CROWS LANDING
INDUSTRIAL BUSINESS PARK

Water Study

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Prepared By:

WOOD RODGERS

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I. INTRODUCTION

The Crows Landing Industrial Business Park is a planned industrial business park located at the site of the former National Aeronautics and Space Administration (NASA) Crows Landing Flight Facility/Ames Research Center in Stanislaus County, California (County). In 1999, the military facility was decommissioned and the property was later conveyed to Stanislaus County. Since that time, the County has envisioned reuse of the former military facility as an opportunity to revitalize the local economy. For over a decade, the County has pursued development of the former military facility as a regional employment center. To that end, the County has designated the site as the Crows Landing Industrial Business Park (CLIBP) to support job growth and economic development in the region (Project).

The Project site encompasses approximately 1,528 acres and is bordered by Bell Road to the east, West Marshall Road to the North, Davis Road to the west and Fink Road to the south. The Project site is located approximately 1.5 miles east of Interstate 5 (I-5). The existing site is primarily farmland, while the former airfield runways are used for a variety of County-approved events. The southern portion of the Project site is bisected by the Delta Mendota Canal (DMC). **Exhibit 1** shows the location of the Crows Landing Industrial Business Park.

II. PURPOSE

The purpose of this Water Study (Study) is to identify the size and location of the backbone water infrastructure required to serve the CLIBP. The proposed potable water system will be a brand-new water supply and distribution system constructed specifically to serve the CLIBP. The water system will be sized to meet the ultimate build-out water demands for indoor use, outdoor use and fire protection. The water system will be owned by Stanislaus County. The County is currently exploring its options for the operation and management of the CLIBP water system, which include 1) establishing a new public water system, 2) consolidation with an adjacent water district, or 3) the formation of a new County Service Area (CSA).

At the time of preparation of this Study, the drilling of the test well at the proposed site for the initial CLIBP well has not yet occurred. The field work is scheduled to begin in mid-May 2020. Therefore, the well location, water quality and quantity of the CLIBP groundwater well(s) has not yet been finalized and further analysis is required to the determine whether groundwater treatment is required. In addition, the details of a proposed interconnection with the Crows Landing Community Services District water system is dependent upon the well design, and therefore requires further analysis as well. The preliminary findings from the test well are expected in late June 2020.

This Study focuses on sizing the transmission, storage and pumping facilities required to serve the CLIBP and meet minimum operational criteria.

III. PREVIOUS STUDIES AND REFERENCE DOCUMENTS

There have been numerous documents and technical studies prepared to support the development of the CLIBP Project. The following studies have been utilized in the preparation of this Water Study:

“Crows Landing Industrial Business Park Specific Plan,” Final document approved by the County Board of Supervisors on December 4, 2018.

“Crows Landing Industrial Business Park Specific Plan Environmental Impact Report,” Public Draft Review, January 2018.

“Crows Landing Industrial Business Park Preferred Water Supply Development Approach,” Addendum No. 5 – Request for Proposals, June 12, 2019.

IV. WATER SYSTEM OVERVIEW

A. Crows Landing Community Services District (CSD)

Crows Landing is a small, unincorporated community in Stanislaus County located at the intersection of State Route 33 (SR 33) and Crows Landing Road, approximately 6 miles south of the city of Patterson and 3 miles east of I-5. The Crows Landing community is located approximately 1.5 miles east of CLIBP, as depicted in **Exhibit 1**.

The Crows Landing Community Services District owns, operates and maintains a water distribution system to serve the approximately 355 residents of the community, with a total of 137 connections. The existing water system is supplied by two groundwater wells, Well 4 and Well 5, with a capacity of 250 gpm and 400 gpm respectively. The existing distribution system is comprised of approximately 4.5 miles of pipeline in sizes ranging from ¾-inch to 8-inch in diameter. The CSD water system does not currently have any storage facilities.

The CSD is currently planning system improvements to upgrade the system’s overall reliability and redundancy, water supply, water quality and operational deficiencies.

B. Crows Landing Industrial Business Park

The Crows Landing Industrial Business Park will be served from a new water distribution system that will be developed specifically to meet the proposed water demands for the Project. The water distribution system will be supplied from groundwater wells that are proposed to be located within, or adjacent to, the CSD boundary. The water will be pumped westerly through a dedicated transmission main located in Fink Road moving to the southeast corner of the CLIBP boundary. At the southeast corner of the CLIBP, the water will be stored in at-grade storage tanks before being boosted into the CLIBP distribution system. The CLIBP water distribution system piping will be looped and sized to meet the maximum day demand plus highest fire flow.

