banks and flow depth of the laterals by approximately 6 inches will achieve the desired increases in capacity, assuming there is adequate available head to do so. It may be possible to achieve this increase by lowering the Manning's n value through constructing concrete lining, but this may not generate adequate additional capacity. Priority for capacity increases should be given to laterals with larger demands and capacities, such as Laterals 3N and 3S.

11.2 Project Cost Estimate

Construction of this project will require a topographic survey and hydraulic analysis of each lateral to determine feasibility and ideal expansion methods (i.e. lateral widening, raising banks, deepen laterals, etc). A full inventory of each lateral's turnouts, structures, connection points, and other infrastructure will be needed as well for accurate estimation of construction costs to protect in place or reconstruct the existing infrastructure. Raising the lateral banks will impact all existing road crossings, turnouts, sublaterals, headwalls, flow measurement stations, and check structures. Due to the complexity of implementing this project and the shallow scope of this plan, a complete cost estimate was not completed for this project. It is assumed that the complexity and cost of this project will be high compared to the other projects included in this plan, and therefore was given an arbitrarily low ranking in terms of cost for the scoring matrix.

11.3 Project Ranking

This project is ranked as a low priority project despite its potential significant improvement to District operations. Implementation of this project will require a large scale topographic and hydraulic model to determine the feasibility and optimal method of completion. Depending on demand and available funding, this project should be constructed in phases, with one to two laterals being improved a year. Little to no environmental restrictions or permitting are anticipated, but there may be permits associated with the multiple road crossings and pipelines that will require improvements as part of this project.

12 Water Quality Monitoring Stations

12.1 Project Description

The District has surface water rights on the San Joaquin River (SJR) and is a contractor on the Delta-Mendota Canal (DMC). Water in the DMC is subject to Central Valley Project water quality standards and is typically of better quality than SJR water, which typically has high total dissolved solids levels and fluctuating water quality. Constructing water quality monitoring stations to monitor total dissolved solids (TDS), electric conductivity (EC), and other water constituents at the District's diversion points on the SJR and DMC would allow the District to establish a water quality monitoring program. This program would provide increased insight into possible water quality issues and would greatly improve water blending programs. Measuring water quality will most likely be necessary with the implementation of any recharge programs or projects to ensure the integrity of existing groundwater quality.

Water quality monitoring stations could also be installed at the inlets to the NSR and SSR, as well as at the Main Canal's terminus at Highway 33. This will allow the District to monitor the quality of water being recirculated throughout the District and provide better understanding of water quality degradation as tail and drainage water get blended back into the delivery system.
As a follow-up to this project, a water blending program could be created to improve overall District water quality. Water quality would most likely require continuous monitoring for multiple years to establish trends and mitigation measures for seasonal constituent spikes.

12.2 Project Cost Estimate

Costs for this project were developed using quotes from manufacturers and construction costs from similar projects and do not include annual operational and maintenance costs or costs to develop a future blending program. Estimated total project costs are estimated to be $105,000. Applying a -20% to +30% contingency gives an estimated project cost range of $84,000 to $137,000. The total estimated project cost of $105,000 includes $95,000 in construction costs and $10,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

12.3 Project Ranking

This project was scored low on the matrix because it provides no direct or significant impact to growers. While it would be simple to implement, there is not a significant need for a water quality monitoring network at this time. However, water quality monitoring would allow for easier implementation of water blending programs in the future.

13 Cast-in-Place Pipeline Replacement

13.1 Project Description

The District is experiencing delivery and operational issues related to aged and leaking cast-in-place concrete pipes. District staff identified approximately 15,500 linear feet of aged and failing pipelines that need to be replaced, ranging from 20 to 42 inches in diameter. Table 4 breaks down pipelines to be replaced by location, existing and proposed nominal diameters, and approximate length to be replaced. Google Earth maps provided by the District depicting size and location of the existing pipelines to be replaced can be seen in Appendix E. Replacing the problematic pipelines with new RGRCP or C900 PVC pipelines will improve system capacity, delivery efficiencies, and overall District operations. New pipelines should have an inside diameter no smaller than the inside diameter of the existing pipelines. Pipelines could be upsized as needed if the District requires additional demand at the time of design or to anticipate future District demands and expansion. Adequate cover must be available for the increased pipe diameter.

Table 4 - Cast-in-Place Pipelines to be Replaced

Pipeline	Existing Dia, inches	Proposed Dia, inches	Length, ft
M Lateral Pipeline	42	42	4,700
Lateral 2N Pipeline	32	36	1,550
Lateral 3S Extension	36	36	2,250
LDMC	36	36	4,925
Sublateral 4N-29	20	20 or 21	2,000

Aerial and street view imagery from Google Earth of the pipeline alignments were examined to identify potential construction issues. There are significant construction considerations for the M Lateral Pipeline replacement. The pipeline runs through the City of Patterson and will require extensive traffic control throughout most of its replacement. Based on locations of junction boxes and aerial imagery, it appears that the alignment parallels approximately 65 large palm trees planted along 9th St and Las Palmas Ave. It was assumed that these trees could be protected in place, but the curb and gutters would need to be reconstructed. After crossing Las Palmas Ave, the alignment passes through a parking lot and both asphalt and grass playground areas of Las Palmas School. Utility locating was excluded from this analysis but the potential for utility conflicts during construction is extremely high due to the pipeline's urban location.

Lateral 2N Pipeline runs through an existing orchard, which will need to be removed along the alignment. If possible, it may be easier and cheaper to abandon the existing CIP pipeline in place and construct a bypass pipeline parallel to existing city and farm roads. The cost estimate assumes that a bypass pipeline would be constructed with its alignment paralleling Loquat Ave to the north and then running through the center of the existing farm road just north of Elm Ave. Costs to locate and protect or replace existing utilities were not explored as part of this analysis.

The desired improvements to Lateral 3S Extension require converting an existing open channel to 36-inch diameter pipe, as well as replacing approximately 170 linear feet of pipe. A new junction box will need to be constructed at the terminus of the existing ditch.

The LDMC runs through multiple fields, orchards, and private residential properties making this pipeline the most difficult to replace. Note that the pipe size for Sublateral 4N-29 is dependent on the material selected, as they do not make C900 PVC pipe with a nominal 21-inch diameter. The initial 2,300 linear feet of pipeline replacement, from the junction box at Ward Ave and Elfers Ave to the irrigation ditch north of Elfers Ave, could be replaced with relatively little impact to the existing orchard. It may be possible to adjust the existing alignment such that it bypasses the orchard through the farm road to the east. The option of re-aligning the second segment needs to be further evaluated, surveyed, and modeled. The existing 2,700 linear feet of cast-in-place pipeline could be abandoned in place if realignment is deemed feasible. The cost estimate is based on the option of re-aligning the pipeline down S Del Puerto Ave and Bartch Ave as seen in Appendix E. The new alignment would be approximately 4,300 linear feet compared to the existing 2,700 linear feet. Costs to locate and protect or replace existing utilities were not explored as part of this analysis.
Replacement priorities will change from year to year depending on the amount of leakage and effort required to fix the pipelines. Outside of the plan, it is recommended that the District consider replacing one pipeline per year, or at least a stretch of a pipeline per year prioritized by which lines are experiencing the greatest leaks and amount of time and resources that can be dedicated to repairs.

13.2 Project Cost Estimate

This cost estimate assumes that the cast-in-place pipelines will be replaced with C900 PVC pipelines with an inside diameter matching or exceeding the existing inside diameter. It does not account for costs to protect-in-place or relocate existing utilities, or costs associated with protecting and/or replacing private residential facilities.

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects. Estimated total project costs are estimated to be $4,544,000. Applying a -20% to +30% contingency gives an estimated project cost range of $3,636,000 to $5,908,000. The total estimated project cost of $4,544,000 includes $3,786,000 in construction costs and $758,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

13.3 Project Ranking

This project scored medium to high in most categories and should be a high priority project for the District. The existing facilities are failing, causing delivery and operational issues for the District. Replacing all identified pipelines may become more feasible if the pipelines are phased out over several years, with a single pipeline replaced each shutdown period. Priority should be given to pipelines with the least amount of structural integrity.

14 Main Canal Settling Pond

14.1 Project Description

The District's main surface water source, the San Joaquin River, tends to be heavily laden in sediment. Although the District's fish screen has a sediment removal system to help alleviate sediment being pumped into the District, sediment is still pumped into the District. For example, during the Schedule A improvements of the Main Canal Rehabilitation Project the District removed approximately 5,200 cubic yards of sediment from the sedimentation pond in front of Pumping Plant 2. This sediment had built up over 10 years and the pond could no longer reduce sediment in the channel. The sediment creates extra wear and tear on pump impellers, causes on-farm plugging issues, and increases District maintenance costs. Sediment build-ups at road crossing culverts can impact lateral capacity by creating restrictions in the culverts and siphons. Excess silt and sediment in the water can damage and/or negatively impact the accuracy of some flow meters as well. To alleviate these issues, PID utilizes settling ponds directly upstream of their Main Canal pump stations. This project involves constructing an additional settling pond between Pumping Plants 1 and 2 on the main canal, upstream of Laterals 1N and 1S. This will reduce wear and tear on any pumps downstream of its location, especially at Pumping Plant 2. It will also improve delivery operations and decrease maintenance on Laterals 1N and 1S. There is currently no settling pond between the pump station located on the SJR and the heads of Laterals 1N and 1S.

14.2 Project Cost Estimate

Further analysis is needed to properly size the basin. The cost estimate assumes a 175 ft x 175 ft pond, 1:1 side slopes, and a depth of 20 feet to match similar dimensions of settlings ponds on the District's main canal.

Construction costs for this project were developed using construction costs from similar projects. Estimated total project costs are estimated to be $311,000. Applying a -20% to +30% contingency gives an estimated project cost range of $249,000 to $405,000. The total estimated project cost of $311,000 includes $246,000 in construction costs and $65,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

14.3 Project Ranking

This project will impact most of the District but is not expected to significantly improve operations. The priority of this project may increase if the District's new Main Canal Pump Stations begin experiencing excessive sedimentation wear. Reducing sediment in Laterals 1N and 1S should improve the water quality and help reduce plugging of emitters and sprinklers.

15 Del Puerto Creek Recharge Project

15.1 Project Description

This project is intended as the implementation phase after the initial feasibility study is performed for recharge potential in PID. The District has infrastructure in place that allows them to divert both surface water and groundwater into Del Puerto Creek. The feasibility of constructing a check structure in the Creek just downstream of the Lateral 1N point of discharge should be explored by the District. A simple concrete structure with two 8-foot flash board bays could check excess surface water, flood water, exchanged or traded water, and tail water in the creek to utilize its sandy soils for recharge. The proposed structure would have a minimal footprint in the creek bed to minimize environmental regulation issues, and flashboards would only be installed when the District is recharging.

Implementing this project is expected to be difficult and lengthy due to environmental permitting issues. An analysis of the required environmental permits and issues was not performed at this time, but the project is expected to require a Streambed Alteration Permit, a Biological Study, and some level of CEQA.

The benefits of this project will need to be re-evaluated if the District implements or constructs other groundwater recharge projects or programs prior to this one. In addition, implementing projects that reduce or eliminate spill through storing and recirculating drainage water could greatly reduce the benefits of this project.

15.2 Project Cost Estimate

This cost estimate does not include or account for feasibility studies, environmental permitting, or possible mitigation measures. It does account for costs to construct the small check structure described above in Del Puerto Creek.

Construction costs for this project were developed using construction costs from similar projects. Estimated total project costs are estimated to be $282,000. Applying a -20% to +30% contingency gives an estimated project cost range of $226,000 to $367,000. The total estimated project cost of $282,000 includes $182,000 in construction costs and $100,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

15.3 Project Ranking

This project requires a feasibility study prior to implementation and is anticipated to require significant environmental permitting. The District does not experience major issues related to shallow groundwater, but the priority of this project may increase as District needs or desires recharge change. The usefulness of this project will need to be evaluated if projects are implemented to capture and recirculate water on the north side, which may reduce or eliminate spill into Del Puerto Creek.

16 North Side Recirculation System Expansion

16.1 Project Description

The District's NSR and recirculation system delivers and collects water to/from north side laterals from/to the NSR along Fruit Ave using pumps, pipelines, and gravity turnouts. A similar recirculation system located further upstream in the north side delivery system would be of significant benefit to District operations and efficiency. It could increase intra-lateral conveyance, surface water storage, and the recapture and recirculation of drainage and irrigation water. The system concept would be placement of a 10 cfs pump station within the NSR and construction of a 24-inch diameter C900 PVC pipeline to convey water to the north side laterals at Lemon Ave. An additional lift station and C900 PVC pipeline could be constructed on Lateral 2N at Lemon Ave to divert 5 cfs to Lateral 3N for increased recirculation capabilities. The preliminary flow rate of 10 cfs was selected to allow for 5 cfs to be diverted to Lateral 1N via the existing 2N-27 intertie and to 3N via the proposed pump station and pipeline. Figure 7 in Appendix B shows a conceptual schematic of the recirculation system expansion.

Having the ability to move water between laterals midway through the system will improve District delivery efficiencies by improving their ability to meet peak irrigation demands and possibly route water around system capacity constrictions. This project may also provide relief from capacity constraints experienced on the District's north side.

The benefits of this project will need to be re-evaluated if automation and metering is expanded throughout the entire District and the capacity constraints identified in this memo are addressed. It is possible that these improvements would produce the same benefits to the District, and this project would not be needed.

16.2 Project Cost Estimate

This project is purely conceptual and actual construction costs could vary significantly. A topographic survey and hydraulic analysis would both be required for a complete design. Costs assume that no additional right-of-way or easements will be required.

Construction costs for this project were developed using construction costs from similar projects. Estimated total project costs are estimated to be $995,000. Applying a -20% to +30% contingency gives an estimated project cost range of $796,000 to $1,294,000. The total estimated project cost of $995,000 includes $773,000 in construction costs and $222,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

16.3 Project Ranking

This project scored high on most categories and should be considered a high priority project for the District. According to District staff, there is a significant need to expand the District's water storage capacity, which would greatly improve operations throughout the District's north side.

17 Construct Additional Monitoring Wells

17.1 Project Description

As the Sustainable Groundwater Management Act (SGMA) is implemented, groundwater extractions and levels will require continuous monitoring and will be subject to increased scrutiny. PID has existing monitoring wells located along Lateral 2S near Prune Ave (MW1) and along Lateral 1N near Olive Ave (MW2). The District could construct additional monitoring wells to monitor groundwater levels and quality around the District perimeter, even though PID historically has had a high water table. Based on conversations with PID, three monitoring wells are recommended along the river, two on the District's western border, and one each near the northern and southern borders. A groundwater hydrologic study should be conducted to determine the optimum depths/locations for the wells.

17.2 Project Cost Estimate

This cost estimate only includes construction costs for seven non-nested monitoring wells around the District. It doesn't account for costs to optimally locate the wells or permitting costs associated with well drilling. Nested monitor wells are not included as part of this estimate and should be further evaluated as the project is pursued.

Construction costs for this project were developed using construction costs from similar projects. Estimated total project costs are estimated to be $360,000. Applying a -20% to +30% contingency gives an estimated project cost range of $288,000 to $468,000. The total estimated project cost of $360,000 includes $320,000 in construction costs and $40,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

17.3 Project Ranking

This project should be a low priority as the District does not experience major issues related to shallow groundwater and the District already has two existing monitoring wells. If groundwater monitoring

becomes a requirement for Districts, or if groundwater levels or quality become a concern of the District, the priority of this project may increase.

18 Automate Check Structures and Lateral Interties

18.1 Project Description

The heads of the main laterals are being reconstructed and automated under PID's Main Canal Rehabilitation Project. Automation could be expanded to include check structures and lateral interties to optimize District operations and delivery efficiency. The proposed check structure and intertie automation could include flow measurement and could be added to PID's existing SCADA system for communication with other structures and facilities. Note that not every check structure and lateral intertie was observed or catalogued as part of this analysis and actual construction costs, automation methods, and improvement configurations will vary by site. Based on field observations, automating many of the structures and turnouts may be achieved without major structural concrete work. Each lateral and existing infrastructure will need to be examined and catalogued in a complete survey as part of the project design. Cost estimates assume rough quantities of existing infrastructure based on conversations with District staff, Google Earth aerial imagery, and historical records and maps provided by PID.

Check Structures

Existing in-channel flashboard check structures could be retrofitted with automated overshot gates in the existing flashboard bays. These units could be purchased from a manufacturer, such as Rubicon, or fabricated by the District. The USBR conducted a study and set up field demonstration sites in 2012 to showcase overshot gates that were self-constructed by various irrigation and water districts (Appendix F). These structures, which were designed as 'drop-in' structures to fit in existing bays, may be fabricated and installed for relatively low costs to the Districts. The example drop-in gates studied by the USBR were installed in 2012 for approximately $750 per foot of gate width. These gates are automated and controlled by water level sensors installed directly upstream of each gate.

All-inclusive drop-in overshot gates can also be purchased from manufacturers such as Rubicon. Rubicon FlumeGates come with their own power supply, telemetry equipment, and sensors and can be tied into the District's existing telemetry system. The FlumeGates, just like the custom overshot gates, will raise or lower automatically to maintain a set upstream water level. If desired by the District, FlumeGates can be programmed to operate as flow control devices as well as upstream level control devices without any additional sensors or programming. Water level and flow rate data is collected by the unit and transmitted to the District. FlumeGates that are installed on the same lateral can communicate with each other to operate in unison in order for changes in flow rate at the head of the canal to travel through the lateral more efficiently. Existing flashboard bays will require bay walls to be constructed in the existing board bays to securely mount the gates in the existing structures. New water level sensors at each check would communicate with the automated gate to maintain a set water surface elevation upstream of it.

Gated Lateral Interties

Existing gated lateral interties could be automated by installing actuators and water level sensors on the existing diversion gates and developing rating curves for each intertie. The sensors and actuators would communicate with each other to adjust the gate opening to achieve the desired flow rate. If the interties are equipped with flow meters, it may be possible to eliminate the water level sensors and program the actuators to adjust based on the measured flow rate.

Existing gated lateral interties could also be automated by replacing the gates with Rubicon SlipMeters, which are all-in-one drop-in structures just like the FlumeGates. SlipMeters contain a flow measurement

device and actuated slide gate, which adjusts to meet a set flow rate through the turnout. They are designed to be installed in existing turnout bays with minimal to no structural modifications and are capable of accurate flow measurement even if the gate is not fully submerged (this requires an additional sensor). These gates will work in unison with any FlumeGates on the same lateral to increase delivery accuracy and reliability.

18.2 Project Cost Estimate

Construction costs for this project were developed using quotes from manufacturers and construction costs from similar projects. Two cost estimates were generated for this project. The first cost estimate assumes the District will fabricate their own custom overshot gates for the check structures, and existing gated interties will be rated and retrofitted with actuators and water level sensors. This design is less robust and conservative but is a much cheaper option for the District. The second cost estimate assumes automation is achieved using SlipMeters and Rubicon FlumeGates and represents a more conservative and robust design with high-end costs. Both cost estimates do not include any training required for District staff to operate the new equipment.

18.2.1 Custom Fabricated Gate Automation Option Cost Estimate

Estimated total project costs for the custom overshot gate option are estimated to be $7,137,000. Applying a -20% to +30% contingency gives an estimated project cost range of $5,710,000 to $9,279,000. The total estimated project cost of $7,137,000 includes $5,947,000 in construction costs and $1,190,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C, which includes a rough breakdown by lateral based on estimated structure quantities. With the exception of Lateral 1S, costs to automate laterals ranges are estimated to be between $500,000 and $800,000, not accounting for General and Non-Construction Items (See Appendix C).

18.2.2 Rubicon Automation Option Cost Estimate

Estimated total project costs for the Rubicon option are estimated to be $14,918,000. Applying a -20% to +30% contingency gives an estimated project cost range of $11,935,000 to $19,394,000. The total estimated project cost of $14,918,000 includes $12,432,000 in construction costs and $2,486,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C, which includes a rough breakdown by lateral based on estimated structure quantities. With the exception of Lateral 1S, costs to automate laterals are estimated to be between $1,000,000 and $1,700,000, not accounting for General and Non-Construction Items (See Appendix C).

18.3 Project Ranking

This project scored medium to high in most categories. A project of this magnitude would significantly improve operations District-wide but would do so at a high cost. In general, District check structures and interties operate without major issues, so there is not a direct and immediate need to automate them. This project should be implemented in phases, where an entire lateral gets automated at the same time, possibly one lateral a year as funding permits. A preliminary trial may be necessary to select the optimum automation methods for the District.

19 Metering Project

19.1 Project Description

The District uses a variety of flow measurement devices and strategies throughout the district including submerged orifices, propeller meters, weirs, flumes, metered/rated gates, acoustic dopplers, and magnetic

meters (magmeters). According to the District's Water Management Plan/Agricultural Water Management Plan dated January 15, 2014 and revised June 15, 2016, only 160 of the District's 283 delivery points are metered; and many of the metered delivery points feed multiple fields. Implementing flow measurement throughout the remainder of the District could lead to more accurate and precise deliveries to growers while reducing system spill and increasing operational efficiencies.

Flow measurement already takes place at the lateral heads but could be expanded to lateral interties, sublaterals, and most farmer turnouts. According to the Water Management Plan (2016), approximately 65-70% of deliveries to growers are made off of short sublaterals, with measurement occurring at the heads of these sublaterals and not at the on-farm level. This is because there is often very little available headloss for individual field flow measurement, and the District often has no direct easement to the field turnouts. The District has had success in estimating on-farm delivered volumes by measuring flows and volumes at the heads of sublaterals where on-farm measurement is infeasible and limits deliveries to one or two users at a time. It may be possible to implement flow measurement on grower turnouts, sublaterals, and interties that divert water using canal gates at relatively low costs to the District.

19.1.1 Rated Meter Gates

Due to existing topographic conditions, limited site access for meter installation and maintenance, and a lack of available headloss at grower turnouts, flow measurement at every field turnout may be infeasible and not cost-effective. The alternative described in the Water Management Plan is to focus measurement locations at the heads of the small sublaterals, where multiple growers divert their water from. This would require improving approximately 70 facilities throughout the District.

Rating tables to calculate approximate flows and volumes could be developed for sublateral and grower turnouts based on gate openings and water levels. Standpipes or stilling wells with level sensors could be constructed downstream of the turnout gate to determine the head differential between the upstream and downstream water surfaces. Note that rating tables are designed for either submerged or free-flow conditions, and one of these conditions needs to be guaranteed throughout the delivery for accurate measurements.

19.1.2 In-Channel Flumes

Flow measurement on larger open channels can be achieved by constructing an in-channel flume and installing water level sensors both upstream and downstream of the flume. Flumes require very little maintenance and have no moving parts but do require a headloss across them. This method was observed throughout the District during site visits and is an effective flow measurement technique best suited for use on larger District laterals.

19.1.3 Pipeline Flow Measurement

Piped systems could be metered with propeller or magnetic flow meters if a full-flowing pipeline could be guaranteed. Propeller meters can be in-line or open to match field conditions, but they do require significant straight runs of pipe for accurate readings. Exact straight run requirements will vary by manufacturer and model but are typically in the magnitude of ten pipe diameters upstream and four diameters downstream. Propeller meters can also be mounted to headwalls and standpipes but still have straight run requirements. Care should be taken when selecting meter location and style (in-line or open), as high-sediment water can cause maintenance issues for propeller meters. These meters could be connected to the District's existing telemetry system so that flow measurement data could be monitored remotely.

To simplify flow measurement device maintenance, replacement, and operations and reduce equipment compatibility issues, the District should consider using a single manufacturer and limit the number of

different meter models and types used. A hydraulic analysis will need to be conducted to explore impacts to system hydraulic grade lines and available head at proposed metered locations. It was assumed that adequate head is available for each of the meter types described below. It may be advantageous for the District to conduct pilot studies with various meter types to ensure the most efficient and cost-effective method is selected

19.1.4 SlipMeters

The most expensive option for sublateral and grower turnouts would be to replace or retrofit the existing turnouts with Rubicon SlipMeters or other similar devices. These all-in-one units include a slide gate, built-in flow measurement, telemetry equipment, local control, and solar power. They are designed to be easily installed in both new and existing turnouts and are capable of accurately measuring high and low flow rates at variable depths. SlipMeters can be programmed for automatic and/or remote operation to improve overall District efficiencies. Note that the smallest gate size is 18-inches, but this can be installed on turnouts with smaller diameter pipes. This option was excluded from the cost estimate due to infeasible construction costs to furnish each turnout in the District with these gates.

19.2 Project Cost Estimate

An in-depth analysis of the hydraulics, topography, and existing site conditions will be required to develop costs to implement flow measurement throughout the entire District. It was assumed that rated meter gates would be constructed at 70 facilities throughout the District as identified in the Water Management Plan. It was assumed that each of the 70 sites operate in submerged conditions downstream of the turnouts. The cost estimate assumes that each site requires upstream and downstream water level sensors, a downstream stilling well, and a new 20-inch diameter canal gate. It may be possible that these rated meter gates will not work at each location.