At this time, the groundwater test wells have yet to be developed and the site-specific water quality is unknown, therefore it is unknown if groundwater treatment will be required. However, space is being allocated at the site of the CLIBP tanks and pump station to accommodate a treatment facility, if required.

C. CSD/CLIBP System Integration

As the County pursued development of the CLIBP, it was planning to develop and permit a new stand-alone potable water system. However, during discussions with the State Water Resources Control Board (SWRCB) Division of Drinking (DDW), DDW staff pointed out that permitting a new potable water system under California Senate Bill 1263 (SB-1263) would be a lengthy process and, further, that there was no guarantee that a permit would be issued at all. Due to the concerns expressed by DDW, the option of establishing a new potable water system is not preferred.

DDW prefers that the CLIBP be consolidated with an existing permitted potable water system. Several annexation alternatives were investigated and analyzed, and it was determined by the County and DDW that annexing the CLIBP into the CSD is a viable solution.

The County has also identified another viable solution to establish a potable water system to serve the CLIBP, which is to establish a County Service Area (CSA) that operates as a special district under the governing body of the County Board of Supervisors and contracts for an extension of water service from the CSD.

No matter which alternative is ultimately selected, both the County and the CSD have agreed that the CLIBP water system can be developed in a way that provides a mutual benefit to both the CSD and County. The CSD operates a relatively small water supply system providing water to a disadvantaged community, and this system has been challenged by reliability issues and historical water quality violations. The County already has an ongoing relationship with the CSD and has assisted it on several occasions with the operation and maintenance of its system.

The addition of new water supply infrastructure for the CLIBP that would be interconnected with the CSD water distribution system would provide emergency support and add much-needed redundancy and resilience to the existing system.

Further coordination between the County and CSD is required to determine the operational and administrative requirements of interconnecting the two systems. In addition, a water supply permit would need to be approved by the Stanislaus County Department of Environmental Resources (DER) with the DDW serving in an advisory capacity, while annexation or formation of a CSA would proceed under the auspices of the Local Agency Formation Commission (LAFCo).

V. PLANNING AND DESIGN CRITERIA

The Crows Landing CSD does not have their own planning and design criteria for a water distribution system. After an evaluation of the design criteria established by several local water retailers, it was determined that the criteria established by the City of Modesto are the most comprehensive and applicable, and will be utilized within this Study. A table detailing the planning and design criteria is included in **Appendix A**. Specific elements of the planning and design criteria utilized for the CLIBP water system analysis and facility sizing are summarized in this section.

A. Storage Criteria for Tank Volume

Storage tanks shall be sized to provide the following volume:

- Operational Storage = 25% of Maximum Day Demand
- Emergency Storage = 100% of Average Day Demand
- Fire Storage = Highest Fire Flow Requirement and Duration

An emergency groundwater storage credit of 85% of the active well production capacity for one day can be applied if the well is equipped with back-up power. It is assumed and recommended that the proposed well(s) for CLIBP be equipped with back-up power. However, for the sake of this analysis, the credit has not been applied at this time.

B. Pumping Capacity

A pump station’s firm capacity shall provide the greater of the maximum day demand with fire flow or the peak hour demand.

C. Water Demand Factors

Water demand factors used to calculate the average daily water demand (acre-feet per year (AFY) and gallons per minute (GPM)) are shown in **Table 1**.

Table 1 – Water Demand Factors		
Water Demand Factor Land Use Designation	Average Day Demand (ADD) Water Demand Factor	
	AFY/acre	GPM/acre
Commercial	2.75	1.70
Industrial	1.75	1.08
Business Park	2.00	1.24
Aviation Landscape	2.08	1.29

D. Peaking Factors

- Maximum Day Demand = 1.75 x Average Day Demand
- Peak Hour Demand = 2.46 x Average Day Demand

E. Fire Flow Requirement

Industrial Land Use = 4,000 gpm for 4 hours (with approved automatic sprinkler system).

F. Pressure Criteria

The water system shall be designed to provide the following minimum service pressures:

- Average Day Demand = 50 pounds per square inch (psi)
- Maximum Day Demand & Peak Hour Demand = 40 psi
- Fire Flow = 20 psi

The maximum allowable system pressure under static conditions is 120 psi.