Construction costs for this project were developed using construction costs from similar projects. Estimated total project costs are estimated to be $1,150,000. Applying a -20% to +30% contingency gives an estimated project cost range of $920,000 to $1,495,000. The total estimated project cost of $1,150,000 includes $958,000 in construction costs and $192,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

19.3 Project Ranking

This project should be a high priority for the District. Volumetric flow measurement is becoming legally mandated in California and PID should explore options to implement it District-wide. Implementing volumetric flow measurement on all delivery points to growers, including volumetric water billing points, will increase delivery efficiencies and improve District operations and management.

20 Construct Storage Basin Off SJR or DMC

20.1 Project Description

Constructing the infrastructure to divert and store water off of the SJR and DMC would allow the District an additional location to help dissipate sediment. In addition, a basin off of the DMC or SJR could increase opportunities for water exchanges, trades, and storage. Excess flood flows could be diverted off the river and stored in the proposed basin for later use when there is irrigation demand. The basin should be located as close to the SJR or DMC as possible to reduce conveyance and capital costs. A hydraulic and water supply analysis will need to be performed to calculate the optimum storage volume, but a total storage volume of 300 acre-feet was assumed for the cost estimate.

20.2 Project Cost Estimate

Environmental permitting costs are not included in the cost estimate. The basin assumes 300 acre-feet of storage on 80 acres of land, 2:1 interior and 1.5:1 exterior side slopes, 2 feet of freeboard, and a depth of 6 feet. The conceptual location is directly adjacent to the District's DMC turnout and pump station, assuming that this allows for the storage basin to be gravity fed. The cost estimate also assumes that the District's existing pump station off the DMC would be used to pump water into the District from the proposed basin.

Construction costs for this project were developed using construction costs from similar projects. Estimated total project costs are estimated to be $8,787,000. Applying a -20% to +30% contingency gives an estimated project cost range of $7,030,000 to $11,424,000. The total estimated project cost of $8,787,000 includes $5,989,000 in construction costs and $2,798,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

20.3 Project Ranking

This is a low scoring project due to the low demand for water storage. Constructing additional storage off of the DMC or SJR would provide benefit to the District, but these benefits will not be addressing any drastic District need. However, the project would improve District operations and their water storage supply if implemented.

21 Pipe the Well Ditch System

21.1 Project Description

The well ditch system branches off of the M Lateral at a settling pond and pump station located on Highway 33 between Lemon and Eucalyptus Avenues. It consists of approximately 2,600 linear feet of pipe and 4,900 linear feet of open ditch parallel to Highway 33. According to conversations with District staff, PID could benefit from converting this system into a pressurized piped system. No records were available for the pump station for design considerations, so it was assumed that it is not adequately sized to pressurize the entire system, which delivers an estimated 7 cfs to approximately 220 acres. Figure 8 (shown in Appendix B) depicts the alignment of the Well Ditch System to be pressurized.

21.2 Project Cost Estimate

It was assumed that the pump station at the head of the system will need to be replaced with a new 7 cfs pump station. The discharge pipeline was designed to have a maximum velocity of 5 feet per second. It was also assumed that 1) the 7 cfs capacity is needed throughout the entire system (constant discharge pipeline diameter), 2) the existing discharge pipeline is 18-inch diameter steel pipe, 3) the new discharge pipeline will be 18-inch diameter C900 PVC, and 4) that the structural foundation for the existing pump station has adequate integrity for the new pump and motor. The pump station housing will be replaced.

Construction costs for this project were developed using construction costs from similar projects. Estimated total project costs are estimated to be $1,262,000. Applying a -20% to +30% contingency gives an estimated project cost range of $1,010,000 to $1,641,000. The total estimated project cost of $1,262,000 includes $1,052,000 in construction costs and $210,000 in non-construction costs. A more detailed breakdown of these costs can be seen in Appendix C.

21.3 Project Ranking

This is a medium ranked project that will only impact a small portion of the District. The simplicity of the project and its relatively low cost may increase its priority to the District if the performance of the system continues to deteriorate.

22 Main Canal Rehab – Schedule B

Schedule B of the Main Canal Rehabilitation Project includes the abandonment of PID's Pumping Plants 4 and 5, the construction of a new Pumping Plant 4, and bypass piping around the abandoned Pumping Plant 5. Existing Pumping Plants 4 and 5 are operating at efficiencies estimated to be around 40% based on efficiency testing of abandoned Pumping Plants 2 and 3. In addition, any single molecule of water that moves through both plants compounds inefficiencies to the point where the plants are operated at an efficiency of approximately 16%, resulting in 84% waste of power supplied to the stations. The existing pumping plants have respective flow capacities of 110 and 65 cfs. Pumping Plant 5 tends to cause a capacity bottleneck for satisfying demands on Lat 5S, M Lateral, and Pumping Plant 6. With the expansion of Pumping Plant 4 to 200 cfs, PID would have plenty of flexibility for deliveries and meeting in-district and conveyance demand to the DMC.

22.1 Project Cost Estimate

Construction costs for this project were provided by the District and were developed by Stantec. The original estimates were developed in 2017 and have been updated to February 2019 dollar values. The total estimated project cost is $11,488,000, not including Construction Management and Engineering Services During Construction (CM/ESDC). The costs for CM/ESDC could range from $500,000 to $1,000,000 depending on timing and needs of the District for the project. A breakdown of the costs can be found in Appendix C.

22.2 Project Ranking

This project scored high in most categories and is anticipated to significantly improve the District's operations including water use and delivery efficiencies. These facilities need to be replaced as the existing facilities are a constraint in the District's main delivery system. This should be one of the top priorities for the District.

23 Main Canal Rehab – Schedule C

Schedule C of the Main Canal Rehabilitation Project includes the expansion of the open channel conveyance of PID's Main Canal on Reaches 1, 3, and 5. The expansion of the first lift addresses the bottleneck at the intersection of Las Palmas Avenue and the Main Canal. Las Palmas Avenue restricts the flow of the Main Canal and requires too much head to push the required pumping capacity through the crossing. The expansion of the third lift increases the capacity of the Main Canal from Sycamore Avenue to Pumping Plant 4 from 130 cfs to 200 cfs. The expansion of the fifth lift increases the capacity of the Main Canal from 65 cfs to 200 cfs up to Highway 33. These improvements would allow the District to operate its pump station at maximum capacity and maintain its water rights. These facilities will also maximize delivery flexibility within the District by allowing staff to move water to satisfy demand throughout the District without capacity limitations at any individual pumping facility.

Another facet of the project is implementing automation and monitoring of the heads of the District's main laterals. The lateral heads would be automated and monitored through PID's SCADA network.

Instead of relying on head adjustments on the lateral heads based on estimates of lateral demands, adjustments could be made based on flow rates to satisfy downstream demands and deliveries.

23.1 Project Cost Estimate

Construction costs for this project were provided by the District and were developed by Stantec. The original estimates were developed in 2017 and have been updated to February 2019 dollar values. The total estimated project cost is approximately $6,417,000, not including Construction Management and Engineering Services During Construction (CM/ESDC). The costs for CM/ESDC could range from $500,000 to $1,000,000 depending on timing and needs of the District for the project. A breakdown of the costs can be observed in Appendix C.

23.2 Project Ranking

This project scored high in most categories and is anticipated to significantly improve the District's operations including water use and delivery efficiencies. These facilities need to be expanded as the existing facilities are a constraint in the District's main delivery system. This should be one of the top priorities for the District.

1.4 OPPORTUNITY PROJECTS/PROGRAMS

1.4.1 Partner with Other Agencies for Out-of-District Recharge

If recharge projects are deemed infeasible it may be possible for the District to partner with other nearby agencies for out-of-District recharge. Water could be recharged or banked on behalf of PID in nearby recharge facilities, such as Central California Irrigation District's Orestimba Creek Recharge Facility. Recharged or banked water could be transferred, sold, or recovered and used during times of low surface water allocations.

1.4.2 Water Treatment Facility

There is an opportunity for the District to treat and deliver surface water to local Disadvantaged Communities (DACs) and Severely Disadvantaged Communities (SDACs). This project would help address water rights for lands that get annexed out of the District and would be part of PID's on-going conservation efforts to decrease consumptive use to free up pre-1914 water to service DACs and SDACs.

1.4.3 Construction of a 160 CFS Pump Station to the DMC

One project that is a component of the Main Canal Rehabilitation Project is a 160 cfs pump station to the DMC (originally a component of the East-West Conveyance Feasibility Study). With the construction of the 200 cfs facility improvements from the San Joaquin River to Highway 33, the District will maximize its flexibility and operations in order to satisfy grower demand in high demand months. This flexibility is beneficial during the irrigation season from an operations standpoint. From a financial standpoint, the benefit of the facilities expansion can be maximized with the construction of an additional 160 cfs pump station to the DMC. This pumping facility would complement the current 40 cfs capacity of Pumping Plant 6. The proposed pump station would allow the District to have a revenue-generating facility that could take advantage of the District's unused system capacity in the off-season to move water for parties that have a water supply to move.

Another benefit to the District on this project is the potential to address climate change and be able to capture higher flows in the San Joaquin River during dry years with a heavy rainfall. The District could pump

water during these years to put into storage in the event that the District water allotments are curtailed that year. Right now, the District can pump approximately 2,000 acre-feet in a good month; whereas the District could pump that same volume in five days if the District had a pumping station that supplied an additional 160 cfs to the DMC. Preliminary estimates put this project at around $25 million to construct.

Appendix A –
Project Ranking Matrix

Patterson Irrigation District - Lateral Evaluation Project

EST. 1968 PROVOST& PRITCHARD CONSULTING GROUP
An Employee Owned Company

PROJECT: Patterson ID - CIP

DATE: 11/12/2019

DESCRIPTION: Project Scoring Matrix by Project Ranking

Project No.	Project Name	A Acres Serviced / Area of Impact 1 - 10	B Estimated Capital Cost 1 - 10	C Need for Improvement / Age of Existing Infrastructure 1 - 10	D Improvements to Water Supply and Storage 1 - 10	E Improvements to Operations 1 - 10	F Environmental Impact / Permitting 1 - 10	**Total Project Score**	**Overall Project Priority / Implemenation Order**	**Low-End Cost Estimate (-20% Contingency)**	**High-End Cost Estimate (+30% Contingency)**
1	SSR Pump Station Relocation	7	5	9	8	8	9	46	1	$ 501,000	$ 814,000
16	North Side Recirculation System Expansion	7	4	5	10	10	5	41	2	$ 796,000	$ 1,294,000
23	Main Canal Rehab - Schedule C	7	3	10	7	7	7	41	2	$ 3,700,000	$ 5,100,000
13	Cast-in-Place Pipeline Replacement	6	3	10	6	9	6	40	4	$ 3,216,000	$ 5,225,000
22	Main Canal Rehab - Schedule B	7	3	9	7	7	7	40	4	$ 6,700,000	$ 9,200,000
6.1	Alleviate Lateral 2N Capacity Constraints - Culvert Replacement Option	6	7	8	4	9	5	39	6	$ 196,000	$ 319,000
6.2	Alleviate Lateral 2N Capacity Constraints - Bypass Pipeline Option	6	5	8	4	9	6	38	7	$ 433,000	$ 703,000
7.1	Alleviate M Lateral Capacity Constraint - Culvert Replacement Option	3	10	7	4	8	5	37	8	$ 70,000	$ 114,000
7.2	Alleviate M Lateral Capacity Constraint - Bypass Pipeline Option	3	8	7	4	8	6	36	9	$ 150,000	$ 244,000
4	Pipe Laterals Inside City Limits	5	3	10	3	6	8	35	10	$ 6,612,000	$ 10,744,000
19	Metering Project	9	3	6	4	7	6	35	10	$ 920,000	$ 1,495,000
8.3	Alleviate Lateral 3S Extension Capacity Constraint - Long Bypass Pipeline Option	2	8	7	3	7	7	34	12	$ 167,000	$ 271,000
18.1	Automate Check Structures and Lateral Interties - Rubicon	8	1	4	3	10	6	32	13	$ 11,935,000	$ 19,394,000
18.2	Automate Check Structures and Lateral Interties - District Fabricated Gates	8	2	4	3	10	4	31	14	$ 5,710,000	$ 9,279,000
21	Pipe the Well Ditch System	1	8	7	0	6	9	31	14	$ 1,010,000	$ 1,641,000
8.1	Alleviate Lateral 3S Extension Capacity Constraint - Culvert Replacement Option	2	6	7	3	7	5	30	16	$ 224,000	$ 364,000
8.2	Alleviate Lateral 3S Extension Capacity Constraint - Short Bypass Pipeline Option	2	6	7	3	7	5	30	16	$ 156,000	$ 254,000
9	North Side Storage Basin	5	3	6	8	5	2	29	18	$ 970,000	$ 1,576,000
11	Increase Lateral Capacities	8	1	4	4	8	3	28	19	$ 3,251,000	$ 5,283,000
14	Main Canal Settling Pond	7	5	5	1	6	3	27	20	$ 249,000	$ 405,000
10	2S-9 Supplmentary Pipeline	2	4	7	0	3	10	26	21	$ 499,000	$ 810,000
12	Water Quality Monitoring Stations	1	9	2	0	4	9	25	22	$ 84,000	$ 137,000
3	Concrete Lining of Laterals	3	2	6	1	5	7	24	23	$ 1,770,000	$ 2,877,000
20	Construct Storage Basin off SJR or DMC	5	2	1	6	5	3	22	24	$ 7,030,000	$ 11,424,000
2	Groundwater Bank Feasibility Study and Construction	4	2	1	7	4	3	21	25	$ 4,340,000	$ 7,052,000
17	Construct Additional Monitoring Wells	2	7	3	2	1	5	20	26	$ 215,000	$ 349,000
15	Del Puerto Creek Recharge Project	2	6	2	7	1	1	19	27	$ 226,000	$ 367,000
5	Concrete Lining of Sublaterals	2	4	2	1	2	7	18	28	$ 527,000	$ 856,000

Category A - Higher values represent an impact to larger portions of the Distirct

Category B - Higher values represent lower estimated project capital costs

Category C - Higher values represent improvements to facilities that are currently failing, in danger of failing, and pose significant safety risks if they failed

Category D - Higher values represent projects that will significantly improve and/or increase the District's water supply and storage

Category E - Higher values represent projects with bigger improvements to District operations and efficiencies

Category F - Higher values represent projects that are not anticipated to have significant implementation issues due to permitting and environmental regulations.

Patterson Irrigation District - Lateral Evaluation Project

EST. 1968 PROVOST& PRITCHARD CONSULTING GROUP
An Employee Owned Company

PROJECT: Patterson ID - CIP

DATE: 11/12/2019

DESCRIPTION: Project Scoring Matrix by Project Number

Project No.	Project Name	A Acres Serviced / Area of Impact 1 - 10	B Estimated Capital Cost 1 - 10	C Need for Improvement / Age of Existing Infrastructure 1 - 10	D Improvements to Water Supply and Storage 1 - 10	E Improvements to Operations 1 - 10	F Environmental Impact / Permitting 1 - 10	**Total Project Score**	**Overall Project Priority / Implemenation Order**	**Low-End Cost Estimate (-20% Contingency)**	**High-End Cost Estimate (+30% Contingency)**
1	SSR Pump Station Relocation	7	5	9	8	8	9	46	1	$ 501,000	$ 814,000
2	Groundwater Bank Feasibility Study and Construction	4	2	1	7	4	3	21	25	$ 4,340,000	$ 7,052,000
3	Concrete Lining of Laterals	3	2	6	1	5	7	24	23	$ 1,770,000	$ 2,877,000
4	Pipe Laterals Inside City Limits	5	3	10	3	6	8	35	10	$ 6,612,000	$ 10,744,000
5	Concrete Lining of Sublaterals	2	4	2	1	2	7	18	28	$ 527,000	$ 856,000
6.1	Alleviate Lateral 2N Capacity Constraints - Culvert Replacement Option	6	7	8	4	9	5	39	6	$ 196,000	$ 319,000
6.2	Alleviate Lateral 2N Capacity Constraints - Bypass Pipeline Option	6	5	8	4	9	6	38	7	$ 433,000	$ 703,000
7.1	Alleviate M Lateral Capacity Constraint - Culvert Replacement Option	3	10	7	4	8	5	37	8	$ 70,000	$ 114,000
7.2	Alleviate M Lateral Capacity Constraint - Bypass Pipeline Option	3	8	7	4	8	6	36	9	$ 150,000	$ 244,000
8.1	Alleviate Lateral 3S Extension Capacity Constraint - Culvert Replacement Option	2	6	7	3	7	5	30	16	$ 224,000	$ 364,000
8.2	Alleviate Lateral 3S Extension Capacity Constraint - Short Bypass Pipeline Option	2	6	7	3	7	5	30	16	$ 156,000	$ 254,000
8.3	Alleviate Lateral 3S Extension Capacity Constraint - Long Bypass Pipeline Option	2	8	7	3	7	7	34	12	$ 167,000	$ 271,000
9	North Side Storage Basin	5	3	6	8	5	2	29	18	$ 970,000	$ 1,576,000
10	2S-9 Supplmentary Pipeline	2	4	7	0	3	10	26	21	$ 499,000	$ 810,000
11	Increase Lateral Capacities	8	1	4	4	8	3	28	19	$ 3,251,000	$ 5,283,000
12	Water Quality Monitoring Stations	1	9	2	0	4	9	25	22	$ 84,000	$ 137,000
13	Cast-in-Place Pipeline Replacement	6	3	10	6	9	6	40	4	$ 3,636,000	$ 5,908,000
14	Main Canal Settling Pond	7	5	5	1	6	3	27	20	$ 249,000	$ 405,000
15	Del Puerto Creek Recharge Project	2	6	2	7	1	1	19	27	$ 226,000	$ 367,000
16	North Side Recirculation System Expansion	7	4	5	10	10	5	41	2	$ 796,000	$ 1,294,000
17	Construct Additional Monitoring Wells	2	7	3	2	1	5	20	26	$ 288,000	$ 468,000
18.1	Automate Check Structures and Lateral Interties - Rubicon	8	1	4	3	10	6	32	13	$ 11,935,000	$ 19,394,000
18.2	Automate Check Structures and Lateral Interties - District Fabricated Gates	8	2	4	3	10	4	31	14	$ 5,710,000	$ 9,279,000
19	Metering Project	9	3	6	4	7	6	35	10	$ 920,000	$ 1,495,000
20	Construct Storage Basin off SJR or DMC	5	2	1	6	5	3	22	24	$ 7,030,000	$ 11,424,000
21	Pipe the Well Ditch System	1	8	7	0	6	9	31	14	$ 1,010,000	$ 1,641,000
22	Main Canal Rehab - Schedule B	7	3	9	7	7	7	40	4	$ 6,700,000	$ 9,200,000
23	Main Canal Rehab - Schedule C	7	3	10	7	7	7	41	2	$ 3,700,000	$ 5,100,000

Category A - Higher values represent an impact to larger portions of the Distirct

Category B - Higher values represent lower estimated project capital costs

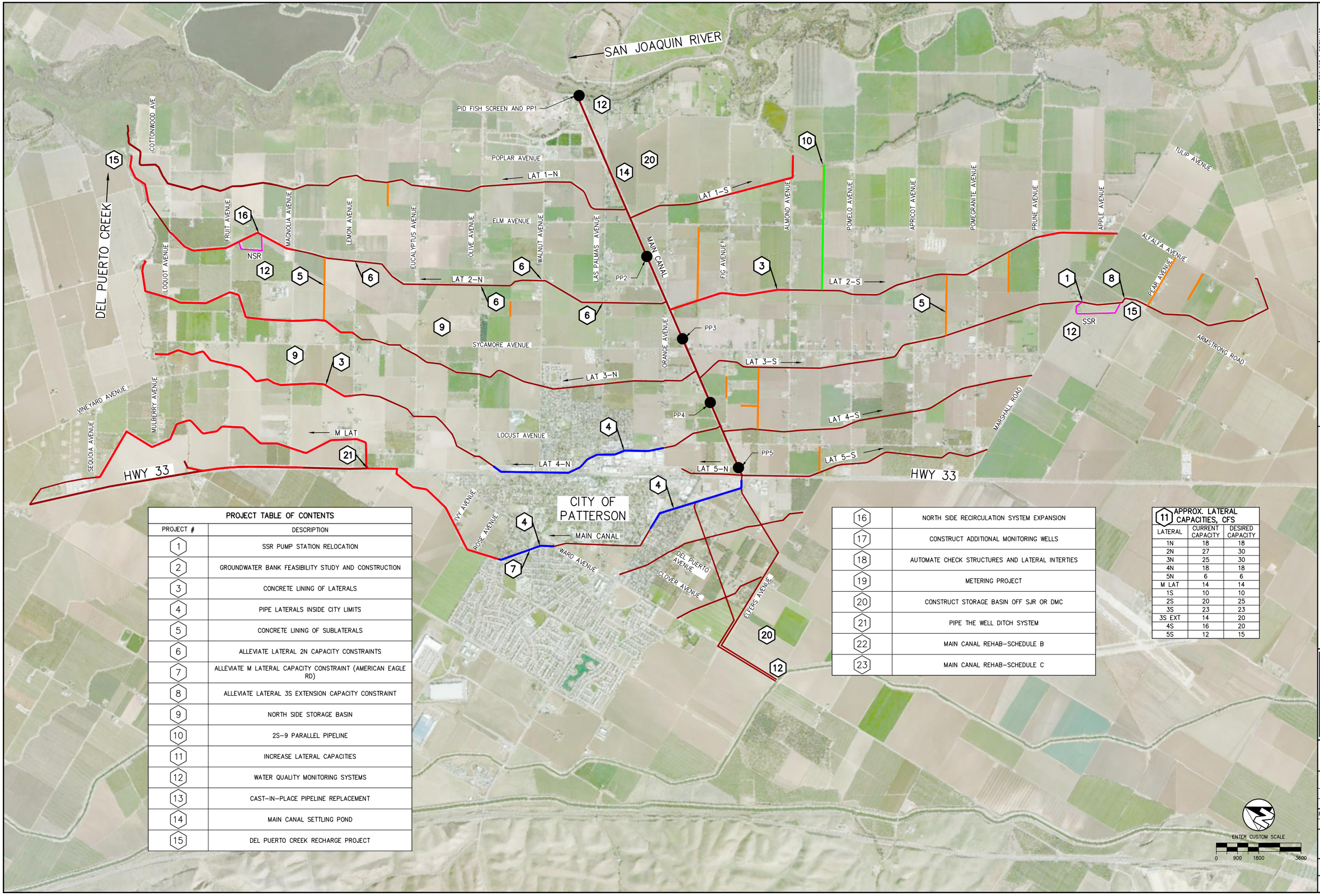
Category C - Higher values represent improvements to facilities that are currently failing, in danger of failing, and pose significant safety risks if they failed

Category D - Higher values represent projects that will significantly improve and/or increase the District's water supply and storage

Category E - Higher values represent projects with bigger improvements to District operations and efficiencies

Category F - Higher values represent projects that are not anticipated to have significant implementation issues due to permitting and environmental regulations.

Appendix B –
Project Figures



PROJECT TABLE OF CONTENTS	
PROJECT #	DESCRIPTION
1	SSR PUMP STATION RELOCATION
2	GROUNDWATER BANK FEASIBILITY STUDY AND CONSTRUCTION
3	CONCRETE LINING OF LATERALS
4	PIPE LATERALS INSIDE CITY LIMITS
5	CONCRETE LINING OF SUBLATERALS
6	ALLEVIATE LATERAL 2N CAPACITY CONSTRAINTS
7	ALLEVIATE M LATERAL CAPACITY CONSTRAINT (AMERICAN EAGLE RD)
8	ALLEVIATE LATERAL 3S EXTENSION CAPACITY CONSTRAINT
9	NORTH SIDE STORAGE BASIN
10	2S–9 PARALLEL PIPELINE
11	INCREASE LATERAL CAPACITIES
12	WATER QUALITY MONITORING SYSTEMS
13	CAST–IN–PLACE PIPELINE REPLACEMENT
14	MAIN CANAL SETTLING POND
15	DEL PUERTO CREEK RECHARGE PROJECT

16	NORTH SIDE RECIRCULATION SYSTEM EXPANSION
17	CONSTRUCT ADDITIONAL MONITORING WELLS
18	AUTOMATE CHECK STRUCTURES AND LATERAL INTERTIES
19	METERING PROJECT
20	CONSTRUCT STORAGE BASIN OFF SJR OR DMC
21	PIPE THE WELL DITCH SYSTEM
22	MAIN CANAL REHAB–SCHEDULE B
23	MAIN CANAL REHAB–SCHEDULE C

11 APPROX. LATERAL CAPACITIES, CFS

LATERAL	CURRENT CAPACITY	DESIRED CAPACITY
1N	18	18
2N	27	30
3N	25	30
4N	18	18
5N	6	6
M LAT	14	14
1S	10	10
2S	20	25
3S	23	23
3S EXT	14	20
4S	16	20
5S	12	15

CONCEPTUAL
NOT FOR CONSTRUCTION
AUGUST 2019

No.	REVISION	BY	DATE

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DATE SIGNED: ____

CAPITAL IMPROVEMENT PLAN
PATTERSON IRRIGATION DISTRICT
STANISLAUS COUNTY, CA
FIGURE 1
PROJECT SUMMARY MAP

PROVOST & PRITCHARD
CONSULTING ENGINEERS
An Employee Owned Company
286 WEST CROMWELL AVENUE
FRESNO, CALIFORNIA 93711–6162
559/449–2700 FAX 559/449–2715
www.ppeng.com

DESIGN ENGINEER: ALEX COLLINS
LICENSE NO: 78242

DRAFTED BY:	CHECKED BY:
TRS	TRS

DATE: AUGUST 2019
JOB NO: 220418001
PROJECT NO: 220418001
PHASE: CIP

0 1"
ORIGINAL SCALE SHOWN IS ONE INCH. ADJUST SCALE FOR REDUCED OR ENLARGED PLANS.

SHEET
1 OF 8

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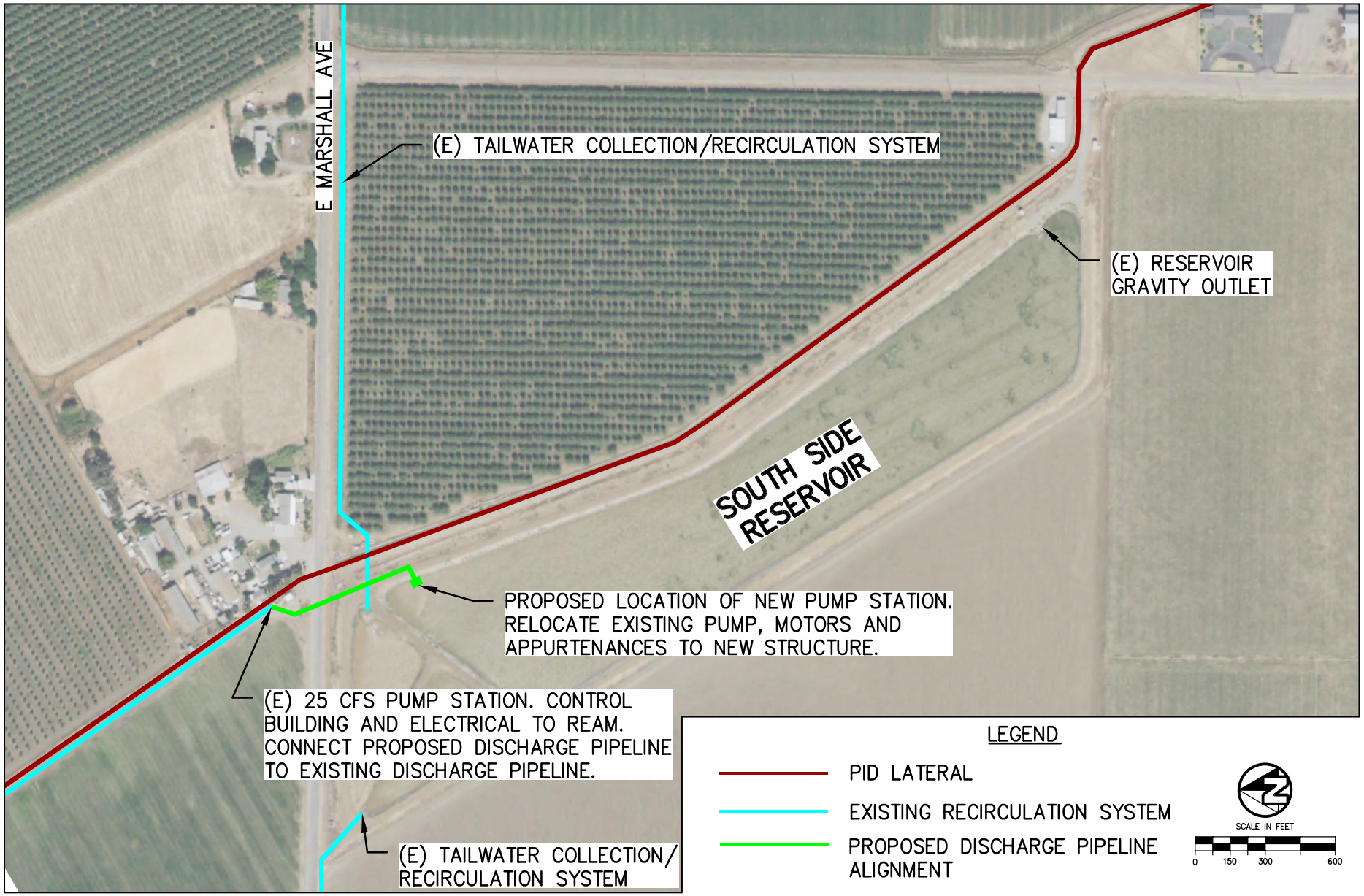

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CAPITAL IMPROVEMENT PLAN
FIGURE 2
PATTERSON IRRIGATION DISTRICT
STANISLAUS COUNTY, CA

PROJECT 1: SSR PUMP STATION RELOCATION

DESIGN ENGINEER: ALEX COLLINS
DATE: AUGUST 2019
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SHEET 2 OF 8

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WARNING
POWER LINES OVERHEAD

SAN JOAQUIN RIVER

PID FISH SCREEN AND PP1

COTTONWOOD AVE
FRUIT AVENUE
MAGNOLIA AVENUE
LEMON AVENUE
EUCALYPTUS AVENUE
OLIVE AVENUE
WALNUT AVENUE
ORANGE AVENUE
FIG AVENUE
ALMOND AVENUE
POMELO AVENUE
APRICOT AVENUE
POMEGRANITE AVENUE
PRUNE AVENUE
APPLE AVENUE
TULIP AVENUE

POPLAR AVENUE
LAT 1-N
LAT 1-S
ELM AVENUE
LAT 2-N
LAT 2-S
PP2
MAIN CANAL
PP3
SYCAMORE AVENUE
LAT 3-N
LAT 3-S
ALFALFA AVENUE
PEAR AVENUE
ARMSTRONG ROAD
PP4
LAT 4-N
LAT 4-S
MARSHALL ROAD
LOCUST AVENUE
PP5
LAT 5-N
LAT 5-S
M LAT

DEL PUERTO CREEK
LOQUOT AVENUE
VINEYARD AVENUE
MULBERRY AVENUE
SEQUOIA AVENUE
HWY 33
HWY 33

CONSTRUCT CONCRETE LINING IN EXISTING LATERALS (TYP)

IVY AVENUE
ROSE AVENUE
CITY OF PATTERSON
MAIN CANAL
WARD AVENUE
DEL PUERTO AVENUE
CLOVER AVENUE
ELFERS AVENUE

DELTA-MENDOTA CANAL
CA AQUEDUCT

CONCRETE LINING	
LATERAL	LF OF CANAL
1-S	3,700
2-S	8,600
2-N	7,300
3-N	6,300
4-N	8,000
M LAT	16,500

LEGEND

PID MAIN CANAL AND LATERALS

CONSTRUCT CONCRETE LINING IN EXISTING EARTHEN LATERALS

SCALE IN FEET
0 900 1800 3600

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CAPITAL IMPROVEMENT PLAN
PATTERSON IRRIGATION DISTRICT
STANISLAUS COUNTY, CA

FIGURE 3
PROJECT 3: CONCRETE LINING OF LATERALS

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8/9/2019 10:47 AM G:\Patterson ID-2204\220418001-Lateral Evaluation\DWG\EXHIBIT\REPORT FIGURES\FIGURE 3 - CONCRETE LINING OF LATERALS.dwg -Jesse Serpa

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WARNING
POWER LINES OVERHEAD

SAN JOAQUIN RIVER
PID FISH SCREEN AND PP1
DEL PUERTO CREEK
COTTONWOOD AVE
FRUIT AVENUE
MAGNOLIA AVENUE
LEMON AVENUE
EUCALYPTUS AVENUE
OLIVE AVENUE
WALNUT AVENUE
ORANGE AVENUE
FIG AVENUE
ALMOND AVENUE
POMELO AVENUE
APRICOT AVENUE
POMEGRANITE AVENUE
PRUNE AVENUE
APPLE AVENUE
TULIP AVENUE
POPLAR AVENUE
LAT 1-N
2N-21
LAT 1-S
ELM AVENUE
LAS PALMAS AVENUE
MAIN CANAL
PP2
2S-2
LOQUOT AVENUE
NSR
3N-27
LAT 2-N
LAT 2-S
3S-22
ALFALFA AVENUE
PEAR AVENUE
3N-12
OPEN CHANNEL SUBLATERAL TO BE LINED (TYP)
3S-18
SSR
PP3
SYCAMORE AVENUE
4S-25
ARMSTRONG ROAD
LAT 3-S
LAT 3-N
4S-1
4S-4
VINEYARD AVENUE
MULBERRY AVENUE
PP4
LAT 4-S
MARSHALL ROAD
SEQUOIA AVENUE
M LAT
LOCUST AVENUE
5S-12
PP5
5S-5
LAT 4-N
LAT 5-N
LAT 5-S
HWY 33
HWY 33
IVY AVENUE
ROSE AVENUE
CITY OF PATTERSON
MAIN CANAL
WARD AVENUE
DEL PUERTO AVENUE
CLOVER AVENUE
ELFERS AVENUE
DELTA-MENDOTA CANAL
CA AQUEDUCT

CONCRETE LINER	
SUBLATERAL	LF OF CANAL
2N-21	1,000
3N-12	700
3N-27	2,400
2S-2	3,100
3S-18	2,600
3S-22	1,700
4S-1	1,000
4S-4	3,400
4S-25	3,400
5S-5	1,100
5S-12	400

LEGEND

PID MAIN CANAL AND LATERALS

CONSTRUCT CONCRETE LINING IN EXISTING EARTHEN SUBLATERALS

SCALE IN FEET
0 900 1800 3600

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CAPITAL IMPROVEMENT PLAN
PATTERSON IRRIGATION DISTRICT
STANISLAUS COUNTY, CA

FIGURE 4
PROJECT 5: CONCRETE LINING OF SUBLATERALS

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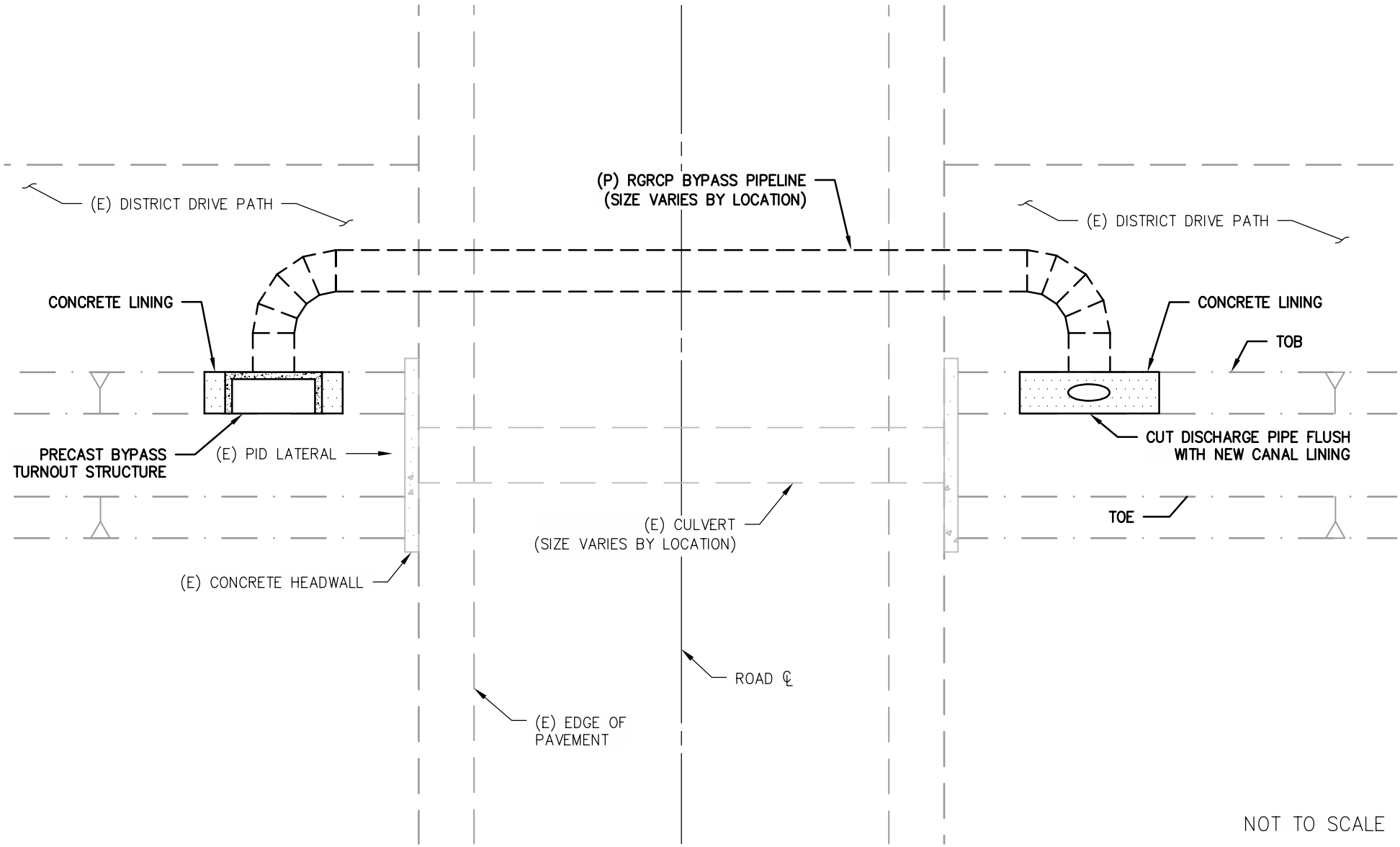
8/9/2019 4:30 PM G:\Patterson ID-2204\220418001-Lateral Evaluation\DWG\EXHIBIT\REPORT FIGURES\FIGURE 4 - CONCRETE LINING OF SUBLATERALS.dwg -Jesse Serpa



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CAPITAL IMPROVEMENT PLAN
FIGURE 5
PATTERSON IRRIGATION DISTRICT
STANISLAUS COUNTY, CA

TYPICAL BYPASS PIPELINE OPTION

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CAPITAL IMPROVEMENT PLAN
FIGURE 6
PATTERSON IRRIGATION DISTRICT
STANISLAUS COUNTY, CA

PROJECT 8.3: 3S EXT CAPACITY CONSTRAINT

DESIGN ENGINEER: ALEX COLLINS
DATE: AUGUST 2019
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SAN JOAQUIN RIVER

PID FISH SCREEN AND PP1

WARNING
POWER LINES OVERHEAD

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POPLAR AVENUE

COTTONWOOD AVE

FRUIT AVENUE

MAGNOLIA AVENUE

LEMON AVENUE

EUCALYPTUS AVENUE

OLIVE AVENUE

WALNUT AVENUE

ORANGE AVENUE

FIG AVENUE

LAT 1-N

LAT 1-S

ELM AVENUE

2N-27 INTERTIE

CONSTRUCT 10 CFS PUMP STATION IN NSR

NSR

F&I 24"ø C900 PVC RECIRCULATION PIPELINE

CONSTRUCT 5 CFS LIFT STATION AND INTERTIE TO LATERAL 3-N

LAT 2-N

MAIN CANAL

PP2

LAT 2-S

DEL PUERTO CREEK

LOQUOT AVENUE

EXISTING RECIRCULATION SYSTEM

SYCAMORE AVENUE

PP3

LAT 3-S

LAT 3-N

VINEYARD AVENUE

MULBERRY AVE.

PP4

LAT 4-S

M LAT

SEQUOIA AVENUE

LAT 4-N

PP5

LAT 5-S

LAT 5-N

HWY 33

CITY OF PATTERSON

IVY AVENUE

DEL PUERTO AVENUE

ROSE AVE.

MAIN CANAL

CLOVER AVENUE

LEGEND

PID MAIN CANAL AND LATERALS

EXISTING RECIRCULATION SYSTEM

SCALE IN FEET
0 500 1000 2000

CONCEPTUAL
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AUGUST 2019

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CAPITAL IMPROVEMENT PLAN

PATTERSON IRRIGATION DISTRICT
STANISLAUS COUNTY, CA

FIGURE 7
PROJECT 16: NORTH SIDE
RECIRCULATION SYSTEM EXPANSION

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PROJECT NO: 220418001
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6/26/2019 12:25 PM G:\Patterson ID-2204\220418001-Laterals Evaluation\DWG\EXHIBITS\REPORT FIGURES\FIGURE 9 - NSR SYSTEM EXPANSION.dwg - Justin Faure