G. Hazen Williams "C" Factor

It is assumed that all pipes will be constructed with polyvinyl chloride (PVC). A Hazen Williams friction coefficient of 130 will be utilized for the hydraulic calculations.

H. Pipeline Sizing Criteria

All pipelines in the system shall be a minimum of 8-inch diameter. Pipelines shall be sized to accommodate the maximum day demand plus highest fire flow, and meet the following criteria:

- Maximum Headloss (ft/1000 ft) = 10 ft/kft
- Maximum Velocity (ft/sec) $\geq$ 16-inch Diameter = 10 ft/sec
- Maximum Velocity (ft/sec) < 16-inch Diameter = 12 ft/sec

VI. LAND USE AND PHASING

The proposed land use and phasing was identified in the Specific Plan, and is summarized in **Table 2** and shown on **Exhibit 2.**

Table 2 – Proposed Land Use (acres)

Specific Plan Land Use Designation	Phase				Total
	1A	1B	2	3	
Logistics/Distribution	52	138	57	102	349
Light Industrial	41	110	71	128	350
Business Park	10	28	14	26	78
Public Facilities		15	35	18	68
General Aviation		370			370
Aviation Related			46		46
Multimodal Transportation Corridor/Green Space			13		13
Subtotal	***103***	***661***	***236***	***274***	***1,274***
Infrastructure/ROW					254
Total					**1,528**

Source: Table 2-1 from Crows Landing Industrial Business Park Specific Plan, dated December 4, 2018

VII. PROPOSED WATER DEMANDS

In order to apply the appropriate water demand factor from Table 1 to the proposed land use, the proposed land use designation identified in the Specific Plan needed to be assigned to the corresponding water demand factor land use. The corresponding land use designation assignments are shown in **Table 3**.

Table 3 – Corresponding Land Use	
Specific Plan Land Use Designation	**Water Demand Factor Land Use Designation**
Logistics/Distribution	Industrial
Light Industrial	Industrial
Business Park	Business Park
Public Facilities	Commercial
General Aviation	Industrial and Aviation Landscape
Aviation Related	Industrial
Multimodal Transportation Corridor/Green Space	Industrial
Infrastructure/ROW	Infrastructure/ROW

Based upon the proposed land use; the corresponding land use; and the water demand and peaking factors identified in Section V, the calculated water demands by planning phase are summarized in **Table 4**. It is noted that the forecasted water demand provided herein has been further refined from the analysis prepared for the Specific Plan and EIR, and the overall demands are projected to be approximately 17% lower than what was previously determined.

Table 4 – Water Demands						
Water Demand Factor Land Use Designation	**Net Acreage**	**Water Demand Factor**		**Demand (gpm)**		
		AFY/Acre	**GPM/Acre**	**ADD**	**MDD**	**PHD**
Phase 1A						
Commercial	0	2.75	1.70	0	0	0
Industrial	93	1.75	1.08	101	177	248
Business Park	10	2.00	1.24	12	22	31
Aviation Landscape	0	2.08	1.29	0	0	0
Subtotal Phase 1A	*103*			*113*	*198*	*279*
Phase 1B						
Commercial	15	2.75	1.70	26	45	63
Industrial	543	1.75	1.08	589	1031	1449
Business Park	28	2.00	1.24	35	61	85
Aviation Landscape	75	2.08	1.29	97	169	238
Subtotal Phase 1B	*661*			*746*	*1306*	*1836*
Phase 2						
Commercial	35	2.75	1.70	60	104	147
Industrial	187	1.75	1.08	203	355	499
Business Park	14	2.00	1.24	17	30	43
Aviation Landscape	0	2.08	1.29	0	0	0
Subtotal Phase 2	*236*			*280*	*490*	*689*
Phase 3						
Commercial	18	2.75	1.70	31	54	75
Industrial	230	1.75	1.08	250	437	614
Business Park	26	2.00	1.24	32	56	79
Aviation Landscape	0	2.08	1.29	0	0	0
Subtotal Phase 3	*274*			*312*	*547*	*769*
TOTAL	**1,274**			**1,452**	**2,541**	**3,572**