Figure 8

Project 13 - Well Ditch Replacement

Appendix C –
Engineer's Opinion of Project Costs

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 1 - SOUTH SIDE RESERVOIR PUMP STATION RELOCATION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 23,000	$ 23,000
2	Worker and Public Protection (2%)	1	LS	$ 9,000	$ 9,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 23,000	$ 23,000
4	SWPPP and DCP (2%)	1	LS	$ 9,000	$ 9,000
				Subtotal	**$ 64,000**
Construction Items					
5	Pump Station Excavation	250	CY	$ 10	$ 2,500
6	Pump Station Backfill and Compaction	200	CY	$ 15	$ 3,000
7	Construct Pump Station	50	CY	$ 2,000	$ 100,000
8	Disconnect, Extend, and Reconnect Electrical; Modify SCADA	1	LS	$ 250,000	$ 250,000
9	Relocate (2) Pumps and Appurtenances to New Pump Station	1	LS	$ 49,000	$ 49,000
10	F&I Water Level Sensors	4	EA	$ 4,000	$ 16,000
11	Construct 24-Inch PVC Pipeline	400	LF	$ 80	$ 32,000
12	Marshall Rd Pipeline Crossing	1	LS	$ 5,000	$ 5,000
				Subtotal	**$ 458,000**
			CONSTRUCTION SUBTOTAL		**$ 522,000**
Non-Construction Items (% of Construction Subtotal)					
13	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 52,000	$ 52,000
14	Construction Review (10%)	1	LS	$ 52,000	$ 52,000
			NON-CONSTRUCTION SUBTOTAL		**$ 104,000**
				Estimated Project Total	**$ 626,000**
	Contingency Range:		-20%		30%
	Preliminary Cost Estimate Range:		**$ 501,000**	**to**	**$ 814,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Further analysis is needed to explore the feasibility of moving pumps and motors but leaving electrical equipment in place.
4. Costs to disconnect, extend, and reconnect electrical/SCADA equipment is a best guess estimate by P&P and will require further analysis.
5. Assumes all pump station equipment can be salvaged and reused.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 2 - GROUNDWATER BANKING FACILITY
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 124,000	$ 124,000
2	Worker and Public Protection (2%)	1	LS	$ 50,000	$ 50,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 124,000	$ 124,000
4	SWPPP and DCP (2%)	1	LS	$ 50,000	$ 50,000
				Subtotal	**$ 348,000**
Construction Items					
5	Clearing and Grubbing	1	LS	$ 50,000	$ 50,000
6	Site Demolition	1	LS	$ 75,000	$ 75,000
7	Construct 100-Acre Recharge Basin (Levees, Keyway, Fencing/Gates)	1	LS	$ 961,000	$ 961,000
8	Construct Basin Inlet Structure	1	LS	$ 220,000	$ 220,000
9	Construct Basin Intertie Structures	2	EA	$ 160,000	$ 320,000
10	Construct Pipe Culvert from Lateral 3N to Basin	1	LS	$ 75,000	$ 75,000
11	F&I Class II Aggregate Base Levee Road Surface	3,420	TN	$ 30	$ 103,000
12	Construct Recovery Well	1	EA	$ 520,000	$ 520,000
13	Construct Discharge Manifold	1	LS	$ 36,000	$ 36,000
14	Construct Monitoring Well	3	EA	$ 40,000	$ 120,000
				Subtotal	**$ 2,480,000**
			CONSTRUCTION SUBTOTAL		**$ 2,828,000**
Non-Construction Items (% of Construction Subtotal)					
15	Feasibility Study	1	LS	$ 30,000	$ 30,000
16	Land Acquisition	100	AC	$ 20,000	$ 2,000,000
15	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 283,000	$ 283,000
17	Construction Review (10%)	1	LS	$ 283,000	$ 283,000
			NON-CONSTRUCTION SUBTOTAL		**$ 2,596,000**
				Estimated Project Total	**$ 5,424,000**
	Contingency Range:		-20%		30%
	Preliminary Cost Estimate Range:		**$ 4,340,000**	**To**	**$ 7,052,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Costs were modified from a groundwater banking project of similar size and magnitude.
4. Assumes that a 100-acre groundwater bank is feasible within Patterson ID.
5. Assumes three cells, ~400 acre-feet of storage, 20 ft wide drive banks, 2:1 exterior & 1.5:1 interior side slopes, two inlet structures.
6. No set location for groundwater bank within District; assumed to be located near the downstream end of Lateral 3N.
7. Costs for land acquisition, clearing and grubbing, and site demolition will vary based on final site location, existing infrastructure and crop type.
8. Land acquisition costs are approximate and will vary based on crop type and current market prices. It is assumed that acquired land does not have trees.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 3 - CONCRETE LINING OF LATERALS
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 88,000	$ 88,000
2	Worker and Public Protection (2%)	1	LS	$ 35,000	$ 35,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 88,000	$ 88,000
4	SWPPP and DCP (2%)	1	LS	$ 35,000	$ 35,000
				Subtotal	**$ 246,000**
Construction Items					
	Lateral 2-N Concrete Lining (7,300 LF)				
5	Canal Cleanup	7,300	LF	$ 3	$ 22,000
6	Construct Concrete Lining	7,300	LF	$ 32	$ 234,000
				Subtotal	**$ 256,000**
	Lateral 3-N Concrete Lining (6,300 LF)				
7	Canal Cleanup	6,300	LF	$ 3	$ 19,000
8	Construct Concrete Lining	6,300	LF	$ 32	$ 202,000
				Subtotal	**$ 221,000**
	Lateral 4-N Concrete Lining (8,000 LF)				
9	Canal Cleanup	8,000	LF	$ 3	$ 24,000
10	Construct Concrete Lining	8,000	LF	$ 32	$ 256,000
				Subtotal	**$ 280,000**
	M Lateral Concrete Lining (16,500 LF)				
11	Canal Cleanup	16,500	LF	$ 3	$ 50,000
12	Construct Concrete Lining	16,500	LF	$ 32	$ 528,000
				Subtotal	**$ 578,000**
	Lateral 1-S Concrete Lining (3,700 LF)				
13	Canal Cleanup	3,700	LF	$ 3	$ 11,000
14	Construct Concrete Lining	3,700	LF	$ 32	$ 118,000
				Subtotal	**$ 129,000**
	Lateral 2-S Concrete Lining (8,600 LF)				
15	Canal Cleanup	8,600	LF	$ 3	$ 26,000
16	Construct Concrete Lining	8,600	LF	$ 32	$ 275,000
				Subtotal	**$ 301,000**
				CONSTRUCTION SUBTOTAL	**$ 2,011,000**
Non-Construction Items (% of Construction Subtotal)					
17	Survey, Engineering, Environmental Documentation, Permitting Assistance (5%)	1	LS	$ 101,000	$ 101,000
18	Construction Review (5%)	1	LS	$ 101,000	$ 101,000
				NON-CONSTRUCTION SUBTOTAL	**$ 202,000**
				Estimated Project Total	**$ 2,213,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 1,770,000**	**To**	**$ 2,877,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects and lining costs supplied by PID.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes minimal canal grading and cleanup will be required. Assumes no import or export of soil is required.
4. Assumes any demolished lining will be used as rip rap within the District (does not account for demolition or hauling costs).
5. Assumes District will remove and replace all lining and turnouts.
6. Costs do not include factors for scale of economy. The more work that is performed at one time typically equates to lower construction unit costs.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 4 - PIPE LATERALS INSIDE CITY LIMITS
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 302,000	$ 302,000
2	Worker and Public Protection (2%)	1	LS	$ 121,000	$ 121,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 302,000	$ 302,000
4	SWPPP and DCP (2%)	1	LS	$ 121,000	$ 121,000
				Subtotal	**$ 846,000**
Construction Items					
	Pipe Lateral 4N (7,500 LF)				
5	Remove (E) Concrete Lining	152,300	SF	$ 3.00	$ 457,000
6	F&I 48-inch RGRCP Pipeline	7,500	LF	$ 252	$ 1,890,000
7	F&I Air Vent	7	EA	$ 5,000	$ 35,000
8	Import Backfill Material	11,000	CY	$ 24	$ 264,000
9	Tie Into Existing Turnouts	10	EA	$ 8,000	$ 80,000
10	Tie Into Existing Orange Ave Crossing (One Side Only)	1	LS	$ 10,000	$ 10,000
11	Tie Into Existing Las Palmas Ave Crossing	1	LS	$ 20,000	$ 20,000
12	Tie Into Existing Culvert at N 1st St #1	1	LS	$ 20,000	$ 20,000
13	Tie Into Existing Walnut Ave Crossing	1	LS	$ 20,000	$ 20,000
14	Tie Into Existing Culvert at Salada Creek Crossing	1	LS	$ 20,000	$ 20,000
15	Tie Into Existing Culvert at N 1st St #2	1	LS	$ 20,000	$ 20,000
				Subtotal	**$ 2,836,000**
	Pipe M-Lat Lateral (8,000 LF)				
16	Remove (E) Concrete Lining	200,800	SF	$ 3	$ 602,000
17	F&I 48-inch RGRCP Pipeline	8,000	LF	$ 252	$ 2,016,000
18	F&I Air Vent	7	EA	$ 5,000	$ 35,000
19	Import Backfill Material	11,700	CY	$ 24	$ 281,000
20	Tie Into Existing Turnouts	20	EA	$ 8,000	$ 160,000
21	Tie Into Existing Pipe Culvert at HWY 33	1	LS	$ 10,000	$ 10,000
22	Tie Into Existing Pipe Culvert at Poppy Ave	1	LS	$ 20,000	$ 20,000
23	Tie Into Existing Pipe Culvert at Del Puerto Ave	1	LS	$ 20,000	$ 20,000
24	Tie Into Existing Pipe Culvert at Ward Ave	1	LS	$ 20,000	$ 20,000
25	Tie Into Existing Pipe Culvert at American Eagle Ave	1	LS	$ 20,000	$ 20,000
26	Tie Into Existing Pipe Culvert at Cliff Swallow Dr	1	LS	$ 20,000	$ 20,000
				Subtotal	**$ 3,204,000**
			CONSTRUCTION SUBTOTAL		**$ 6,886,000**
Non-Construction Items (% of Construction Subtotal)					
27	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 689,000	$ 689,000
28	Construction Review (10%)	1	LS	$ 689,000	$ 689,000
			NON-CONSTRUCTION SUBTOTAL		**$ 1,378,000**
				Estimated Project Total	**$ 8,264,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 6,612,000**	**To**	**$ 10,744,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 4 - PIPE LATERALS INSIDE CITY LIMITS
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. Lateral 4N piping extents: Orange Ave to Olive Ave.
5. M Lateral piping extents: Hwy 33 to Del Puerto Ave, Ward Ave to Cliff Swallow Dr.
6. Connections to existing headwalls/road crossings is made by doweling into existing headwalls.
7. No hydraulic analysis was performed to asses implications from the proposed improvements.
8. The number of turnouts is based on records supplied by the District plus 10%. Sizes and materials are unknown.
9. Assumes no flow measurement is required on the newly piped sections.
10. Assumes that existing turnouts can be re-constructed by teeing off the new pipeline.
11. Lateral 4N crosses N 1st St twice.
12. Assumes existing headwalls are structurally sound and can handle the proposed improvements.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 5 - CONCRETE LINING OF SUBLATERALS
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 21,000	$ 21,000
2	Worker and Public Protection (2%)	1	LS	$ 8,000	$ 8,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 21,000	$ 21,000
4	SWPPP and DCP (2%)	1	LS	$ 8,000	$ 8,000
				Subtotal	**$ 58,000**
Construction Items					
	Sublateral 2N-21 (1,000 LF)				
5	Canal Cleanup	1,000	LF	$ 2	$ 2,000
6	Construct Concrete Lining	1,000	LF	$ 21	$ 21,000
				Subtotal	**$ 23,000**
	Sublateral 3N-12 (700 LF)				
7	Canal Cleanup	700	LF	$ 2	$ 1,000
8	Construct Concrete Lining	700	LF	$ 21	$ 15,000
				Subtotal	**$ 16,000**
	Sublateral 3N-27 (2,400 LF)				
9	Canal Cleanup	2,400	LF	$ 2	$ 5,000
10	Construct Concrete Lining	2,400	LF	$ 21	$ 50,000
				Subtotal	**$ 55,000**
	Sublateral 2S-2 (3,100 LF)				
11	Canal Cleanup	3,100	LF	$ 2	$ 6,000
12	Construct Concrete Lining	3,100	LF	$ 21	$ 65,000
				Subtotal	**$ 71,000**
	Sublateral 3S-18 (3,400 LF)				
13	Canal Cleanup	3,400	LF	$ 2	$ 7,000
14	Construct Concrete Lining	3,400	LF	$ 21	$ 71,000
				Subtotal	**$ 78,000**
	Sublateral 3S-22 (1,700 LF)				
15	Canal Cleanup	1,700	LF	$ 2	$ 3,000
16	Construct Concrete Lining	1,700	LF	$ 21	$ 36,000
				Subtotal	**$ 39,000**
	Sublateral 4S-1 (1,000 LF)				
17	Canal Cleanup	1,000	LF	$ 2	$ 2,000
18	Construct Concrete Lining	1,000	LF	$ 21	$ 21,000
				Subtotal	**$ 23,000**
	Sublateral 4S-4 (2,600 LF)				
19	Canal Cleanup	2,600	LF	$ 2	$ 5,000
20	Construct Concrete Lining	2,600	LF	$ 21	$ 55,000
				Subtotal	**$ 60,000**
	Sublateral 4S-25 (1,000 LF)				
21	Canal Cleanup	1,000	LF	$ 2	$ 2,000
22	Construct Concrete Lining	1,000	LF	$ 21	$ 21,000
				Subtotal	**$ 23,000**
	Sublateral 5S-5 (1,100 LF)				
23	Canal Cleanup	1,100	LF	$ 2	$ 2,000
24	Construct Concrete Lining	1,100	LF	$ 21	$ 23,000
				Subtotal	**$ 25,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 5 - CONCRETE LINING OF SUBLATERALS
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
	Sublateral 5S-12 (400 LF)				
25	Canal Cleanup	400	LF	$ 2	$ 1,000
26	Construct Concrete Lining	400	LF	$ 21	$ 8,000
				Subtotal	**$ 9,000**
				CONSTRUCTION SUBTOTAL	**$ 558,000**
Non-Construction Items					
27	Survey, Engineering, Environmental Documentation, Permitting Assistance	1	LS	$ 50,000	$ 50,000
28	Construction Review	1	LS	$ 50,000	$ 50,000
				NON-CONSTRUCTION SUBTOTAL	**$ 100,000**
				Estimated Project Total	**$ 658,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 527,000**	**To**	**$ 856,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes minimal canal grading and cleanup will be required. Assumes no import or export of soil is required.
4. Assumes any demolished lining will be used as rip rap within the District (does not account for demolition or hauling costs).
5. Assumes existing turnouts will remain and new lining will tie into them (turnouts not being demolished and reconstructed).
6. Costs do not include factors for scale of economy. The more work that is performed typically equates to lower construction unit costs.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 6.1 - ALLEVIATE LATERAL 2N CAPACITY CONSTRAINTS: CULVERT REPLACEMENT OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 20,000	$ 20,000
2	Worker and Public Protection (2%)	1	LS	$ 8,000	$ 8,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 20,000	$ 20,000
4	SWPPP and DCP (2%)	1	LS	$ 8,000	$ 8,000
				Subtotal	**$ 56,000**
Construction Items					
	Replace Existing Las Palmas Ave Culvert				
5	Demo Existing Culvert and Headwalls	1	LS	$ 40,000	$ 40,000
6	F&I 60-Inch Culvert Crossing	5	LF	$ 337	$ 2,000
7	Construct New Headwalls	2	EA	$ 20,000	$ 40,000
8	Las Palmas Ave Crossing - Open Cut	60	LF	$ 120	$ 7,000
9	Traffic Control	5	Days	$ 1,800	$ 9,000
				Subtotal	**$ 98,000**
	Replace Existing Walnut Ave Culvert				
10	Demo Existing Culvert and Headwalls	1	LS	$ 40,000	$ 40,000
11	F&I 54-Inch Culvert Crossing	30	LF	$ 275	$ 8,000
12	Construct New Headwalls	2	EA	$ 20,000	$ 40,000
13	Walnut Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
14	Traffic Control	5	Days	$ 1,800	$ 9,000
				Subtotal	**$ 100,000**
	Replace Existing Olive Ave Culvert				
15	Demo Existing Culvert and Headwalls	1	LS	$ 40,000	$ 40,000
16	F&I 54-Inch Culvert Crossing	45	LF	$ 275	$ 12,000
17	Construct New Headwalls	2	EA	$ 20,000	$ 40,000
18	Olive Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
19	Traffic Control	5	Days	$ 1,800	$ 9,000
				Subtotal	**$ 104,000**
	Replace Existing Lemon Ave Culvert				
20	Demo Existing Culvert and Headwalls	1	LS	$ 40,000	$ 40,000
21	F&I 42-Inch Culvert Crossing	35	LF	$ 210	$ 7,000
22	Construct New Headwalls	2	EA	$ 20,000	$ 40,000
23	Lemon Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
24	Traffic Control	5	Days	$ 1,800	$ 9,000
				Subtotal	**$ 99,000**
			CONSTRUCTION SUBTOTAL		**$ 457,000**
Non-Construction Items					
25	Survey, Engineering, Environmental Documentation, Permitting Assistance	1	LS	$ 42,000	$ 42,000
26	Construction Review	1	LS	$ 42,000	$ 42,000
			NON-CONSTRUCTION SUBTOTAL		**$ 84,000**
				Estimated Project Total	**$ 541,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 433,000**	**To**	**$ 703,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 6.1 - ALLEVIATE LATERAL 2N CAPACITY CONSTRAINTS: CULVERT REPLACEMENT OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. No hydraulic analysis was performed to asses implications from the proposed improvements.
5. Assumes no flow measurement or control gates on the new culverts.
6. Assumes precast RGRCP for the culvert replacement.
7. Costs to locate, protect-in-place, and/or relocate existing utilities was not considered.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 6.2 - ALLEVIATE LATERAL 2N CAPACITY CONSTRAINTS: BYPASS PIPELINE OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 7,000	$ 7,000
2	Worker and Public Protection (2%)	1	LS	$ 3,000	$ 3,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 7,000	$ 7,000
4	SWPPP and DCP (2%)	1	LS	$ 3,000	$ 3,000
				Subtotal	**$ 20,000**
Construction Items					
	Construct Bypass Pipeline at Las Palmas Ave				
5	Remove (E) Concrete Lining	450	SF	$ 3	$ 1,000
6	F&I Precast Turnout Structure	1	EA	$ 12,000	$ 12,000
7	F&I 24-Inch PVC Bypass Pipeline	150	LF	$ 80	$ 12,000
8	Construct Concrete Lining (3" Thick)	450	SF	$ 6	$ 3,000
9	Las Palmas Ave Crossing - Open Cut	60	LF	$ 120	$ 7,000
10	Traffic Control	4	Days	$ 1,800	$ 7,000
				Subtotal	**$ 42,000**
	Construct Bypass Pipeline at Walnut Ave				
11	Remove (E) Concrete Lining	450	SF	$ 3	$ 1,000
12	F&I Precast Turnout Structure	1	EA	$ 12,000	$ 12,000
13	F&I 24-Inch PVC Bypass Pipeline	110	LF	$ 80	$ 9,000
14	Construct Concrete Lining (3" Thick)	450	SF	$ 6	$ 3,000
15	Walnut Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
16	Traffic Control	4	Days	$ 1,800	$ 7,000
				Subtotal	**$ 35,000**
	Construct Bypass Pipeline at Olive Ave				
17	Remove (E) Concrete Lining	450	SF	$ 3	$ 1,000
18	F&I Precast Turnout Structure	1	EA	$ 12,000	$ 12,000
19	F&I 24-Inch PVC Bypass Pipeline	100	LF	$ 80	$ 8,000
20	Construct Concrete Lining (3" Thick)	450	SF	$ 6	$ 3,000
21	Olive Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
22	Traffic Control	4	Days	$ 1,800	$ 7,000
				Subtotal	**$ 34,000**
	Construct Bypass Pipeline at Lemon Ave				
23	Remove (E) Concrete Lining	450	SF	$ 3	$ 1,000
24	F&I Precast Turnout Structure	1	EA	$ 12,000	$ 12,000
25	F&I 24-Inch PVC Bypass Pipeline	100	LF	$ 80	$ 8,000
26	Construct Concrete Lining (3" Thick)	450	SF	$ 6	$ 3,000
27	Lemon Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
28	Traffic Control	4	Days	$ 1,800	$ 7,000
				Subtotal	**$ 34,000**
			CONSTRUCTION SUBTOTAL		**$ 165,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 6.2 - ALLEVIATE LATERAL 2N CAPACITY CONSTRAINTS: BYPASS PIPELINE OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
Non-Construction Items					
29	Survey, Engineering, Environmental Documentation, Permitting Assistance	1	LS	$ 40,000	$ 40,000
30	Construction Review	1	LS	$ 40,000	$ 40,000
		NON-CONSTRUCTION SUBTOTAL			**$ 80,000**
				Estimated Project Total	**$ 245,000**
	Contingency Range:		-20%		30%
	Preliminary Cost Estimate Range:		**$ 196,000**	**To**	**$ 319,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. No hydraulic analysis was performed to asses implications from the proposed improvements.
5. Assumes no flow measurement or control gates on the bypass pipeline.
6. Assumes a precast turnout structure and no discharge structure (pipe will be cut flush with new canal lining).
7. Assumes open-cut crossings are feasible with existing utilities.
8. Costs to locate, protect-in-place, and/or relocate existing utilities was not considered.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 7.1 - ALLEVIATE M LATERAL CAPACITY CONSTRAINTS: CULVERT REPLACEMENT OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 6,000	$ 6,000
2	Worker and Public Protection (2%)	1	LS	$ 2,000	$ 2,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 6,000	$ 6,000
4	SWPPP and DCP (2%)	1	LS	$ 2,000	$ 2,000
				Subtotal	**$ 16,000**
Construction Items					
	Replace Existing American Eagle Rd Culvert				
5	Demo Existing Culvert and Headwalls	1	LS	$ 40,000	$ 40,000
6	F&I 54-Inch Culvert Crossing	100	LF	$ 275	$ 28,000
7	Construct New Headwalls	2	EA	$ 20,000	$ 40,000
8	American Eagle Rd Crossing - Open Cut	50	LF	$ 120	$ 6,000
9	Traffic Control	5	Day	$ 1,800	$ 9,000
				Subtotal	**$ 123,000**
			CONSTRUCTION SUBTOTAL		**$ 139,000**
Non-Construction Items (% of Construction Subtotal)					
10	Survey, Engineering, Environmental Documentation, Permitting Assistance	1	LS	$ 24,000	$ 24,000
11	Construction Review	1	LS	$ 24,000	$ 24,000
			NON-CONSTRUCTION SUBTOTAL		**$ 48,000**
				Estimated Project Total	**$ 187,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 150,000**	**To**	**$ 244,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. No hydraulic analysis was performed to asses implications from the proposed improvements.
5. Assumes no flow measurement or control gates on the new culverts.
6. Assumes precast RGRCP for the culvert replacement.
7. Costs to locate, protect-in-place, and/or relocate existing utilities was not considered.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 7.2 - ALLEVIATE M LATERAL CAPACITY CONSTRAINTS: BYPASS PIPELINE OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 3,000	$ 3,000
2	Worker and Public Protection (2%)	1	LS	$ 1,000	$ 1,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 3,000	$ 3,000
4	SWPPP and DCP (2%)	1	LS	$ 1,000	$ 1,000
				Subtotal	**$ 8,000**
Construction Items					
	Construct Bypass Pipeline at American Eagle Rd				
5	Remove (E) Concrete Lining	450	SF	$ 3	$ 2,000
6	F&I Precast Turnout Structure	1	EA	$ 12,000	$ 12,000
7	F&I 36-Inch RGRCP Bypass Pipeline	180	LF	$ 189	$ 35,000
8	Construct Concrete Lining (3" Thick)	320	SF	$ 6	$ 2,000
9	American Eagle Rd Crossing (Open Cut)	50	LF	$ 120	$ 6,000
10	Traffic Control	4	Days	$ 1,800	$ 8,000
				Subtotal	**$ 65,000**
			CONSTRUCTION SUBTOTAL		**$ 73,000**
Non-Construction Items (% of Construction Subtotal)					
11	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 7,000	$ 7,000
12	Construction Review (10%)	1	LS	$ 7,000	$ 7,000
			NON-CONSTRUCTION SUBTOTAL		**$ 14,000**
				Estimated Project Total	**$ 87,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 70,000**	**To**	**$ 114,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. No hydraulic analysis was performed to asses implications from the proposed improvements.
5. Assumes no flow measurement or control gates on the bypass pipeline.
6. Assumes a precast turnout structure and no discharge structure (pipe will be cut flush with new canal lining).
7. Assumes open-cut crossings are feasible with existing utilities.
8. Costs to locate, protect-in-place, and/or relocate existing utilities was not considered.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 8.1 - ALLEVIATE LATERAL 3S EXT CAPACITY CONSTRAINT: CULVERT REPLACEMENT OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 10,000	$ 10,000
2	Worker and Public Protection (2%)	1	LS	$ 4,000	$ 4,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 10,000	$ 10,000
4	SWPPP and DCP (2%)	1	LS	$ 4,000	$ 4,000
				Subtotal	**$ 28,000**
Construction Items					
	Replace Existing Armstrong Rd Culvert, Widen Lateral				
5	Demo Existing Culvert and Headwalls	1	LS	$ 40,000	$ 40,000
6	F&I 48-Inch Culvert Crossing	45	LF	$ 252	$ 11,000
7	Armstrong Rd Crossing - Open Cut	50	LF	$ 120	$ 6,000
8	Construct New Headwalls	2	EA	$ 20,000	$ 40,000
9	Traffic Control	5	Days	$ 1,800	$ 9,000
10	Widen Lateral 3S Extension	640	CY	$ 4	$ 3,000
11	Construct Concrete Lining (3" Thick)	14,800	SF	$ 6	$ 89,000
12	Reconstruct Turnout	1	EA	$ 8,000	$ 8,000
				Subtotal	**$ 206,000**
			CONSTRUCTION SUBTOTAL		**$ 234,000**
Non-Construction Items (% of Construction Subtotal)					
13	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 23,000	$ 23,000
14	Construction Review (10%)	1	LS	$ 23,000	$ 23,000
			NON-CONSTRUCTION SUBTOTAL		**$ 46,000**
				Estimated Project Total	**$ 280,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 224,000**	**To**	**$ 364,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. No hydraulic analysis was performed to asses implications from the proposed improvements.
5. Assumes no flow measurement or control gates on the new culverts.
6. Assumes precast RGRCP for the culvert replacement.
7. Costs to locate, protect-in-place, and/or relocate existing utilities was not considered.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 8.2 - ALLEVIATE LATERAL 3S EXT CAPACITY CONSTRAINT: SHORT BYPASS PIPELINE OPTION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 7,000	$ 7,000
2	Worker and Public Protection (2%)	1	LS	$ 3,000	$ 3,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 7,000	$ 7,000
4	SWPPP and DCP (2%)	1	LS	$ 3,000	$ 3,000
				Subtotal	**$ 20,000**
Construction Items					
	Construct Short Bypass Pipeline at Armstrong Rd, Widen Lateral				
5	Remove (E) Concrete Lining	450	SF	$ 3	$ 1,000
6	F&I Precast Turnout Structure	1	LS	$ 12,000	$ 12,000
7	F&I 24-Inch PVC Bypass Pipeline	100	LF	$ 80	$ 8,000
8	Armstrong Rd Crossing - Open Cut	50	LF	$ 120	$ 6,000
9	Traffic Control	4	Days	$ 1,800	$ 7,000
10	Widen Lateral 3S Extension	640	CY	$ 4	$ 3,000
11	Haul Excess Material	200	CY	$ 6	$ 1,000
12	Construct Concrete Lining (3" Thick)	14,800	SF	$ 6	$ 89,000
13	Reconstruct Turnout	2	EA	$ 8,000	$ 16,000
				Subtotal	**$ 143,000**
			CONSTRUCTION SUBTOTAL		**$ 163,000**
Non-Construction Items (% of Construction Subtotal)					
14	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 16,000	$ 16,000
15	Construction Review (10%)	1	LS	$ 16,000	$ 16,000
			NON-CONSTRUCTION SUBTOTAL		**$ 32,000**
				Estimated Project Total	**$ 195,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 156,000**	**To**	**$ 254,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. No hydraulic analysis was performed to asses implications from the proposed improvements.
5. Assumes no flow measurement or control gates on the bypass pipeline.
6. Assumes a precast turnout structure and no discharge structure (pipe will be cut flush with new canal lining).
7. Assumes open-cut crossings are feasible with existing utilities.
8. Costs to locate, protect-in-place, and/or relocate existing utilities was not considered.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 8.3 - ALLEVIATE LATERAL 3S EXT CAPACITY CONSTRAINT: LONG BYPASS PIPELINE
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 7,000	$ 7,000
2	Worker and Public Protection (2%)	1	LS	$ 3,000	$ 3,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 7,000	$ 7,000
4	SWPPP and DCP (2%)	1	LS	$ 3,000	$ 3,000
				Subtotal	**$ 20,000**
Construction Items					
	Construct Long Bypass Pipeline Parallel to Armstrong Rd				
5	Remove (E) Concrete Lining	450	SF	$ 3	$ 1,000
6	F&I Precast Turnout Structure	1	LS	$ 12,000	$ 12,000
7	F&I 24-Inch PVC Bypass Pipeline	1,300	LF	$ 80	$ 104,000
8	Armstrong Rd Crossing - Open Cut	50	LF	$ 120	$ 6,000
9	Traffic Control	10	Days	$ 1,800	$ 18,000
10	Construct Concrete Lining (3" Thick)	450	SF	$ 6	$ 3,000
				Subtotal	**$ 144,000**
			CONSTRUCTION SUBTOTAL		**$ 164,000**
Non-Construction Items (% of Construction Subtotal)					
11	Land Acquisition	0.6	AC	$ 20,000	$ 12,000
12	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 16,000	$ 16,000
13	Construction Review (10%)	1	LS	$ 16,000	$ 16,000
			NON-CONSTRUCTION SUBTOTAL		**$ 44,000**
				Estimated Project Total	**$ 208,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 167,000**	**To**	**$ 271,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes any demolished lining will be used as rip rap within the District (does not account for hauling costs).
4. No hydraulic analysis was performed to asses implications from the proposed improvements.
5. Assumes no flow measurement or control gates on the bypass pipeline.
6. Assumes a precast turnout structure and no discharge structure (pipe will be cut flush with new canal lining).
7. Assumes open-cut crossings are feasible with existing utilities.
8. Costs to locate, protect-in-place, and/or relocate existing utilities was not considered.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 9 - NORTH SIDE STORAGE BASIN
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 30,000	$ 30,000
2	Worker and Public Protection (2%)	1	LS	$ 12,000	$ 12,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 30,000	$ 30,000
4	SWPPP and DCP (2%)	1	LS	$ 12,000	$ 12,000
				Subtotal	**$ 84,000**
Construction Items					
5	Clearing and Grubbing / Orchard Removal	10	AC	$ 5,200	$ 52,000
6	Site Demolition	1	LS	$ 20,000	$ 20,000
7	Construct 10-Acre Storage Basin (Cut and Fill)	32,000	CY	$ 4	$ 128,000
8	Construct Levee Keyway	1,900	LF	$ 5	$ 10,000
9	Haul Excess Material	24,000	CY	$ 6	$ 144,000
10	Construct Pumped Basin Inlet Structure	1	LS	$ 48,000	$ 48,000
11	F&I 20 cfs Pump and Appurtenances	1	LS	$ 65,000	$ 65,000
12	Construct Gravity Outlet Structure	1	LS	$ 60,000	$ 60,000
13	F&I Class II Aggregate Base Levee Road Surface	70	TN	$ 30	$ 2,000
14	Place Rip Rap on Side Slopes	790	TN	$ 80	$ 63,000
				Subtotal	**$ 592,000**
				CONSTRUCTION SUBTOTAL	**$ 676,000**
Non-Construction Items (% of Construction Subtotal)					
15	Land Acquisition	10	AC	$ 40,000	$ 400,000
16	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 68,000	$ 68,000
17	Construction Review (10%)	1	LS	$ 68,000	$ 68,000
				NON-CONSTRUCTION SUBTOTAL	**$ 536,000**
				Estimated Project Total	**$ 1,212,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 970,000**	**To**	**$ 1,576,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Costs for land acquisition, clearing and grubbing, and site demolition will vary based on final site location and existing infrastructure.
4. Assumes land is available for the District along Lateral 3N.
5. Land acquisition costs assumes existing orchards.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 10 - 2S-9 PARALLEL PIPELINE
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 23,000	$ 23,000
2	Worker and Public Protection (2%)	1	LS	$ 9,000	$ 9,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 23,000	$ 23,000
4	SWPPP and DCP (2%)	1	LS	$ 9,000	$ 9,000
				Subtotal	**$ 64,000**
Construction Items					
5	Clearing and Grubbing	3.0	AC	$ 1,000	$ 3,000
6	F&I 24-inch C900 PVC Parallel Drainage Pipeline	5,300	LF	$ 80	$ 424,000
7	Elm Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
8	Traffic Control for Road Crossings (Elm Ave)	3	Days	$ 1,800	$ 5,000
9	Construct Field Connections, Disconnect Existing Drainage Inlets	8	EA	$ 2,500	$ 20,000
				Subtotal	**$ 455,000**
			CONSTRUCTION SUBTOTAL		**$ 519,000**
Non-Construction Items (% of Construction Subtotal)					
10	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 52,000	$ 52,000
11	Construction Review (10%)	1	LS	$ 52,000	$ 52,000
			NON-CONSTRUCTION SUBTOTAL		**$ 104,000**
				Estimated Project Total	**$ 623,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 499,000**	**To**	**$ 810,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes that the new pipe fits within existing PID right of way, and no additional land acquisition or easement will be required.
4. This estimate does not account for any land acquisition or replacement of existing landowner infrastructure.
5. Number of connections to the new pipeline will need to be field verified based on pipeline operations.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 12 - WATER QUALITY MONITORING STATIONS
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 4,000	$ 4,000
2	Worker and Public Protection (2%)	1	LS	$ 2,000	$ 2,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 4,000	$ 4,000
				Subtotal	**$ 10,000**
Construction Items					
4	F&I Water Quality Monitoring Station at DMC Turnout	1	LS	$ 2,000	$ 2,000
5	F&I Water Quality Monitoring Station at Hwy 33	1	LS	$ 2,000	$ 2,000
6	F&I Water Quality Monitoring Station at SSR	1	LS	$ 2,000	$ 2,000
7	F&I Water Quality Monitoring Station at NSR	1	LS	$ 2,000	$ 2,000
8	F&I Water Quality Monitoring Station at SJR Pump Station	1	LS	$ 2,000	$ 2,000
9	Add Monitoring Stations to SCADA System for Remote Monitoring	5	EA	$ 15,000	$ 75,000
				Subtotal	**$ 85,000**
			CONSTRUCTION SUBTOTAL		**$ 95,000**
Non-Construction Items (% of Construction Subtotal)					
10	Engineering (10%)	1	LS	$ 10,000	$ 10,000
			NON-CONSTRUCTION SUBTOTAL		**$ 10,000**
				Estimated Project Total	**$ 105,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 84,000**	**To**	**$ 137,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes that no upgrades to the District's existing SCADA system will be required.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 13 - CAST-IN-PLACE PIPELINE REPLACEMENT
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 166,000	$ 166,000
2	Worker and Public Protection (2%)	1	LS	$ 66,000	$ 66,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 166,000	$ 166,000
4	SWPPP and DCP (2%)	1	LS	$ 66,000	$ 66,000
				Subtotal	**$ 464,000**
Construction Items					
	M Lateral Pipeline Replacement				
5	Demolition & Hauling - 42-inch CIP Pipeline and Appurtenances	4,700	LF	$ 17	$ 80,000
6	F&I 42-inch C900 PVC Pipeline and Appurtenances	4,700	LF	$ 210	$ 987,000
7	Tie into Existing 42-inch Pipeline or Headwall	2	EA	$ 3,000	$ 6,000
8	Tree Removal Along Alignment	65	EA	$ 2,000	$ 130,000
9	Reconstruct Street Asphalt, Curb, & Gutters	4,700	LF	$ 40	$ 188,000
10	Reconstruct Asphalt Playground (Las Palmas School)	500	SF	$ 25	$ 13,000
11	Remove and Replace Chain Link Fence	1,500	LF	$ 12	$ 18,000
12	Traffic Control	30	Days	$ 1,800	$ 54,000
				Subtotal	**$ 1,476,000**
	Lateral 2N Pipeline Replacement				
13	Abandon (E) 32-inch CIP Pipeline (Disconnect and Cap Both Ends)	1	LS	$ 2,000	$ 2,000
14	F&I 36-inch C900 PVC Pipeline and Appurtenances	2,200	LF	$ 189	$ 416,000
15	Tie into Existing Headwall	2	LS	$ 3,000	$ 6,000
16	Loquat Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
17	Traffic Control	8	Days	$ 1,800	$ 15,000
				Subtotal	**$ 442,000**
	Lateral 3S Extension Pipeline Replacement				
18	Demolition & Hauling - 36-inch CIP Pipeline and Appurtenances	170	LF	$ 15	$ 3,000
19	F&I 36-inch C900 PVC Pipeline and Appurtenances	170	LF	$ 158	$ 27,000
20	Construct Junction Box w/ 36-inch Canal Gate	1	LS	$ 20,000	$ 20,000
				Subtotal	**$ 50,000**
	LDMC Replacement				
21	Demolition & Hauling - 36-inch CIP Pipeline and Appurtenances	4,925	LF	$ 15	$ 74,000
21	F&I 36-inch C900 PVC Pipeline and Appurtenances (Segment 1)	2,300	LF	$ 158	$ 364,000
22	F&I 36-inch C900 PVC Pipeline and Appurtenances (Segment 2)	4,300	LF	$ 158	$ 680,000
23	Tie into Existing 36-inch Headwall or Junction Box	4	EA	$ 3,000	$ 12,000
24	Del Puerto Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
25	Bartch Ave Crossing - Open Cut	25	LF	$ 120	$ 3,000
				Subtotal	**$ 1,136,000**
	Sublateral 4N-29				
26	Demolition & Hauling - 20-Inch CIP Pipeline and Appurtenances	2,000	LF	$ 12	$ 24,000
27	F&I 20-inch C900 PVC Pipeline and Appurtenances	2,000	LF	$ 95	$ 190,000
28	Tie into Existing 20-inch Pipeline or Headwall	2	EA	$ 2,000	$ 4,000
				Subtotal	**$ 218,000**
			CONSTRUCTION SUBTOTAL		**$ 3,786,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 13 - CAST-IN-PLACE PIPELINE REPLACEMENT
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
Non-Construction Items (% of Construction Subtotal)					
29	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 379,000	$ 379,000
30	Construction Review (10%)	1	LS	$ 379,000	$ 379,000
			NON-CONSTRUCTION SUBTOTAL		**$ 758,000**
				Estimated Project Total	**$ 4,544,000**
	Contingency Range:		-20%		30%
	Preliminary Cost Estimate Range:		**$ 3,636,000**	**To**	**$ 5,908,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes new pipelines will be installed along existing alignments, and no land acquisition is required.
4. Assumes new pipelines will connect to existing infrastructure without needing to replace the entire facility (turnouts, standpipes, etc).
5. Costs do not include factors for scale of economy. The more work that is performed at one time typically equates to lower construction unit costs.
6. Replacing the LDMC will require crossing multiple ag fields and private residential properties.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 14 - MAIN CANAL SETTLING POND
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 11,000	$ 11,000
2	Worker and Public Protection (2%)	1	LS	$ 4,000	$ 4,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 11,000	$ 11,000
4	SWPPP and DCP (2%)	1	LS	$ 4,000	$ 4,000
				Subtotal	**$ 30,000**
Construction Items					
5	Construct Settling Pond	18,000	CY	$ 6	$ 108,000
6	Haul Excess Material	18,000	CY	$ 6	$ 108,000
				Subtotal	**$ 216,000**
			CONSTRUCTION SUBTOTAL		**$ 246,000**
Non-Construction Items (% of Construction Subtotal)					
7	Land Acquisition	0.7	AC	$ 20,000	$ 15,000
8	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 25,000	$ 25,000
9	Construction Review (10%)	1	LS	$ 25,000	$ 25,000
			NON-CONSTRUCTION SUBTOTAL		**$ 65,000**
				Estimated Project Total	**$ 311,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 249,000**	**To**	**$ 405,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes land is available for sale to the District.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 15 - DEL PUERTO CREEK RECHARGE PROJECT
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 8,000	$ 8,000
2	Worker and Public Protection (2%)	1	LS	$ 3,000	$ 3,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 8,000	$ 8,000
4	SWPPP and DCP (2%)	1	LS	$ 3,000	$ 3,000
				Subtotal	**$ 22,000**
Construction Items					
5	Construct Flashboard Check Structure in Del Puerto Creek	1	LS	$ 160,000	$ 160,000
				Subtotal	**$ 160,000**
			CONSTRUCTION SUBTOTAL		**$ 182,000**
Non-Construction Items					
6	Survey, Engineering, Environmental Documentation, Permitting Assistance	1	LS	$ 50,000	$ 50,000
7	Construction Review	1	LS	$ 50,000	$ 50,000
			NON-CONSTRUCTION SUBTOTAL		**$ 100,000**
				Estimated Project Total	**$ 282,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 226,000**	**To**	**$ 367,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes groundwater recharge in Del Puerto Creek is feasible.
4. Cost estimate does not include CEQA or any other permitting.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 16 - NORTH SIDE RECIRCULATION SYSTEM EXPANSION
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 34,000	$ 34,000
2	Worker and Public Protection (2%)	1	LS	$ 14,000	$ 14,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 34,000	$ 34,000
4	SWPPP and DCP (2%)	1	LS	$ 14,000	$ 14,000
				Subtotal	**$ 96,000**
Construction Items					
5	Clearing and Grubbing	3.4	AC	$ 1,000	$ 3,000
6	Construct Pump Station in NSR	1	LS	$ 35,000	$ 35,000
7	F&I 10 cfs Pump and Appurtenances	1	LS	$ 40,000	$ 40,000
8	F&I 24-Inch C900 PVC Pipeline to Lemon Ave	4,400	LF	$ 80	$ 352,000
9	Construct 5 CFS Pump Station at Lemon Ave	1	CY	$ 28,000	$ 28,000
10	F&I 5 cfs Pump and Appurtenances	1	LS	$ 30,000	$ 30,000
11	F&I 16-Inch PVC Pipeline to Lemon Ave	3,000	LF	$ 55	$ 165,000
12	Construct Turnout Outlet Structure	2	EA	$ 12,000	$ 24,000
				Subtotal	**$ 677,000**
			CONSTRUCTION SUBTOTAL		**$ 773,000**
Non-Construction Items (% of Construction Subtotal)					
13	Land Acquisition	3.4	AC	$ 20,000	$ 68,000
14	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 77,000	$ 77,000
15	Construction Review (10%)	1	LS	$ 77,000	$ 77,000
			NON-CONSTRUCTION SUBTOTAL		**$ 222,000**
				Estimated Project Total	**$ 995,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 796,000**	**To**	**$ 1,294,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 17 - CONSTRUCT MONITORING WELLS
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 14,000	$ 14,000
2	Worker and Public Protection (2%)	1	LS	$ 6,000	$ 6,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 14,000	$ 14,000
4	SWPPP and DCP (2%)	1	LS	$ 6,000	$ 6,000
				Subtotal	**$ 40,000**
Construction Items					
5	Construct Monitoring Wells (D = 100 ft)	7	EA	$ 40,000	$ 280,000
				Subtotal	**$ 280,000**
			CONSTRUCTION SUBTOTAL		**$ 320,000**
Non-Construction Items					
6	Survey, Engineering, Environmental Documentation, Permitting Assistance	1	LS	$ 20,000	$ 20,000
7	Construction Review	1	LS	$ 20,000	$ 20,000
			NON-CONSTRUCTION SUBTOTAL		**$ 40,000**
				Estimated Project Total	**$ 360,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 288,000**	**To**	**$ 468,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes monitoring wells will be located on land already owned by Patterson Irrigation District.
4. Costs for well drilling and environmental permits were not considered in this estimate.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 18.1 - AUTOMATE CHECK STRUCTURES AND LATERAL INTERTIES: DISTRICT FABRICATED GATES
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 261,000	$ 261,000
2	Worker and Public Protection (2%)	1	LS	$ 104,000	$ 104,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 261,000	$ 261,000
4	SWPPP and DCP (2%)	1	LS	$ 104,000	$ 104,000
				Subtotal	**$ 730,000**
Construction Items					
	LATERAL 1-N				
	Check Structures				
5	F&I Custom Overshot Check Structure w/ Water Level Sensors	18	EA	$ 15,000	$ 270,000
6	Modify Existing Checks	18	EA	$ 10,000	$ 180,000
	SCADA				
7	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 530,000**
	LATERAL 2-N				
	Check Structures				
8	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	25	EA	$ 15,000	$ 375,000
9	Modify Existing Checks, Install Flume Gates	25	EA	$ 10,000	$ 250,000
	Lateral Interties				
10	F&I Gate Actuators	5	EA	$ 8,000	$ 40,000
11	F&I Water Level Sensors	5	EA	$ 4,000	$ 20,000
	SCADA				
12	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 785,000**
	LATERAL 3-N				
	Check Structures				
13	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	20	EA	$ 15,000	$ 300,000
14	Modify Existing Checks, Install Flume Gates	20	EA	$ 10,000	$ 200,000
	Lateral Interties				
15	F&I Gate Actuators	5	EA	$ 8,000	$ 40,000
16	F&I Water Level Sensors	5	EA	$ 4,000	$ 20,000
	SCADA				
17	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 660,000**
	LATERAL 4-N				
	Check Structures				
18	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	25	EA	$ 15,000	$ 375,000
19	Modify Existing Checks, Install Flume Gates	25	EA	$ 10,000	$ 250,000
d	***Lateral Interties***				
20	F&I Gate Actuators	3	EA	$ 8,000	$ 24,000
21	F&I Water Level Sensors	3	EA	$ 4,000	$ 12,000
	SCADA				
22	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 761,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 18.1 - AUTOMATE CHECK STRUCTURES AND LATERAL INTERTIES: DISTRICT FABRICATED GATES
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
	LATERAL 1-S				
	Check Structures				
23	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	5	EA	$ 15,000	$ 75,000
24	Modify Existing Checks, Install Flume Gates	5	EA	$ 10,000	$ 50,000
	SCADA				
25	SCADA Integration	1	LS	$ 50,000	$ 50,000
				Subtotal	**$ 175,000**
	LATERAL 2-S				
	Check Structures				
26	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	15	EA	$ 15,000	$ 225,000
27	Modify Existing Checks, Install Flume Gates	15	EA	$ 10,000	$ 150,000
	Lateral Interties				
28	F&I Gate Actuators	3	EA	$ 8,000	$ 24,000
29	F&I Water Level Sensors	3	EA	$ 4,000	$ 12,000
	SCADA				
30	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 491,000**
	LATERAL 3-S				
	Check Structures				
31	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	25	EA	$ 15,000	$ 375,000
32	Modify Existing Checks, Install Flume Gates	25	EA	$ 10,000	$ 250,000
	Lateral Interties				
33	F&I Gate Actuators	5	EA	$ 8,000	$ 40,000
34	F&I Water Level Sensors	5	EA	$ 4,000	$ 20,000
	SCADA				
35	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 785,000**
	LATERAL 4-S				
	Check Structures				
36	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	15	EA	$ 15,000	$ 225,000
37	Modify Existing Checks, Install Flume Gates	15	EA	$ 10,000	$ 150,000
	Lateral Interties				
38	F&I Gate Actuators	5	EA	$ 8,000	$ 40,000
39	F&I Water Level Sensors	5	EA	$ 4,000	$ 20,000
	SCADA				
40	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 515,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 18.1 - AUTOMATE CHECK STRUCTURES AND LATERAL INTERTIES: DISTRICT FABRICATED GATES
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
	M LATERAL				
	Check Structures				
41	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	15	EA	$ 15,000	$ 225,000
42	Modify Existing Checks, Install Flume Gates	15	EA	$ 10,000	$ 150,000
	Lateral Interties				
43	F&I Gate Actuators	5	EA	$ 8,000	$ 40,000
44	F&I Water Level Sensors	5	EA	$ 4,000	$ 20,000
	SCADA				
45	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 515,000**
			CONSTRUCTION SUBTOTAL		**$ 5,947,000**
Non-Construction Items (% of Construction Subtotal)					
46	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 595,000	$ 595,000
47	Construction Review (10%)	1	LS	$ 595,000	$ 595,000
			NON-CONSTRUCTION SUBTOTAL		**$ 1,190,000**
				Estimated Project Total	**$ 7,137,000**
	Contingency Range:		-20%		30%
	Preliminary Cost Estimate Range:		**$ 5,710,000**	**To**	**$ 9,279,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes no more than 5 interties per lateral to be automated.
4. Assumes all checks along a lateral will be retrofitted with FlumeGates.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 18.2 - AUTOMATE CHECK STRUCTURES AND LATERAL INTERTIES: RUBICON
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 545,000	$ 545,000
2	Worker and Public Protection (2%)	1	LS	$ 218,000	$ 218,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 545,000	$ 545,000
4	SWPPP and DCP (2%)	1	LS	$ 218,000	$ 218,000
				Subtotal	**$ 1,526,000**
Construction Items					
	LATERAL 1-N				
	Check Structures				
5	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	18	EA	$ 48,000	$ 864,000
6	Modify Existing Checks, Install Flume Gates	18	EA	$ 10,000	$ 180,000
	SCADA				
7	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 1,124,000**
	LATERAL 2-N				
	Check Structures				
8	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	25	EA	$ 48,000	$ 1,200,000
9	Modify Existing Checks, Install Flume Gates	25	EA	$ 10,000	$ 250,000
	Lateral Interties				
10	F&I SlipMeters	5	EA	$ 22,000	$ 110,000
	SCADA				
11	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 1,660,000**
	LATERAL 3-N				
	Check Structures				
12	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	20	EA	$ 48,000	$ 960,000
13	Modify Existing Checks, Install Flume Gates	20	EA	$ 10,000	$ 200,000
	Lateral Interties				
14	F&I SlipMeters	5	EA	$ 22,000	$ 110,000
	SCADA				
15	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 1,370,000**
	LATERAL 4-N				
	Check Structures				
16	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	25	EA	$ 48,000	$ 1,200,000
17	Modify Existing Checks, Install Flume Gates	25	EA	$ 10,000	$ 250,000
d	***Lateral Interties***				
18	F&I SlipMeters	3	EA	$ 22,000	$ 66,000
	SCADA				
19	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 1,616,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 18.2 - AUTOMATE CHECK STRUCTURES AND LATERAL INTERTIES: RUBICON
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
	LATERAL 1-S				
	Check Structures				
20	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	5	EA	$ 48,000	$ 240,000
21	Modify Existing Checks, Install Flume Gates	5	EA	$ 10,000	$ 50,000
	SCADA				
22	SCADA Integration	1	LS	$ 50,000	$ 50,000
				Subtotal	**$ 340,000**
	LATERAL 2-S				
	Check Structures				
23	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	15	EA	$ 48,000	$ 720,000
24	Modify Existing Checks, Install Flume Gates	15	EA	$ 10,000	$ 150,000
	Lateral Interties				
25	F&I SlipMeters	3	EA	$ 22,000	$ 66,000
	SCADA				
26	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 1,016,000**
	LATERAL 3-S				
	Check Structures				
27	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	25	EA	$ 48,000	$ 1,200,000
28	Modify Existing Checks, Install Flume Gates	25	EA	$ 10,000	$ 250,000
	Lateral Interties				
29	F&I SlipMeters	5	EA	$ 22,000	$ 110,000
	SCADA				
30	SCADA Integration	1	LS	$ 100,000	$ 100,000
				Subtotal	**$ 1,660,000**
	LATERAL 4-S				
	Check Structures				
31	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	15	EA	$ 48,000	$ 720,000
32	Modify Existing Checks, Install Flume Gates	15	EA	$ 10,000	$ 150,000
	Lateral Interties				
33	F&I SlipMeters	5	EA	$ 22,000	$ 110,000
	SCADA				
34	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 1,060,000**

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 18.2 - AUTOMATE CHECK STRUCTURES AND LATERAL INTERTIES: RUBICON
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
	M LATERAL				
	Check Structures				
35	Furnish Rubicon Flume Gates, Commissioning, & SCADA Kits	15	EA	$ 48,000	$ 720,000
36	Modify Existing Checks, Install Flume Gates	15	EA	$ 10,000	$ 150,000
	Lateral Interties				
37	F&I SlipMeters	5	EA	$ 22,000	$ 110,000
	SCADA				
38	SCADA Integration	1	LS	$ 80,000	$ 80,000
				Subtotal	**$ 1,060,000**
			CONSTRUCTION SUBTOTAL		**$ 12,432,000**
Non-Construction Items (% of Construction Subtotal)					
39	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 1,243,000	$ 1,243,000
40	Construction Review (10%)	1	LS	$ 1,243,000	$ 1,243,000
			NON-CONSTRUCTION SUBTOTAL		**$ 2,486,000**
				Estimated Project Total	**$ 14,918,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 11,935,000**	**To**	**$ 19,394,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes no more than 5 interties per lateral to be automated.
4. Assumes all checks along a lateral will be retrofitted with Rubicon FlumeGates.
5. Assumes each lateral intertie will be retrofitted with a Rubicon SlipMeter

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 19 - METERING PROJECT
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 42,000	$ 42,000
2	Worker and Public Protection (2%)	1	LS	$ 17,000	$ 17,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 42,000	$ 42,000
4	SWPPP and DCP (2%)	1	LS	$ 17,000	$ 17,000
				Subtotal	**$ 118,000**
Construction Items					
5	F&I Rated Meter Gate Turnout (20-inch Dia.)	70	EA	$ 12,000	$ 840,000
	F&I 20-inch Diameter Gate	1	EA	$ 3,000	
	F&I Water Level Sensors (Upstream and Downstream)	2	EA	$ 4,000	
	Construct 8" Stilling Well	1	EA	$ 3,000	
	Earthwork / Repair Canal Geometry and Lining	1	LS	$ 2,000	
				Subtotal	**$ 840,000**
				CONSTRUCTION SUBTOTAL	**$ 958,000**
Non-Construction Items (% of Construction Subtotal)					
1	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 96,000	$ 96,000
2	Construction Review (10%)	1	LS	$ 96,000	$ 96,000
				NON-CONSTRUCTION SUBTOTAL	**$ 192,000**
				Estimated Project Total	**$ 1,150,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 920,000**	**To**	**$ 1,495,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes each turnout will operate solely in free-flow or submerged conditions.
4. Assumes a standard diameter of 20-inches

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 20 - CONSTRUCT STORAGE BASIN OFF SJR OR DMC
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 263,000	$ 263,000
2	Worker and Public Protection (2%)	1	LS	$ 105,000	$ 105,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 263,000	$ 263,000
4	SWPPP and DCP (2%)	1	LS	$ 105,000	$ 105,000
				Subtotal	**$ 736,000**
Construction Items					
5	Clearing and Grubbing / Site Demolition	80	AC	$ 5,200	$ 416,000
6	Construct 80-acre Storage Basin (Cut and Fill)	474,000	CY	$ 4	$ 1,896,000
7	Construct Levee Keyway	8,000	LF	$ 5	$ 40,000
8	Haul Excess Material	440,000	CY	$ 6	$ 2,640,000
9	Construct Basin Inlet Structure	1	LS	$ 80,000	$ 80,000
10	Construct Intertie to Existing Pump Station	1	LS	$ 100,000	$ 100,000
11	F&I Class II Aggregate Base Levee Road Surface	2,700	TN	$ 30	$ 81,000
				Subtotal	**$ 5,253,000**
			CONSTRUCTION SUBTOTAL		**$ 5,989,000**
Non-Construction Items (% of Construction Subtotal)					
12	Land Acquisition	80	AC	$ 20,000	$ 1,600,000
13	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 599,000	$ 599,000
14	Construction Review (10%)	1	LS	$ 599,000	$ 599,000
			NON-CONSTRUCTION SUBTOTAL		**$ 2,798,000**
				Estimated Project Total	**$ 8,787,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 7,030,000**	**To**	**$ 11,424,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes that an 80-acre storage basin is feasible.
4. Assumes a single cell, ~300 acre-feet of storage, 20 ft wide drive banks, 2:1 exterior & 1.5:1 interior side slopes.
5. No set location for basin was selected.
6. Costs for land acquisition, clearing and grubbing, and site demolition will vary based on final site location and existing infrastructure.

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ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PATTERSON IRRIGATION DISTRICT
LATERAL EVALUATION
PROJECT 21 - PIPE THE WELL DITCH SYSTEM
Conceptual Level Design
November 2019

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
General Items (% of Construction Items)					
1	Mobilization/Demobilization, Bonds and Insurance and Permits (5%)	1	LS	$ 46,000	$ 46,000
2	Worker and Public Protection (2%)	1	LS	$ 18,000	$ 18,000
3	Miscellaneous Facilities and Operations (5%)	1	LS	$ 46,000	$ 46,000
4	SWPPP and DCP (2%)	1	LS	$ 18,000	$ 18,000
				Subtotal	**$ 128,000**
Construction Items					
5	Demolition & Hauling - 18-inch Steel Pipeline and Appurtenances	2,600	LF	$ 12	$ 31,000
6	Demolition & Hauling - Existing Pump, Motor, Electrical, and Housing	1	LS	$ 15,000	$ 15,000
7	Demolition & Hauling - Concrete Lining and Headwalls	4,900	LF	$ 12	$ 59,000
8	F&I New Pump Station Housing	1	LS	$ 50,000	$ 50,000
9	F&I 7 cfs Pump, Motor, and Appurtenances	1	LS	$ 80,000	$ 80,000
10	Pump Station Electrical	1	LS	$ 40,000	$ 40,000
11	F&I 18-inch Dia. C900 PVC Discharge Pipe and Appurtenances	7,500	LF	$ 70	$ 525,000
12	Import Backfill Material	5,000	CY	$ 6	$ 30,000
13	Reconstruct Field Connections	6	EA	$ 5,000	$ 30,000
14	Road Crossings (Including Traffic Control)	4	EA	$ 16,000	$ 64,000
				Subtotal	**$ 924,000**
			CONSTRUCTION SUBTOTAL		**$ 1,052,000**
Non-Construction Items (% of Construction Subtotal)					
15	Survey, Engineering, Environmental Documentation, Permitting Assistance (10%)	1	LS	$ 105,000	$ 105,000
16	Construction Review (10%)	1	LS	$ 105,000	$ 105,000
			NON-CONSTRUCTION SUBTOTAL		**$ 210,000**
				Estimated Project Total	**$ 1,262,000**

Contingency Range:	-20%		30%
Preliminary Cost Estimate Range:	**$ 1,010,000**	**To**	**$ 1,641,000**

Notes:

1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects.
2. Totals rounded to the nearest one-thousand dollars.
3. Assumes that an 80-acre storage basin is feasible.
4. Assumes a single cell, ~300 acre-feet of storage, 20 ft wide drive banks, 2:1 exterior & 1.5:1 interior side slopes.
5. No set location for basin was selected.
6. Costs for land acquisition, clearing and grubbing, and site demolition will vary based on final site location and existing infrastructure.

Patterson Irrigation District
Main Canal Rehabilitation Project
Schedule B - Project 22
Station 140+00 to Station 169+02

Opinion of Probable Construction Costs (OPCC)

Currency: USD-United States-JANUARY 2017 Dollar

Grand Total Price: $ 8,400,000

Proj #	GC	Description	Quantity	UOM	Unit Cost	Total Cost	Comments	Final Total
1		**Mobilization**	1	ls	*$210,200*	**$210,200**		***$330,000***
1	P	***Mob & General Conditions Costs***	1	ls	$0	$0	covered below in Construction Allowances	
2	P	***Construct Access/Setup Yard/Temporary SWPPP BMPs***	7	dys	$4,000	$28,000	say 5 days to mobe/set-up, grade road to project area & install any BMPs	
3	P	BMP Materials	1	ls	$5,000	$5,000	straw bales, waddles, hay, etc.	
4	P	Establish Water Supply	1	dys	$4,000	$4,000	set trash pump or hurricane pump and Klien tower	
5	P	Rent Water Supply Equipment	4	mo	$2,500	$10,000	pumps, pipes, tower, as required	
6	P	***Sheeting, Shoring & Bracing & Constructability***	3	dys	$4,000	$12,000	truck wash, Air Monitoring Sensors,	
7	P	Costs covered below	1	ls	$0	$0		
8	P	Large Crane Allowance (50T-100T)	4	mos	$37,800	$151,200	Operated, reach 100' for rebar/concrete placement at PS construction	
2		**Pumping Plant #4**	1	ls	*$2,711,564*	**$2,711,564**	***$2,712***	***$4,190,000***
1	P	***Site Demolition***			***$36,858***		/hp	
2	P	Demo & Remove (e) Secondary Pump Structure	1	ls	$7,500	$7,500		
3	P	Excavate/Remove and & Dispose of (e) 24" Discharge Piping (5)	325	lf	$72	$23,400	at 75' per run	
4	P	Demo, Reduce, Load & Dispose (e) Canal Headwall & Lining	49	cys	$100	$4,852		
5	P	Disposal Fees	11	lds	$100	$1,106		
6	P	***Civils/Structural***			***$726,151***			
7	S	Install Sheetpile/Cofferdam at Settling Basin #1 - 15' high	-	sf	$45	not required	design, in/out, rental, clean-up, etc.,	
8	S	Install Sheetpile Wall at PS#2 Structure - 25' high (avg)	-	sf	$40	not required	design, in/out, rental, clean-up, etc.,	
9	P	Pit Excavation	7,400	cys	$12	$88,800	6,400 cys to on-site stockpile at say <5 miles	
10	P	Dewatering Allowance	1	ls	$15,000	$15,000	sump w/ trash pumps, 3 mos	
11	P	Foundation Preparation	4,500	sys	$3	$13,500		
12	P	Import/Place/Compact Foundation Gravel - 1.5'	210	cys	$40	$8,400		
13	P	F/P/S/F Concrete Foundation Slab on Grade at Wet Well - 2'	108	cys	$375	$40,444		
14	P	F/P/S/F Concrete Vertical Walls at Wet Well - 1'	71	cys	$675	$48,125		
15	P	F/P/S/F Concrete Vertical Walls at Wet Well - 1.5'	80	cys	$675	$54,141		
16	P	F/P/S/F Concrete Top Slab at Wet Well - 1.75'	40	cys	$400	$16,178		
17	P	F/P/S/F Concrete Equipment Pads (15)	1.1	cys	$1,500	$1,667		
18	P	F/P/S/F Concrete Elev Slab at Wet Well - 1.75'	90	cys	$800	$71,815		
19	P	F/P/S/F Concrete Walls at Basin Inlet - 2'	22	cys	$675	$14,940		
20	P	F/P/S/F Concrete Walls at Basin Inlet - 2'	36	cys	$675	$24,000		
21	P	F/P/S/F Concrete Fdn Slab at Basin Inlet -2'	49	cys	$375	$18,489		
22	P	F/P/S/F Concrete Fdn Slab at Basin Inlet -2'	76	cys	$375	$28,444		
23	P	F/P/S/F Concrete Corner Fill at Basin Inlet	20	cys	$250	$5,000		
24	S	Reinforcing Steel at 175#/cy	104,000	lbs	$0.90	$93,600		
25	P	CLSM Backfill at Top Slab Area	890	cys	$85	$75,650	60x20x20	
26	P	Metal Grates at Equipment Openings (5)	45	sf	$100	$4,500		
27	P	Structure Backfill	3,600	cys	$12	$43,200	from local stockpile, load, haul and compact	
28	P	Load/Haul Waste Structure Excavation	3,800	cys	$8	$28,500	Haul to settling basin #2	
29	S	Security Fencing - 8' CL w/ BW	577	lf	$25	$14,425		
30	S	Dbl Gate	4	ea	$1,000	$4,000		
31	S	6" Gravel at PS Yard	333	cys	$40	$13,333	110x180 = between fence lines	
32	P	***Mechanical***			***$980,450***			
33	P	Purchase 200hp Pumps & Motors + VFDs & Spare Parts	3	ea	$150,000	$450,000	budget quote: Cascade	
34	P	Traveling Screen	1	ls	$0	$0	by others	
35	P	30" Restraining Dismantling Joint	3	ea	$3,000	$9,000		
36	P	30" Check Valve	3	ea	$19,500	$58,500		
37	P	30" B'Fly Valve	3	ea	$22,500	$67,500		
38	P	30" Harnessed Sleeve Coupling	5	ea	$4,500	$22,500		
39	P	Combo Air/VAC Assembly	5	ea	$3,500	$17,500		
40	P	Air/Vacuum Valve for Pumps	5	ea	$1,500	$7,500		
41	P	30" 90 Elbow	5	ea	$6,750	$33,750		
42	P	30" Pipe Special - 3'	5	ea	$2,025	$10,125		
43	P	30" Pipe Special - 7'	5	ea	$4,725	$23,625		
44	P	30" Pipe Special - 2'	5	ea	$1,350	$6,750		
45	P	Pipe Stands (3)	15	ea	$250	$3,750		
46	P	90" RW Manifold Special - T=0.457	1	ea	$56,700	$56,700	40' long	
47	P	90" RW Manifold 90d Elbow - T= 0.457	1	ea	$60,750	$60,750		
48	P	Mechanical Install Crew	25	days	$6,100	$152,500	1-5 man crew + equipment + misc + tools, say 1.5 mos	
49	P	***Control Building Structure***	*$134*	*sf*	***$72,605***			
50	S	Earthworks/Foundation Prep	1	days	$3,000	$3,000		
51	S	6" Aggregate Base at Foundation	15	cys	$40	$593		
52	S	F/P/S/F Concrete Slab on Grade -1'	13	cys	$375	$5,000		
53	S	Reinforcing Steel at 175#/cy	2,333	lbs	$0.90	$2,100		
54	S	12" Smooth Face CMU Walls	1,224	sf	$18	$22,032		
55	S	Exterior Sgl Door	1	ea	$1,800	$1,800		
56	S	Exterior Dbl Door	1	ea	$2,500	$2,500		
57	S	HVAC Heat Pump Unit - 5 tons	2	ea	$2,500	$5,000	incls controls	
58	S	Concrete Landings at Doors	2	ea	$500	$1,000		
59	S	Roof Structural	540	sf	$15	$8,100		
60	S	Standing Seam Metal Roofing w/ Gutters	540	sf	$22	$11,880		
61	S	FE	2	ea	$250	$500		
62	S	LV Electrical	390	sf	$20	$7,800	8 ceiling lights & 6 receptacles	
63	P	Exterior Light Fixture	2	ea	$650	$1,300		
64	P	***Electrical***			***$795,500***			
65	S	Overhead Power Hookup	1	ea	$5,000	$5,000		
66	S	1500 KVA Pad Mounted Transformer	1	ea	$47,000	$47,000		
67	S	ATS	1	ea	$23,000	$23,000		
68	S	RVSSs	3	ea	$75,000	$225,000		
69	S	VFDs	2	ea	$0	$0	by pump mfg	
70	S	PLCs	1	ea	$0	$0	covered by SCADA integrator under Owner Allowances	
71	S	VFD Controls	12	ea	$2,000	$24,000		
72	S	Transformer	1	ea	$15,000	$15,000		
73	S	DP-1	1	ea	$3,500	$3,500		
74	S	LP-1	1	ea	$4,000	$4,000		
75	S	Electrical Manholes	2	ea	$2,500	$5,000		
76	S	Hand Hole	2	ea	$1,500	$3,000		
77	S	Remove (e) Transformer	1	ea	$1,000	$1,000		
78	S	Main Switchgear	12	sec	$10,000	$120,000		
79	S	Pump VFDs by Pump Manufacturer	5	ea	$0	$0		
80	S	Conduits & Wiring	1	ls	$35,000	$35,000		
81	S	Duct banks	250	lf	$100	$25,000		
82	S	Electrical Misc	1	ls	$50,000	$50,000		
83	S	Electrical Crew	42	days	$5,000	$210,000	2 mo	
84	P	***Instrumentation***			***$100,000***			
85	P	Allowance	1	ls	$100,000	$100,000		
3		**Pipeline Conveyance**	1	ls	*$2,302,212*	**$2,302,212**		***$3,560,000***

Patterson Irrigation District
Main Canal Rehabilitation Project
Schedule B - Project 22
Station 140+00 to Station 169+02

Opinion of Probable Construction Costs (OPCC)

Currency: USD-United States-JANUARY 2017 Dollar

Grand Total Price: $ 8,400,000

Proj #	GC	Description	Quantity	UOM	Unit Cost	Total Cost	Comments	Final Total
1	P	***90" Pipeline***					avg depth =12.5'	
2	P	*Sta 143+00 to Sta 169+20, Type II Trench*	***$795***	*lf*	***$2,042,843***			
3	P		***$8.83***	*dia-in*				
4	P							
5	P	Purchase 90" - T=0.4375 C200 ML & TC Pipe	2,571	lf	$409	$1,052,274	deld, budget quote per Ameron	
6	P	Purchase 90" - T=0.4375 C200 Pipe 11s or 45s	4	ea	$6,549	$26,194	"	
7	P	Purchase 90" - T=0.4375 C200 Pipe Tee x 16"-24"	4	ea	$13,097	$52,389	"	
8	P	Fabricate 30" - T=0.257 C200 Flanged Outlet for Manholes	4	ea	$11,400	$45,600	"	
9	P	Incremental for Restrained Joints	-	ea	$3,300	$0		
10	P	String/Stage Pipe at ROW	2,571	lf	$2.50	$6,428	90"	
11	P	Excavate Trench/Stockpile Soils	14,000	cy	$6.84	$95,760	1:1 at spring line, vertical at bottom, with sgl or dbl trench box	
12	P	Dewatering Allowance	2,571	lf	$75.00	$192,825	scope TBD,	
13	P	Install/Remove Speed Shoring at Bottom - 9' or Secondary Shield	2,571	lf	$10	$25,710		
14	P	Purchase Sand Bedding	840	cys	$30	$25,200	deld	
15	P	Purchase Pipe Zone	3,810	cys	$30	$114,300	deld	
16	P	Place Bedding	840	cys	$6.24	$5,242	for complete pipe zone	
17	P	Install Pipe	2,571	lf	$32.21	$82,818		
18	S	90" Welds	68	ea	$767.19	$52,380		
19	P	Place/Compact Pipe Zone Materials	3,810	cys	$8.77	$33,414	at 40'	
20	P	Place/Compact Native Backfill Matls from Stockpile	7,800	cys	$3.63	$28,314		
21	P	Load/Haul/Dispose of Excess Soils	6,200	cys	$22	$135,000	assume <5 mi one-way haul, ~6,000 cys to Settling Basin #2 at 1/2 mile	
22	P	Support/Repairs at (e) Pipelines	2	ea	$5,000	$10,000		
23	P	Install Pipe Access Manholes	3	ea	$10,000	$30,000	60" precast rings	
24	S	Purchase/Install CARVs	-	ea	$15,000	$0		
25	S	Purchase/Install Blowoffs	1	ea	$11,000	$11,000		
26	S	Purchase/Install ARVs	-	ea	$15,000	$0		
27	S	Cathodic Protection Systems	2,571	lf	$7	$17,997		
28	S	Traffic Controls	-	dys	$5,000	$0		
29	P	***Reach 2 Pipeline Outlet Structure***			***$46,667***		No current structural details	
30	P	Structure Excavation & Foundation Prep	1	ls	$5,000	$5,000		
31	P	Structural Concrete	39	cys	$750.00	$29,167	includes rebar	
32	P	Bar Screen	1	ls	$7,500	$7,500		
33	P	Miscellanous	1	ls	$5,000	$5,000		
34	P	***Laterals***						
35	P	***4-N (20") Sta 152+39***	*1*	*ls*	***$94,778***			
36	P	***Meter Vault***			***$46,144***			
37	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
38	P	Precast Concrete Vault (6x6)	7	cys	$750	$5,347	deld and set	
39	P	Vault Lid & Frame & Ladder	25	sf	$100	$2,500		
40	P	Dampproofing, Backfill & Misc.	1	ls	$2,500	$2,500		
41	P	20" Mag Meter	1	ea	$17,000	$17,000		
42	P	20" Automated Valve	1	ea	$14,000	$14,000	motorized flow control	
43	S	Electrical Power & Communication	1	ls	$3,500	$3,500	RTU pnl + 3 conduit runs at 20' + connects (4)	
44	P	**Pipe Lateral**			***$30,542***			
45	P	20" B'Fly Iso valve	1	ea	$15,600	$15,600		
46	P	20" PVC	88	lf	$144.00	$12,672		
47	P	20" PVC 45d Elbows	2	ea	$790	$1,580		
48	P	20" PVC 22d Elbow	1	ea	$690	$690		
51	P	**Baffled Outlet Structure**			***$21,093***			
52	P	Structure Excavation & Foundation Prep	74	cy	$35	$2,593		
53	P	Structural Concrete	16	cys	$750	$12,000	includes rebar	
54	P	Dampproofing, Backfill & Misc.	1	ls	$3,500	$3,500		
55	P	Canal Connection Details	1	ls	$3,000	$3,000		
56	P	***4-S (18") Sta 154+79***	*1*	*ls*	***$82,880***			
57	P	***Meter Vault***			***$43,044***			
58	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
59	P	Precast Concrete Vault (6x6)	7	cys	$750	$5,347	deld and set	
60	P	Vault Lid & Frame & Ladder	25	sf	$100	$2,500		
61	P	Dampproofing, Backfill & Misc.	1	ls	$2,500	$2,500		
62	P	18" Mag Meter	1	ea	$15,300	$15,300		
63	P	18" Automated Valve	1	ea	$12,600	$12,600	motorized flow control	
64	S	Electrical Power & Communication	1	ls	$3,500	$3,500	RTU pnl + 3 conduit runs at 20' + connects (4)	
65	P	**Pipe Lateral**			***$21,744***			
66	P	18" B'Fly Iso valve	1	ea	$11,700	$11,700		
67	P	18" PVC	33	lf	$108.00	$3,564		
68	P	18" PVC 45d Elbows	2	ea	$690	$1,380		
69	P	18" PVC 22d Elbow	1	ea	$600	$600		
70	S	Remove/Replace Roadway Pvmt	100	sf	$20	$2,000		
71	S	Traffic Control at Road X-ing	1	ls	$2,500	$2,500		
72	P	**Baffled Outlet Structure**			***$21,093***			
73	P	Structure Excavation & Foundation Prep	74	cy	$35	$2,593		
74	P	Structural Concrete	16	cys	$750	$12,000	includes rebar	
75	P	Dampproofing, Backfill & Misc.	1	ls	$3,500	$3,500		
76	P	Canal Connection Details	1	ls	$3,000	$3,000		
77	P	***Turnouts***						
78	P	***L4-N01 (14") Sta 152+26***	*1*	*ls*	***$16,712***			
79	P	***Meter Vault***			***$0***	$0		
87	P	**Pipe Lateral**			***$16,712***			
88	P	14" B'Fly Iso valve	1	ea	$9,100	$9,100		
89	P	14" PVC	73	lf	$84.00	$6,132		
90	P	14" PVC 45d Elbows	2	ea	$515	$1,030		
91	P	14" PVC 22d Elbow	1	ea	$450	$450		
92	S	Remove/Replace Roadway Pvmt	-	sf	$20	$0		
93	S	Traffic Control at Road X-ing	-	ls	$2,500	$0		
94	P	***L4-S01 (14") Sta 86+66***	*1*	*ls*	***$12,332***			
95	P	***Meter Vault***			***$0***	$0		
103	P	**Pipe Lateral**			***$12,332***			
104	P	14" B'Fly Iso valve	1	ea	$9,100	$9,100		
105	P	14" PVC	23	lf	$84.00	$1,932		
106	P	14" PVC 45d Elbows	2	ea	$450	$900		
107	P	14" PVC 22d Elbow	1	ea	$400	$400		
4		**Miscellanous**	1	ls	*$191,155*	**$191,155**		***$300,000***
1	P	***Settling Basin No. 3***						
2	P	Demo (e) Concrete Liner	193	cys	$75.00	$14,468	demo, haul-off and disposal -C12	
3	P	Import Fill Materials from PS #2 or Waste Pipe Exc	13,200	cys	$0	$0	costs covered above	
4	S	Place/Compact/Shape Imported Fill Materials	13,200	cys	$8	$105,600		
5	P	***Settling Basin No. 4***						

Patterson Irrigation District
Main Canal Rehabilitation Project
Schedule B - Project 22
Station 140+00 to Station 169+02

Opinion of Probable Construction Costs (OPCC)

Currency: USD-United States-JANUARY 2017 Dollar

Grand Total Price: $ 8,400,000

Proj #	GC	Description	Quantity	UOM	Unit Cost	Total Cost	Comments	Final Total
6	P	Demo (e) Concrete Liner	193	cys	$75.00	$14,468	demo, haul-off and disposal -C12	
7	P	Import Fill Materials from PS #2 or Waste Pipe Exc	3,500	cys	$0	$0	costs covered above	
8	S	Place/Compact/Shape Imported Fill Materials	3,500	cys	$8	$28,000		
9	P	***PID Well No. 6***						
10	P	90"x12" Flanged Outlet	1	ea	$4,500	$4,500		
11	P	12" C200	35	lf	$150	$5,250		
12	P	12" C200 90d Elbow	1	ea	$1,620	$1,620		
13	P	Connection	1	ea	$1,500	$1,500		
14	P	***ROW Fencing***						
15	S	New 5' BW Fencing	6,300	lf	$2.50	$15,750		
16	P	***Temporary Construction Easement***						
17	P	Costs to Acquire Temporary Construction Easement	-	ac	$5,000	$0	by Owner	
					Running Subtotal:	**$5,415,131**		
A		**Startup/Commission/Owner Training**	1	ls		**$94,000**		
1	P	Pre-commissioning	300	hrs	$150	$45,000		
2	S	Vendor Support	1	ls	$10,000	$10,000		
3	P	Commissioning	200	hrs	$150	$30,000		
4	P	Training	40	hrs	$100	$4,000		
5	P	Startup Expendables	1	ls	$5,000	$5,000		
					Running Subtotal:	**$5,509,131**		
6	P	Unlisted Items Allowance	1	ls	5.0%	$275,457	on running subtotal, for unpriced details or to mitigate estimating accuracy issues	
					Running Subtotal:	**$5,784,588**	**Direct Construction Costs (DCC)**	
B		**Construction Allowances**	1	ls		**$2,391,460**		
1		Prime Contractor General Conditions	1	ls	7%	$320,000	$22,857	14
2		Subcontractor General Conditions	1	ls	6%	$74,700		
3		Market Factor	1	ls	0%	$0	Premium for remote location, logistics, complexity, etc.	
4		Construction Phasing Factor	1	ls	0%	$0	Premium for interfaces, constraints, etc.	
5		Subcontractor Overheads & Markups	1	ls	15%	$197,863	H/O Overheads, Job Fee & Risk, insur, bond	
6		Subcontractor Bonding	1	ls	1.5%	$18,666		
7		Prime Contractor OH&P on Subs	1	ls	5%	$75,848	Oversight + Risk	
8		Prime Contractor OH&P on Self-Perform	1	ls	11%	$534,600	Job Fee + Risk	
9		Contractor Insurance Program	1	ls	2.5%	$175,157	Performance/Payments Bonds, Genl Liability	
10		State Sales Taxes	1	ls	8.75%	$251,350	On Materials at 40% of running subtotal	
11		Design/Estimating Contingency	1	ls	10%	$743,277		
				1.484	**Running Subtotal:**	**$8,176,000**	**Base Construction Costs (BCC)**	
C		**Project Allowances**				**$0**		
1		Escalation	1	ls	0.0%	**$0**	Excluded, current costs	
2		Construction Change Contingency	1	ls	0.0%	**$0**	Excluded,	
					Running Subtotal:	**$8,176,000**	**Total Construction Costs (TCC)**	
D		**Owner Allowances**				**$195,100**		
1		Misc Owner's Soft Costs (All)	1	ls	0.0%	**Excluded**	engr, legal, permitting, CM, admin, finance, etc.	
2		***SCADA Integration Services, RTU's, PLC (Sierra Controls)***						
3		PS #4 -Automated System Integration & Programming	1	ls	$162,900	**$162,900**	Sierra Controls budget quote	
4		Laterals	2	ea	$16,100	**$32,200**	"	
6								
			Markup Factor	1.5459				Total
						$8,371,000	**Total Project Costs (TPC)**	***$8,380,000***

Cost Range: **$6,700,000** **$9,200,000** AACEI Criteria

Assumptions:

1) Cost estimate assumes that a TCE for an access road and staging area will be secured by the owner for the contractor's unrestricted usage adjacent to PS#2.
2) The PS excavation will not require a designed sheetpile/cofferdam system to support construction operations and the TCE will accommodate pit limits and need for the stockpiling of excavated materials.
3) Extensive dewatering will not be required for the pipeline install as the schedule will allow construction during periods of assumed low groundwater (Aug-Nov).

Qualifications:

1) This OPCC is classified as a Class 4 cost estimate per AACE guidelines. Stated accuracy range = -20% to + 10%
2) Pricing basis = 4th Qtr 2016, escalation to midpoint of construction is excluded
3) P=Prime, S=Subcontractor
4) Special inspections not included.

OPCC Disclaimer

MWH has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the OPCC of this project, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, Client recognizes that this OPCC deliverable is based on normal market conditions, defined by stable resource supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. Client further acknowledges that this OPCC is a "snapshot in time" and that the reliability of this OPCC will degrade over time. Client agrees that MWH cannot and does not make any warranty, promise, guarantee or representation, either express or implied that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from MWH's good faith **CLASS 5 OPCC**

AACE International CLASS 4 Cost Estimate - Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. Typically, engineering is 10% to 40% complete. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Virtually all Class 4 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric and modeling techniques. Expected accuracy ranges are from -15% to -30% on the low side and +20% to 50% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. As little as 20 hours or less to perhaps more than 300 hours may be spent preparing the estimate depending on the project and estimating methodology (AACE International Recommended Practices and Standards).

Patterson Irrigation District
Main Canal Rehabilitation Project
Schedule C - Project 23
Sta 0+00 to Sta 72+00, Sta 118+78 to Sta 140+00, Sta 169+00 to Sta 174+50

Opinion of Probable Construction Costs (OPCC)

Currency: USD-United States-JANUARY 2017 Dollar

Grand Total Price: $ 4,700,000

Proj #	GC	Description	Quantity	UOM	Unit Cost	Total Cost	Comments	Final Total
1		**Mobilization**	1	ls	*$59,000*	**$59,000**		***$90,000***
1	P	***Mob & General Conditions Costs***	1	ls	$0	$0	covered below in Construction Allowances	
2	P	***Construct Access/Setup Yard/Temporary SWPPP BMPs***	7	dys	$4,000	$28,000	say 5 days to mobe/set-up, grade road to project area & install any BMPs	
3	P	BMP Materials	1	ls	$5,000	$5,000	straw bales, waddles, hay, etc.	
4	P	Establish Water Supply	1	dys	$4,000	$4,000	set trash pump or hurricane pump and Klien tower	
5	P	Rent Water Supply Equipment	4	mo	$2,500	$10,000	pumps, pipes, tower, as required	
6	P	***Sheeting, Shoring & Bracing & Constructability***	3	dys	$4,000	$12,000	truck wash, Air Monitoring Sensors,	
7	P	Costs covered below	1	ls	$0	$0		
2		**Canal Conveyance**	1	ls	*$2,952,736*	**$2,952,736**		***$4,430,000***
1	P	***Reach 1 - Sta 0+00 - Sta 72+00 - Flume***						
2		Demo (e) 3" Canal Concrete Lining	7,175	lf	$15	$107,625	budget pricing at ~ $65/cy from McElvany Constr.	
3		Canal Excavation, Embankment, Trimming & Concrete Placement	7,175	lf	$155	$1,112,125	budget pricing from McElvany Constr.	
4	P	Flume Connects	2	ea	$2,500	$5,000		
5	P	Import, Place & Compact Common Embankment for O&M Roads, etc.	23,200	cys	$25	$580,000	off-site source TBD, assume <7.5 miles one way, minimal royalty	
6	P	Fine Grade and Compact Roadway Subgrade	22,400	sy	$1.50	$33,600	for both O&M roads	
7	P	Import, Place & Compact Aggregate Base for 16' Road Surface	1,100	cys	$40	$44,000		
8	P	***Reach 3 - Sta 118+73 - Sta 140+00***						
9		Demo (e) 3" Canal Concrete Lining	2,127	lf	$15	$31,905	budget pricing at ~ $65/cy from McElvany Constr.	
10		Canal Excavation, Embankment, Trimming & Concrete Placement	2,127	lf	$155	$329,685	budget pricing from McElvany Constr.	
11	P	Import, Place & Compact Common Embankment for O&M Roads, etc.	1,600	cys	$25	$40,000	off-site source TBD, assume <7.5 miles one way, minimal royalty	
12	P	Fine Grade and Compact Roadway Subgrade	6,695	sy	$1.50	$10,043	for both O&M roads	
13	P	Import, Place & Compact Aggregate Base for 16' Road Surface	400	cys	$40	$16,000		
14	P	***Reach 5 - Sta 169+00 - Sta 174+50***						
15		Demo (e) 3" Canal Concrete Lining	550	lf	$15	$8,250	budget pricing at ~ $65/cy from McElvany Constr.	
16		Canal Excavation, Embankment, Trimming & Concrete Placement	550	lf	$155	$85,250	budget pricing from McElvany Constr.	
17	P	Import, Place & Compact Common Embankment for O&M Roads, etc.	1,500	cys	$25	$37,500	off-site source TBD, assume <7.5 miles one way, minimal royalty	
18	P	Fine Grade and Compact Roadway Subgrade	1,789	sy	$1.50	$2,683	for both O&M roads	
19	P	Import, Place & Compact Aggregate Base for 16' Road Surface	100	cys	$40	$4,000		
20	P	***Laterals***						
21	P	***1-S (24") Sta 54+46***	*1*	*ls*	***$53,336***			
22	P	***Canal Inlet Structure***			***$30,644***			
23	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
24	P	CIP Concrete Vault	7	cys	$750	$5,347		
25	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
26	P	Canal Gate	1	ea	$23,000	$23,000	manual	
27	P	**Pipe Lateral**			***$2,592***			
28	P	24" PVC	18	lf	$144.00	$2,592		
29	P	**Lateral Outlet Structure**			***$38,100***			
30	P	Structure Excavation & Foundation Prep	110	cy	$35	$3,850		
31	P	Structural Concrete	19	cys	$750	$14,250	includes rebar	
32	P	Dampproofing, Backfill & Misc.	1	ls	$2,000	$2,000		
33	P	16" RW Bypass w/ Gate	1	ls	$15,000	$15,000		
34	P	Canal Connection Details	1	ls	$3,000	$3,000		
35	P	***1-N (36") Sta 50+20***	*1*	*ls*	***$54,776***			
36	P	***Canal Inlet Structure***			***$30,644***			
37	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
38	P	CIP Concrete Vault	7	cys	$750	$5,347		
39	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
40	P	Canal Gate	1	ea	$23,000	$23,000	manual	
41	P	**Pipe Lateral**			***$4,032***			
42	P	36" RCP	14	lf	$288.00	$4,032		
43	P	**Lateral Outlet Structure**			***$38,100***			
44	P	Structure Excavation & Foundation Prep	110	cy	$35	$3,850		
45	P	Structural Concrete	19	cys	$750	$14,250	includes rebar	
46	P	Dampproofing, Backfill & Misc.	1	ls	$2,000	$2,000		
47	P	16" RW Bypass w/ Gate	1	ls	$15,000	$15,000		
48	P	Canal Connection Details	1	ls	$3,000	$3,000		
49	P	***3-N (42") Sta 125+286***	*1*	*ls*	***$68,914***			
50	P	***Canal Inlet Structure***			***$32,644***			
51	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
52	P	CIP Concrete Vault	7	cys	$750	$5,347		
53	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
54	P	Canal Gate	1	ea	$25,000	$25,000		
55	P	**Pipe Lateral**			***$16,170***			
56	P	42" RCP	35	lf	$462.00	$16,170		
57	P	**Lateral Outlet Structure**			***$43,100***			
58	P	Structure Excavation & Foundation Prep	110	cy	$35	$3,850		
59	P	Structural Concrete	19	cys	$750	$14,250		
60	P	Dampproofing, Backfill & Misc.	1	ls	$2,000	$2,000		
61	P	20" RW Bypass w/ Gate	1	ls	$20,000	$20,000		
62	P	Canal Connection Details	1	ls	$3,000	$3,000		
63	P	***3-S (43") Sta 125+286***	*1*	*ls*	***$57,364***			
64	P	***Canal Inlet Structure***			***$32,644***			
65	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
66	P	CIP Concrete Vault	7	cys	$750	$5,347		
67	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
68	P	Canal Gate	1	ea	$25,000	$25,000		
69	P	**Pipe Lateral**			***$4,620***			
70	P	42" RCP	10	lf	$462.00	$4,620		
71	P	**Lateral Outlet Structure**			***$48,100***			
72	P	Structure Excavation & Foundation Prep	110	cy	$35	$3,850		
73	P	Structural Concrete	19	cys	$750	$14,250		
74	P	Dampproofing, Backfill & Misc.	1	ls	$2,000	$2,000		
75	P	20" RW Bypass w/ Gate	1	ls	$25,000	$25,000		
76	P	Canal Connection Details	1	ls	$3,000	$3,000		
77	P	***Turnouts***						
78	P	***L1-S01 (16") Sta 3+64***	*1*	*ls*	***$36,288***			
79	P	***Canal Inlet Structure***			***$32,644***			
80	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
81	P	CIP Concrete Vault	7	cys	$750	$5,347		
82	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
83	S	Canal Gate	1	ea	$25,000	$25,000		
84	P	**Pipe Lateral**			***$3,644***			
85	P	16" PVC	14	lf	$96.00	$1,344		
86	P	16" PVC 45d Elbows	2	ea	$650	$1,300		
87	P	Couple to (e) Pipe	1	ea	$1,000	$1,000		
88	P	***L1-102 (20") Sta 24+18***	*1*	*ls*	***$36,338***			

Patterson Irrigation District
Main Canal Rehabilitation Project
Schedule C - Project 23
Sta 0+00 to Sta 72+00, Sta 118+78 to Sta 140+00, Sta 169+00 to Sta 174+50

Opinion of Probable Construction Costs (OPCC)

Currency: USD-United States-JANUARY 2017 Dollar

Grand Total Price: $ 4,700,000

Proj #	GC	Description	Quantity	UOM	Unit Cost	Total Cost	Comments	Final Total
89	P	***Canal Inlet Structure***			***$32,644***			
90	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
91	P	CIP Concrete Vault	7	cys	$750	$5,347		
92	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
93	S	Canal Gate	1	ea	$25,000	$25,000		
94	P	**Pipe Lateral**			***$3,694***			
95	P	20" PVC	14	lf	$96.00	$1,344		
96	P	20" PVC 45d Elbows	2	ea	$675	$1,350		
97	P	Couple to (e) Pipe	1	ea	$1,000	$1,000		
98	P	***L2-S03 (20") Sta 24+40***	*1*	*ls*	***$36,674***			
99	P	***Canal Inlet Structure***			***$32,644***			
100	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
101	P	CIP Concrete Vault	7	cys	$750	$5,347		
102	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
103	S	Canal Gate	1	ea	$25,000	$25,000		
104	P	**Pipe Lateral**			***$4,030***			
105	P	20" PVC	14	lf	$120.00	$1,680		
106	P	20" PVC 45d Elbows	2	ea	$675	$1,350		
107	P	Couple to (e) Pipe	1	ea	$1,000	$1,000		
108	P	***L1-S04 (24") Sta 54+17***	*1*	*ls*	***$37,360***			
109	P	***Canal Inlet Structure***			***$32,644***			
110	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
111	P	CIP Concrete Vault	7	cys	$750	$5,347		
112	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
113	S	Canal Gate	1	ea	$25,000	$25,000		
114	P	**Pipe Lateral**			***$4,716***			
115	P	24" PVC	14	lf	$144.00	$2,016		
116	P	24" PVC 45d Elbows	2	ea	$850	$1,700		
117	P	Couple to (e) Pipe	1	ea	$1,000	$1,000		
118	P	***L1-N02 (20") Sta 57+45***	*1*	*ls*	***$37,024***			
119	P	***Canal Inlet Structure***			***$32,644***			
120	P	Structure Excavation & Foundation Prep	37	cy	$35	$1,296		
121	P	CIP Concrete Vault	7	cys	$750	$5,347		
122	P	Dampproofing, Backfill & Misc.	1	ls	$1,000	$1,000		
123	S	Canal Gate	1	ea	$25,000	$25,000		
124	P	**Pipe Lateral**			***$4,380***			
125	P	20" PVC	14	lf	$120.00	$1,680		
126	P	20" PVC 45d Elbows	2	ea	$850	$1,700		
127	P	Couple to (e) Pipe	1	ea	$1,000	$1,000		
3		**Miscellanous**	1	ls	*$105,932*	**$105,932**		*$160,000*
1	P	***Reach 1 Concrete Spillway - Sta 56+00***			*$13,066*			
2	P	Remove (e) Concrete Spillway - 6"	68	cys	$75	$5,126	break, load, haul & dispose	
3	P	Fine Grade and Compact Grade for New Spillway	149	sy	$5	$744		
4	P	Import, Place & Compact Aggregate Base at Fdn - 6"	25	cys	$40	$993		
5	P	F/P/S/F Concrete Flatwork - 6"	25	cys	$250	$6,204	incls mesh or rebar	
6	P	***Reach 3 Concrete Spillway***			*$12,373*			
7	P	Remove (e) Concrete Spillway - 6"	43	cys	$75	$3,241	break, load, haul & dispose	
8	P	Fine Grade and Compact Grade for New Spillway	171	sy	$5	$856		
9	P	Import, Place & Compact Aggregate Base at Fdn - 6"	29	cys	$40	$1,141		
10	P	F/P/S/F Concrete Flatwork - 6"	29	cys	$250	$7,134	incls mesh or rebar	
11	P	***PID Well No. 1-4 Modifications***						
12	S	90"x12" Flanged Outlet	4	ea	$4,500	$18,000	no details available	
13	S	12" C200	140	lf	$150	$21,000		
14	S	12" C200 90d Elbow	4	ea	$1,620	$6,480		
15	S	Connection	4	ea	$1,500	$6,000		
16	P	***ROW Fencing***						
17	S	New 5' BW Fencing	11,605	lf	$2.50	$29,013		
18	P	***Temporary Construction Easement***						
19	P	Costs to Acquire Temporary Construction Easement	-	ac	$5,000	$0	by Owner	
					Running Subtotal:	**$3,117,667**		
A		**Startup/Commission/Owner Training**	1	ls		**$94,000**		
1	P	Pre-commissioning	300	hrs	$150	$45,000		
2	S	Vendor Support	1	ls	$10,000	$10,000		
3	P	Commissioning	200	hrs	$150	$30,000		
4	P	Training	40	hrs	$100	$4,000		
5	P	Startup Expendables	1	ls	$5,000	$5,000		
					Running Subtotal:	**$3,211,667**		
6	P	Unlisted Items Allowance	1	ls	5.0%	$160,583	on running subtotal, for unpriced details or to mitigate estimating accuracy issues	
					Running Subtotal:	**$3,372,251**	**Direct Construction Costs (DCC)**	
B		**Construction Allowances**	1	ls		**$970,011**		
1		Prime Contractor General Conditions	1	ls	7%	$110,000	$7,857	14
2		Subcontractor General Conditions	1	ls	6%	$13,000		
3		Market Factor	1	ls	0%	$0	Premium for remote location, logistics, complexity, etc.	
4		Construction Phasing Factor	1	ls	0%	$0	Premium for interfaces, constraints, etc.	
5		Subcontractor Overheads & Markups	1	ls	15%	$34,274	H/O Overheads, Job Fee & Risk, insur, bond	
6		Subcontractor Bonding	1	ls	1.5%	$3,232		
7		Prime Contractor OH&P on Subs	1	ls	5%	$13,138	Oversight + Risk	
8		Prime Contractor OH&P on Self-Perform	1	ls	11%	$175,100	Job Fee + Risk	
9		Contractor Insurance Program	1	ls	2.5%	$93,025	Performance/Payments Bonds, Genl Liability	
10		State Sales Taxes	1	ls	8.75%	$133,491	On Materials at 40% of running subtotal	
11		Design/Estimating Contingency	1	ls	10%	$394,751		
				1.352	**Running Subtotal:**	**$4,342,300**	**Base Construction Costs (BCC)**	
C		**Project Allowances**				**$0**		
1		Escalation	1	ls	0.0%	**$0**	Excluded, current costs	
2		Construction Change Contingency	1	ls	0.0%	**$0**	Excluded,	
					Running Subtotal:	**$4,342,000**	**Total Construction Costs (TCC)**	

Patterson Irrigation District
Main Canal Rehabilitation Project
Schedule C - Project 23
Sta 0+00 to Sta 72+00, Sta 118+78 to Sta 140+00, Sta 169+00 to Sta 174+50

Opinion of Probable Construction Costs (OPCC)

Currency: USD-United States-JANUARY 2017 Dollar

Grand Total Price: $ 4,700,000

Proj #	GC	Description	Quantity	UOM	Unit Cost	Total Cost	Comments	Final Total
D		**Owner Allowances**				$334,400		
1		Misc Owner's Soft Costs (All)	1	ls	0.0%	**Excluded**	engr, legal, permitting, CM, admin, finance, etc.	
2		***SCADA Integration Services, RTU's, PLC (Sierra Controls)***						
3		Laterals	4	ea	$41,100	$164,400	"	
4		Relocate (e) Overhead 12 kVA Electric Line	10,000	lf	$17.00	$170,000	12-18" wood poles at ~250 o.c. 20 feet high, new conductor (250 kcmil - med vol sgl cable)	
			Markup Factor	1.4998				Total
						$4,676,000	**Total Project Costs (TPC)**	*$4,680,000*

Cost Range: $3,700,000 $5,100,000 AACEI Criteria

Assumptions:

1) Cost estimate assumes that a TCE for an access road and staging area will be secured by the owner for the contractor's unrestricted usage adjacent to PS#2 and/or PS#4.
2) The PS excavation will not require a designed sheetpile/cofferdam system to support construction operations and the TCE will accommodate pit limits and need for the stockpiling of excavated materials.
3) Extensive dewatering will not be required for the pipeline install as the schedule will allow construction during periods of assumed low groundwater (Aug-Nov).

Qualifications:

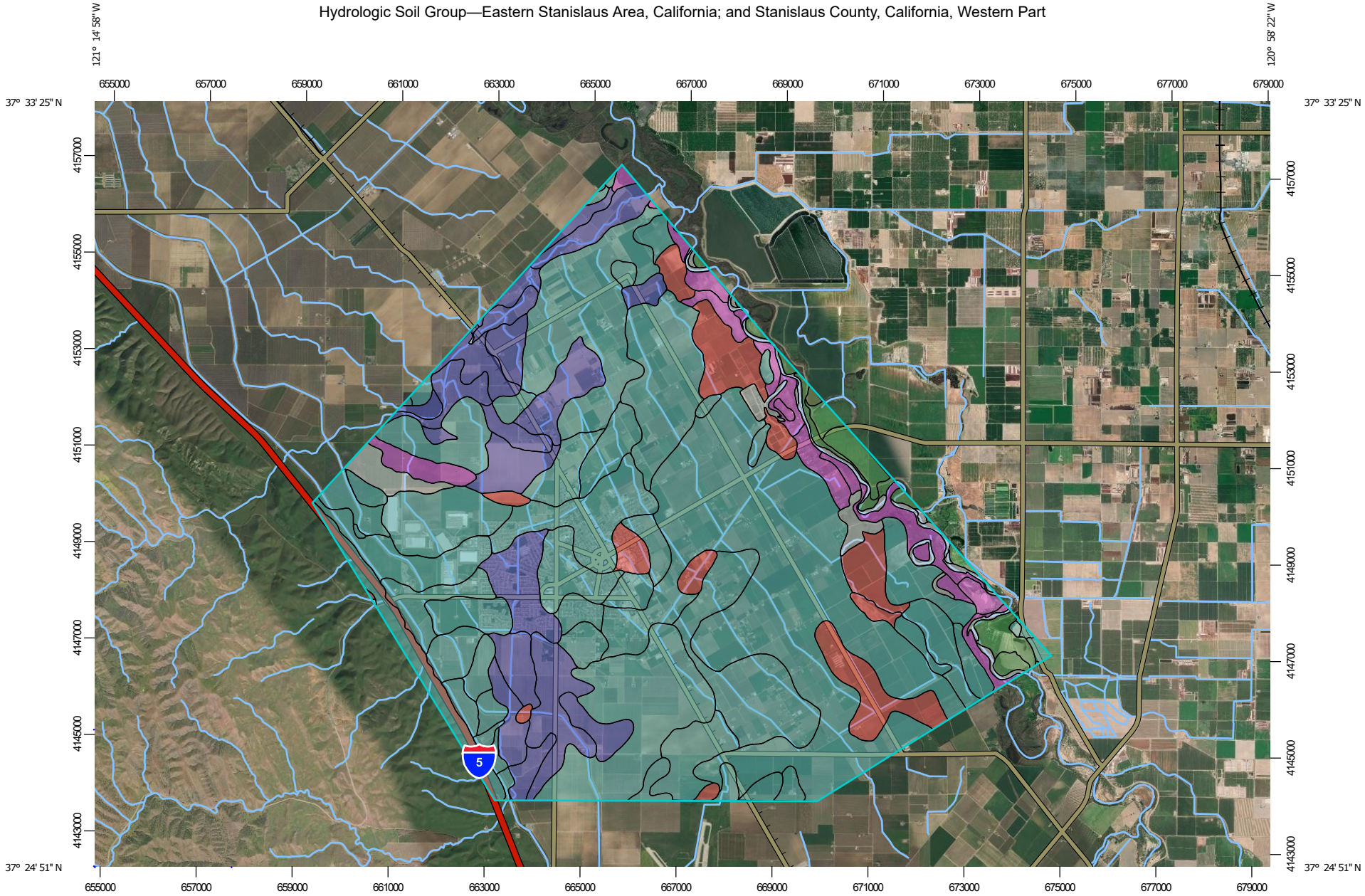
1) This OPCC is classified as a Class 4 cost estimate per AACE guidelines. Stated accuracy range = -20% to + 10%
2) Pricing basis = 4th Qtr 2016, escalation to midpoint of construction is excluded
3) P=Prime, S=Subcontractor
4) Special inspections not included.

OPCC Disclaimer

MWH has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the OPCC of this project, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, Client recognizes that this OPCC deliverable is based on normal market conditions, defined by stable resource supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. Client further acknowledges that this OPCC is a "snapshot in time" and that the reliability of this OPCC will degrade over time. Client agrees that MWH cannot and does not make any warranty, promise, guarantee or representation, either express or implied that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from MWH's good faith **CLASS 4 OPCC**

AACE International CLASS 4 Cost Estimate - Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. Typically, engineering is 10% to 40% complete. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Virtually all Class 4 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric and modeling techniques. Expected accuracy ranges are from -15% to -30% on the low side and +20% to 50% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. As little as 20 hours or less to perhaps more than 300 hours may be spent preparing the estimate depending on the project and estimating methodology (AACE International Recommended Practices and Standards).

Appendix D –
NRCS Web Soil Survey


121° 14' 58" W
120° 58' 22" W
37° 33' 25" N
37° 24' 51" N
655000
657000
659000
661000
663000
665000
667000
669000
671000
673000
675000
677000
679000
4157000
4155000
4153000
4151000
4149000
4147000
4145000
4143000
5
Map Scale: 1:112,000 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 1500 3000 6000 9000
Feet
0 5000 10000 20000 30000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Eastern Stanislaus Area, California
Survey Area Data: Version 12, Sep 14, 2018

Soil Survey Area: Stanislaus County, California, Western Part
Survey Area Data: Version 13, Sep 12, 2018

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 11, 2011—Mar 14, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CcA	Columbia fine sandy loam, 0 to 1 percent slopes	A/D	0.3	0.0%
CeA	Columbia loam, 0 to 1 percent slopes	A/D	275.2	1.0%
CpA	Columbia soils, 0 to 1 percent slopes	A/D	75.5	0.3%
CsB	Columbia soils, channeled, 0 to 8 percent slopes	A/D	365.9	1.3%
DwA	Dinuba sandy loam, slightly saline-alkali, 0 to 1 percent slopes	C	44.7	0.2%
Rr	Riverwash		32.4	0.1%
ThA	Temple silty clay loam, slightly saline, 0 to 1 percent slopes	C/D	21.0	0.1%
W	Water		241.2	0.8%
WbA	Waukena fine sandy loam, moderately saline-alkali, 0 to 1 percent slopes	C	14.6	0.1%
WdA	Waukena sandy loam, slightly saline-alkali, 0 to 1 percent slopes	C	1.1	0.0%
Subtotals for Soil Survey Area			**1,072.1**	**3.8%**
Totals for Area of Interest			**28,554.4**	**100.0%**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
100	Capay clay, 0 to 1 percent slopes, MLRA 17	C	2,586.5	9.1%
101	Capay clay, wet, 0 percent slopes, MLRA 17	C	5,739.6	20.1%
102	Capay clay, 0 to 1 percent slopes, loamy substratum, MLRA 17	D	903.7	3.2%
106	Capay clay, 0 percent slopes, rarely flooded, MLRA 17	C	874.8	3.1%
116	El Solyo silty clay loam, 0 to 2 percent slopes, rarely flooded	C	312.2	1.1%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
120	Vernalis-Zacharias complex, 0 to 2 percent slopes	C	1,657.0	5.8%
122	Vernalis loam, 0 to 2 percent slopes	B	1,065.5	3.7%
123	Vernalis clay loam, wet, 0 to 2 percent slopes	C	80.6	0.3%
125	Vernalis clay loam, 0 to 2 percent slopes	C	1,764.3	6.2%
126	Vernalis-Zacharias complex, 0 to 2 percent slopes, rarely flooded	C	385.0	1.3%
127	Vernalis loam, 0 to 2 percent slopes, rarely flooded	B	1,364.0	4.8%
128	Water		485.0	1.7%
130	Stomar clay loam, 0 to 2 percent slopes	C	1,165.2	4.1%
131	Stomar clay loam, wet, 0 to 2 percent slopes	D	522.0	1.8%
140	Zacharias clay loam, 0 to 2 percent slopes	C	1,112.7	3.9%
141	Zacharias clay loam, wet, 0 to 2 percent slopes	C	1,148.1	4.0%
144	Zacharias gravelly clay loam, 2 to 5 percent slopes	C	36.3	0.1%
145	Zacharias clay loam, 2 to 5 percent slopes	C	83.0	0.3%
146	Zacharias clay loam, 0 to 2 percent slopes, rarely flooded	C	448.4	1.6%
147	Zacharias gravelly clay loam, 0 to 2 percent slopes, rarely flooded	C	488.1	1.7%
150	Columbia fine sandy loam, 0 to 2 percent slopes, occasionally flooded	A	122.3	0.4%
151	Columbia complex, 0 to 2 percent slopes, occasionally flooded	A	56.3	0.2%
153	Columbia fine sandy loam, channeled, partially drained, o to 2 percent slopes, frequently flooded	A	436.9	1.5%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
157	Columbia complex, 0 to 2 percent slopes, rarely flooded	A	136.6	0.5%
159	Columbia complex, 0 to 2 percent slopes, frequently flooded	A	179.9	0.6%
160	Merritt silty clay loam, partially drained, 0 to 2 percent slopes, occasionally flooded	C	395.3	1.4%
165	Merritt silty clay loam, partially drained, 0 to 2 percent slopes, rarely flooded	C	9.3	0.0%
170	Dospalos-Bolfar complex, 0 to 2 percent slopes, occasionally flooded	C	329.6	1.2%
175	Dospalos-Bolfar complex, 0 to 2 percent slopes, rarely flooded	C	202.5	0.7%
180	Dello fine sandy loam, channeled, 0 to 2 percent slopes, frequently flooded	A	23.9	0.1%
190	Clear Lake clay, drained, 0 to 2 percent slopes, occasionally flooded, MLRA 17	D	282.0	1.0%
195	Clear Lake silty clay, drained, 0 to 2 percent slopes, MLRA 17	D	197.5	0.7%
200	Veritas sandy loam, 0 to 2 percent slopes, rarely flooded	A	169.3	0.6%
210	Cortina gravelly sandy loam, 0 to 5 percent slopes, rarely flooded	A	217.1	0.8%
246	Bolfar-Columbia complex, 0 to 2 percent slopes, occasionally flooded	C	130.4	0.5%
255	Calla-Carbona complex, 30 to 50 percent slopes	C	512.9	1.8%
270	Elsalado fine sandy loam, 0 to 2 percent slopes, rarely flooded	B	638.7	2.2%
271	Elsalado loam, 0 to 2 percent slopes, rarely flooded	B	389.4	1.4%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
273	Elsalado fine sandy loam, 0 to 2 percent slopes	B	137.8	0.5%
274	Elsalado loam, 0 to 2 percent slopes	B	581.2	2.0%
301	Damluis clay loam, 2 to 8 percent slopes	C	107.6	0.4%
500	Wisflat-Arburua-San Timoteo complex, 30 to 50 percent slopes, MLRA 15	D	3.7	0.0%
Subtotals for Soil Survey Area			**27,482.3**	**96.2%**
Totals for Area of Interest			**28,554.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

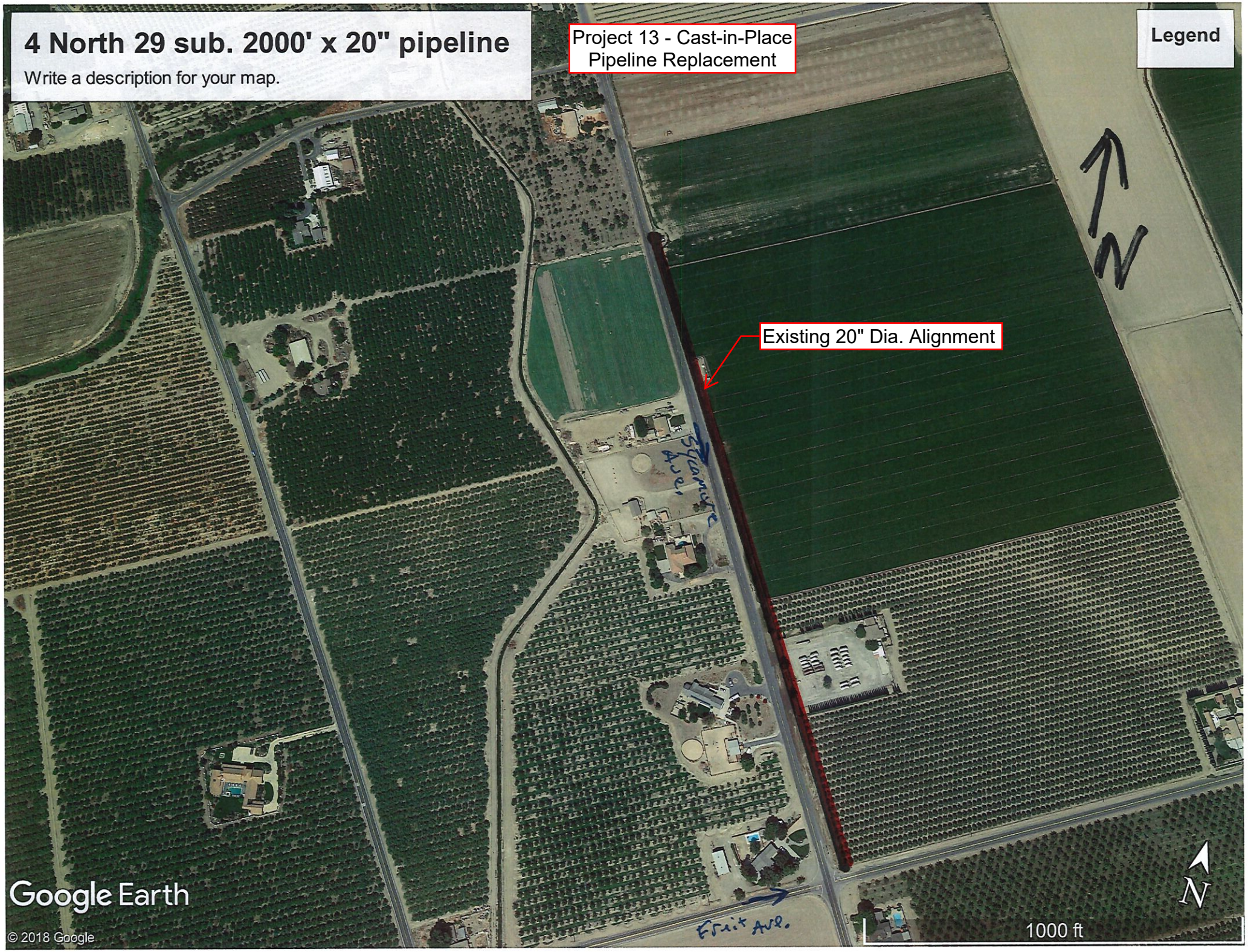
Rating Options

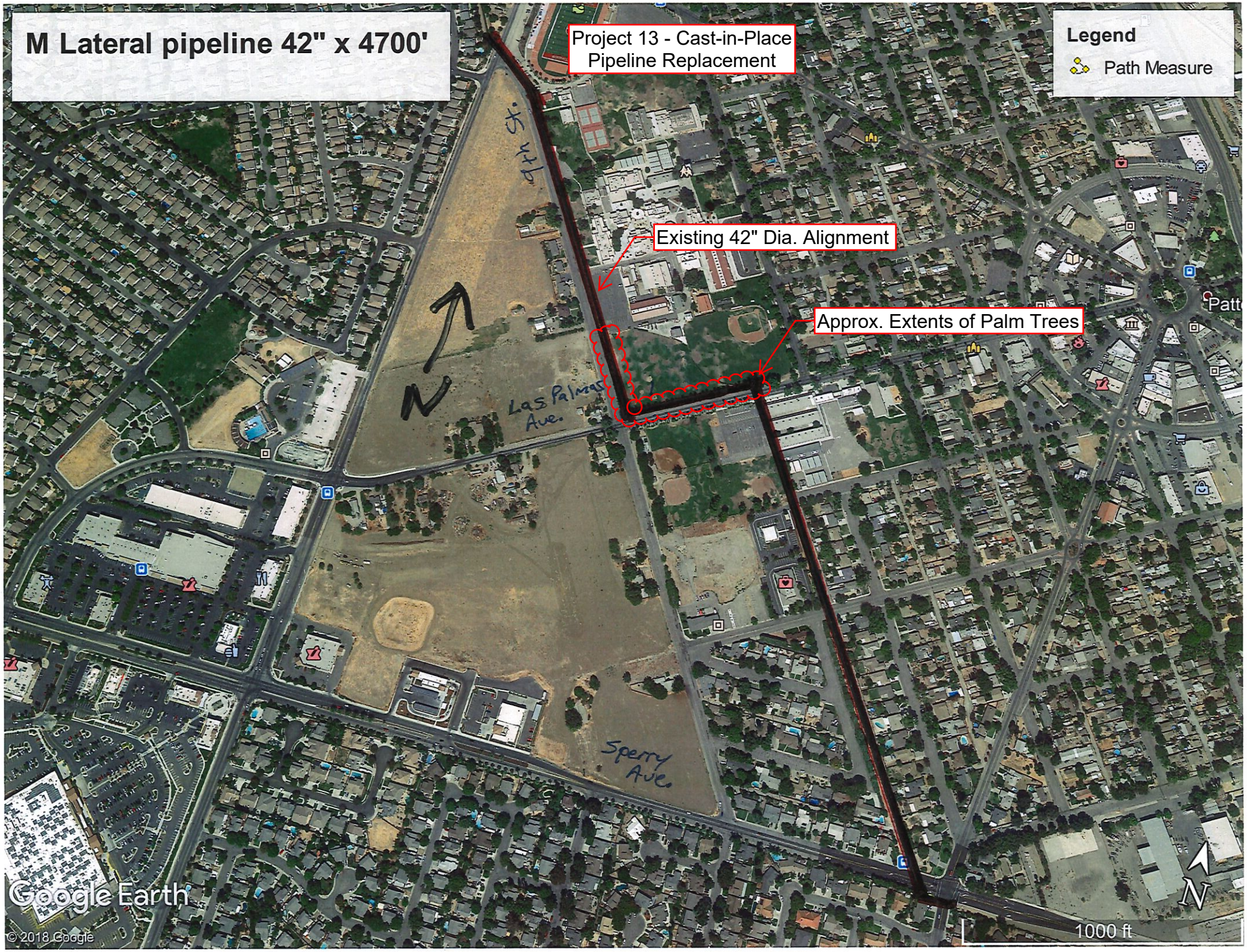
Aggregation Method: Dominant Condition

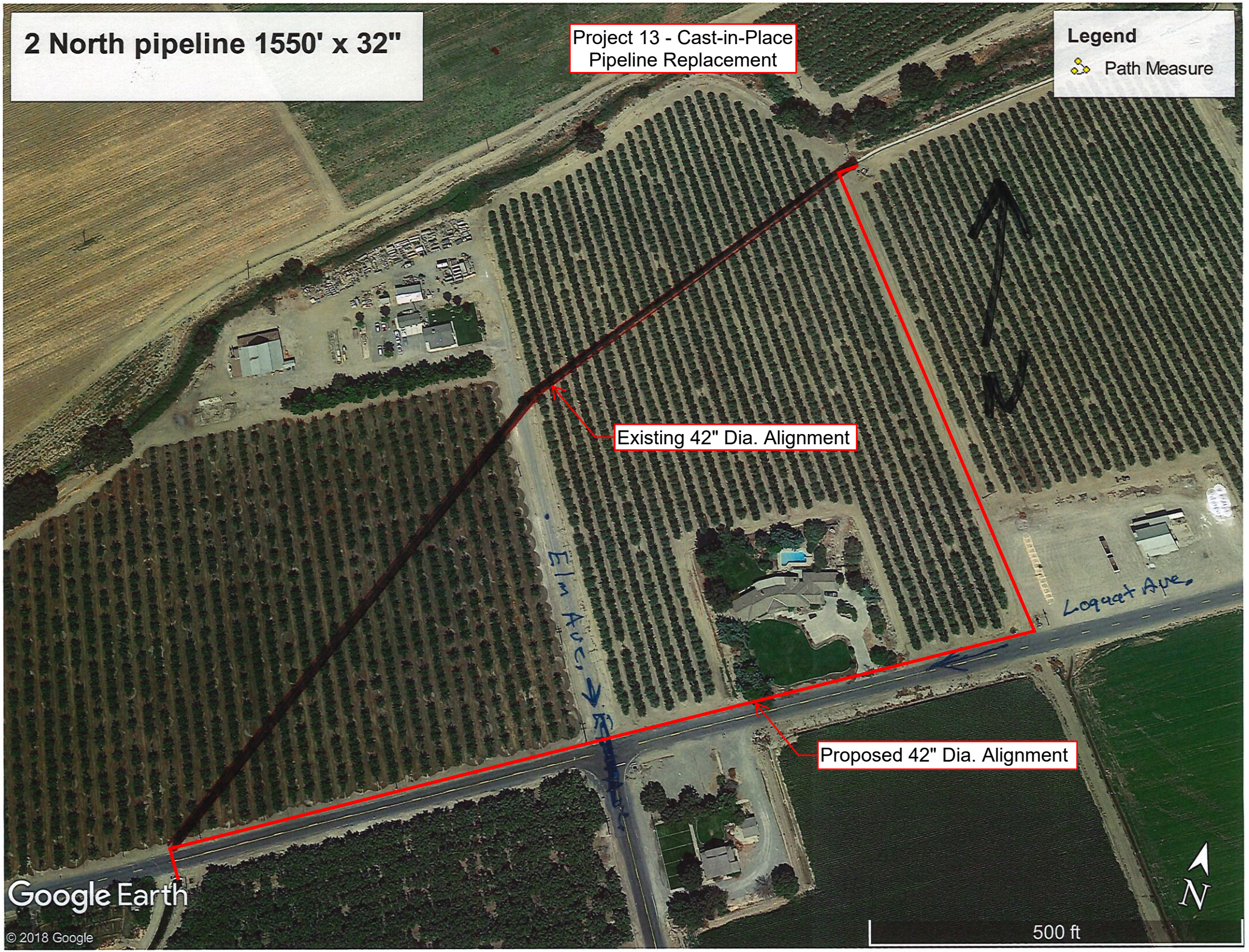
Component Percent Cutoff: None Specified

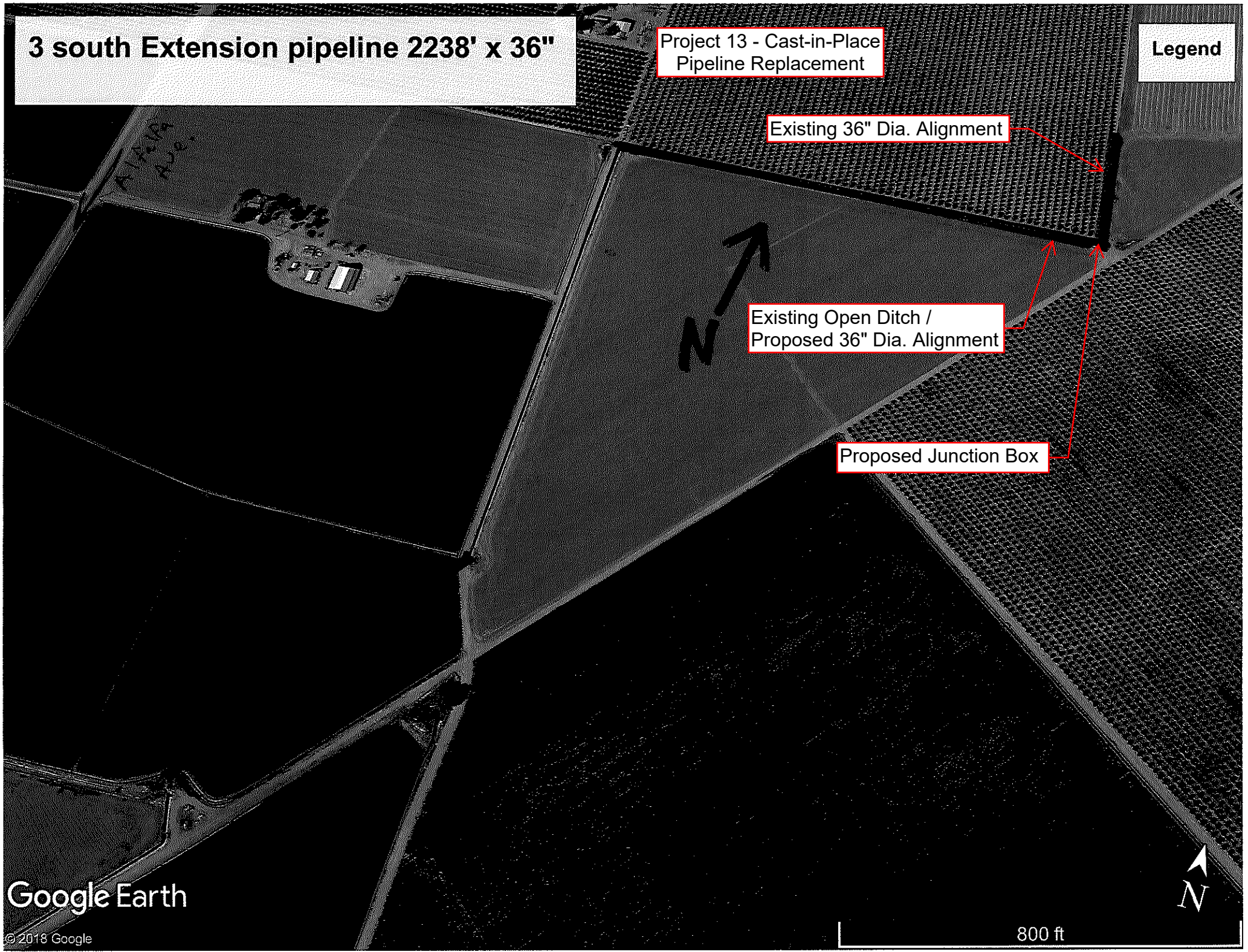
Tie-break Rule: Higher

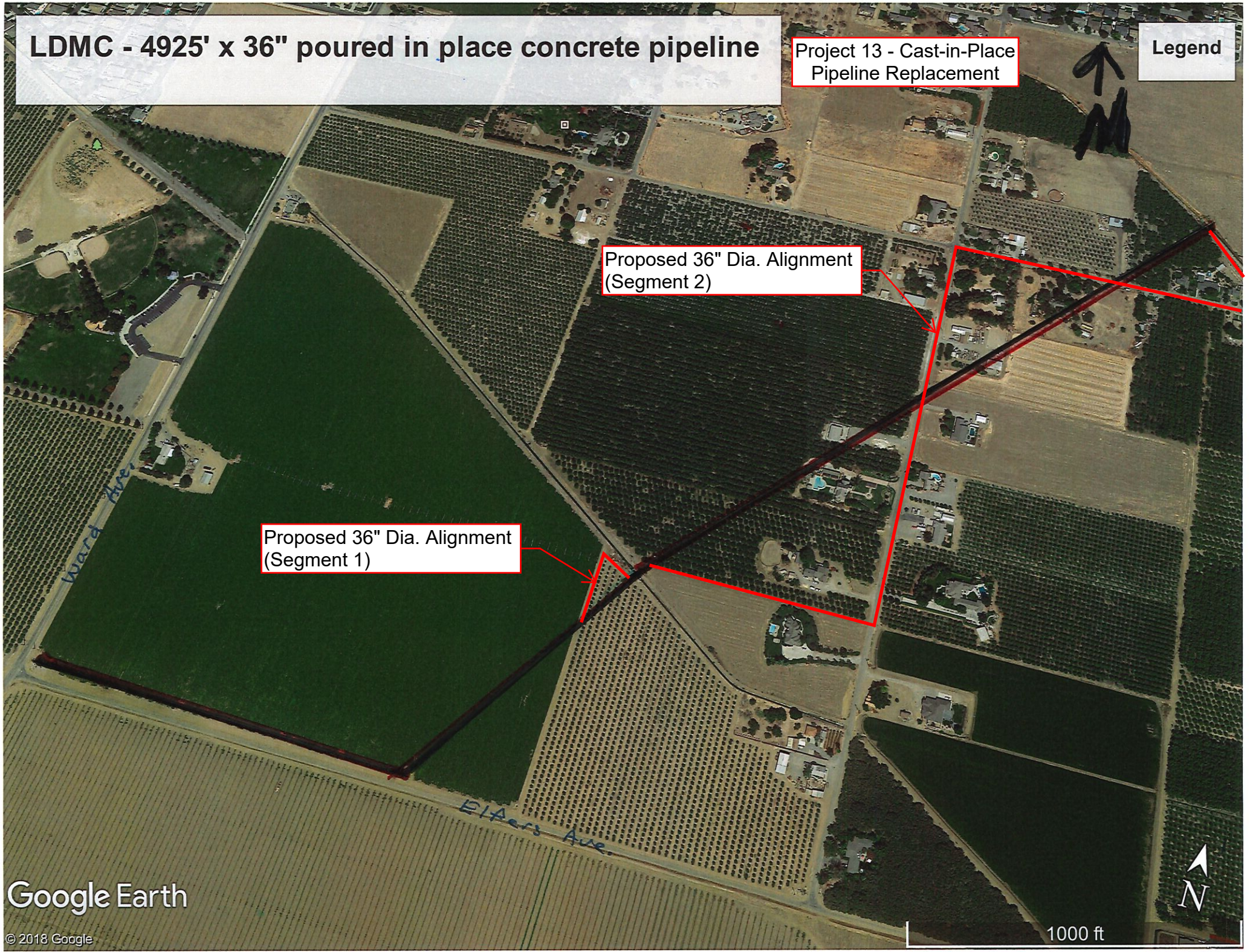
Appendix E –
Cast-in-Place Figures


4 North 29 sub. 2000' x 20" pipeline
Write a description for your map.
Project 13 - Cast-in-Place Pipeline Replacement
Legend
Existing 20" Dia. Alignment
Sycamore Ave.
Fruit Ave.
Google Earth
© 2018 Google
1000 ft
N


M Lateral pipeline 42" x 4700'
Project 13 - Cast-in-Place Pipeline Replacement
Legend
Path Measure
Existing 42" Dia. Alignment
Approx. Extents of Palm Trees
9th St.
Las Palmas Ave.
Sperry Ave.
N
Google Earth
© 2018 Google
1000 ft


2 North pipeline 1550' x 32"
Project 13 - Cast-in-Place Pipeline Replacement
Legend
Path Measure
Existing 42" Dia. Alignment
Proposed 42" Dia. Alignment
Elm Ave.
Loquat Ave.
Google Earth
© 2018 Google
N
500 ft


3 south Extension pipeline 2238' x 36"
Project 13 - Cast-in-Place Pipeline Replacement
Legend
Existing 36" Dia. Alignment
Existing Open Ditch / Proposed 36" Dia. Alignment
Proposed Junction Box
N
Google Earth
© 2018 Google
800 ft
N


LDMC - 4925' x 36" poured in place concrete pipeline
Project 13 - Cast-in-Place Pipeline Replacement
Legend
Proposed 36" Dia. Alignment (Segment 2)
Proposed 36" Dia. Alignment (Segment 1)
Ward Ave.
El Ares Ave.
Google Earth
© 2018 Google
N
1000 ft

Appendix F –
USBR Manual Overshot Gates

RECLAMATION Managing Water in the West

October 2012
Research and
Development Office
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The Knowledge Stream
Research Update

Simplified Overshot Gate Development

Overshot gates that irrigation districts can construct themselves

Bottom Line

Irrigation districts can construct these gates and maintain them using commonly available tools and techniques.

Better, Faster, Cheaper

These overshot gates are less expensive than commercially available gates and can be tailored to an irrigation district's needs and fabrication capabilities.

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Collaborators

Reclamation:

- **Science and Technology Program**
- **Nebraska-Kansas Area Office**
- **Dakotas Area Office**

External:

- **New Mexico State University**
- **Buford-Trenton Irrigation**
- **Nebraska Bostwick Irrigation**
- **South Platte Ditch Company**
- **Tucumcari Irrigation District**
- **Carlsbad Irrigation**

Problem

Control structures in irrigation canals raise the upstream water surface elevation to deliver water into lateral canals or farm turnouts. Irrigation districts have historically preferred stoplog controls (wooden planks) as control structures. As flows pass over the top, stoplog controls enable floating debris to pass on downstream, reducing maintenance. They also provide for better control of flows than controls structures pass flows under the structure (such as sluice gates), as there is less variation of the upstream water level as the flow rate moving through the canal changes.

In typical control operations, stoplogs are stacked in slots up to a height that will raise the water level to a desired elevation. The portion of flow continuing downstream past the check passes over the stoplogs. Since stoplogs must be physically installed or removed, this type of control is not readily adaptable for automated or remote control operations.

As water districts seek to adopt modernized canal operating technologies, they commonly face the need to upgrade stoplog controls. Stoplogs must be replaced with gates that can be readily motorized to be compatible with automated or remote control operation. Overshot gates offer a way to maintain the advantages of over-the-top flows offered by stoplogs. However, the various commercially produced overshot gate systems available represent a level of investment that can prevent many irrigation districts from considering adoption of modernized canal technologies beyond anything more than a demonstration-level scale.

Solution

This Science and Technology Program research project is partnered with cooperating irrigation districts and the Water Conservation Programs at Reclamation's Dakotas and Nebraska-Kansas Area Offices to establish field demonstration sites for self-constructed overshot gates. Each of the prototype overshot gate installations in this project have been configured for simple construction and installation at the existing structures. Additionally, we used differing gate operating mechanisms at the various sites to suit the cooperating districts' preferences and fabrication capabilities.

Application

We constructed and installed prototype overshot gates at:

- South Platte Ditch Company near Merino, Colorado
- Nebraska Bostwick Irrigation District near Red Cloud, Nebraska
- Buford-Trenton Irrigation District near Trenton, North Dakota

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At all the demonstration sites, overshot gates were fabricated for installation in existing stoplog bays. All gates are powered by solar-charged 12-volt DC motors. All of the demonstration site gates are set up for local manual operation and for automated/remote operation. The remote terminal units can be programmed to adjust a gate automatically or for a gate to be operated.

Figures 1, 2, and 3 show overshot gates installed at Buford-Trenton Irrigation District, at Nebraska Bostwick Irrigation District, and at the South Platte Ditch Company, respectively. These overshot gates, which were built using in-house capabilities and equipment at the respective districts, are able to fully meet operational objectives of the cooperating districts.

In figures 1 and 2, rubber belting is attached to the sides of the overshot gate leaf to seal against concrete piers on each side of the bay of the control structure. The overshot gates at these sites are simply a steel gate leaf with the upstream edge hinged to the floor of the structure and a lifting system attached to the downstream gate edge. The existing control structure in figure 3 features wide flange steel sections installed vertically to form the stoplog slots. Bottom and side sheets constructed of steel plates were required for this overshot gate, which was designed as a "drop-in" structure to install in the existing stoplog slots.

These overshot gates are a cost-effective option for districts. For example, the "drop-in" style 4-foot-wide gate shown in figure 3 was constructed and installed (including the 12-volt DC actuator) for approximately $3,000, or about $750 per foot of width. This compares with commercially produced overshot gates in the cost range of $2,500 per foot width.

Figure 1: Burford-Trenton Irrigation District.

Figure 2: Nebraska Bostwick Irrigation District.

Figure 3: South Platte Ditch Company.

"The overshot gate on our spill structure fully meets our needs at a fraction of the cost of a commercially built gate. With the linear actuator, the gate is SCADA ready and will be automated for upstream level control."

Charlie Bartlett,
South Platte Ditch Company
Board Member

Future Plans

Reclamation researchers are working to develop a "standardized" materials list and general design methodology that will be suitable for fabricating overshot gates over a range of gate sizes for "drop-in" installations in existing stoplog bays in irrigation canal check structures. We are working in cooperation with a research team from New Mexico State University to further refine the overshot gate design concept with planned demonstration sites at Tucumcari Irrigation District and Carlsbad Irrigation District.