ADD = Average Day Demand
MDD = Maximum Day Demand
PHD = Peak Hour Demand

VIII. TOPOGRAPHY AND ELEVATIONS

The CLIBP Project site is located on 1,528 acres in the San Joaquin Valley. The topography is generally flat, with the existing surface generally sloping from the southwest towards the northeast. The highest elevations within Project site are approximately 200 feet above mean sea level (amsl), with the lowest elevations at approximately 113 feet amsl. The existing surface elevations by phase are shown in **Table 5** and on **Exhibit 3.**

Table 5 – Existing Site Elevations (feet)		
Phase	**Min.**	**Max.**
Phase 1A	176.4	200.4
Phase 1B	139.7	188.7
Phase 2	112.8	149.2
Phase 3	115.1	145.4

IX. WATER SYSTEM ANALYSIS

A. Pressure Zone Hydraulic Grade Line (HGL)

The existing site elevations range a total 87 feet, from 113 feet to 200 feet. With the relatively small elevation difference, it is possible to serve the entire CLIBP from a single pressure zone hydraulic grade line. The benefit of serving the entire CLIBP from a single pressure zone is that multiple water facilities are not required throughout the development, which can ease the operations and maintenance burden.

The design criteria require a minimum residual pressure of 50 psi under the average day demand condition and a maximum pressure of 120 psi. Based on the existing elevation range and the preferred pressure range, a recommended HGL for the system is approximately 340 feet. Based on a 340-foot HGL, the approximate static pressures within the CLIBP are shown in **Table 6**.

Table 6 – Static Hydraulic Gradient Range				
	Elevations (feet)		**Static Pressure (psi)**	
Phase	**Min.**	**Max.**	**Max.**	**Min.**
Phase 1A	176.4	200.4	70.8	60.4
Phase 1B	139.7	188.7	86.7	65.5
Phase 2	112.8	149.2	98.4	82.6
Phase 3	115.1	145.4	97.4	84.2

The minimum static pressure of 60 psi allows for approximately 10 psi of system losses under the average day demand condition, which has been verified through the hydraulic modeling analysis, as discussed later in this Study.

B. Water Supply

Water supply for the CLIBP will be provided by new wells drilled in the local groundwater basin. At the time of this Study, a test well was planned to be drilled just north of Bonita Elementary School, within the CSD boundary, to determine the quantity and quality of water available. The test well will be drilled to a depth of 750 feet below ground surface (bgs), and will target the aquifers between 350 and 680 feet bgs. Water quality testing will be performed to determine which aquifer is preferred to provide water supply. A preliminary hydrogeological analysis has estimated that the production well will produce approximately 500 gpm, and that assumption is utilized in this Study. A separate well design report will be prepared at the completion of the site investigation and testing. The draft well design report is expected to be available in late June 2020.

Per the design criteria, the water supply should equal the maximum day demand. The maximum day demand for Phase 1A is estimated to be 198 gpm; therefore, one new well is proposed to serve Phase 1A. The maximum day demand for Phase 1B is estimated to be 1,306 gpm. It is likely that a second well will be required to be installed for Phase 1B. The location of the second well, and any future wells, will require further site investigations and analysis. Future wells beyond Phase 1B will be determined at a later date depending upon the well production capabilities.

At this time, the water quality of the groundwater is unknown. An evaluation of the water quality data for the CSD's existing Well No. 4 indicates that there are no regulated constituents that exceed the primary maximum contaminant level (MCL). The CSD Well No. 4 water quality data indicates elevated levels of hexavalent chromium, a constituent for which a maximum contaminant level has yet to be determined. For the purposes of this Study, space has been allocated at the site of the CLIBP tanks and pump station to accommodate a groundwater treatment facility if deemed necessary. The draft well design report, expected to be available in late June 2020, will provided further detail.

C. Storage

Based on the storage criteria identified herein, the minimum required storage volume per phase is summarized in **Table 7.**

Table 7 – Storage								
	Water Demand (gpm)		Fire Flow		Storage Requirements			
Phase	**ADD**	**MDD**	**Flowrate (gpm)**	**Duration (hrs)**	**Operational (25% of MDD)**	**Emergency (100% of ADD)**	**Fire**	**Total**
Phase 1A	113	198	4000	4	71,377	163,148	960,000	1,194,526
Phase 1B	746	1,306	n/a		470,114	1,074,547	0	1,544,661
Phase 2	280	490	n/a		176,344	403,073	0	579,417
Phase 3	312	547	n/a		196,849	449,941	0	646,791
Total	**1,452**	**2,541**						**3,965,395**

A total of 4.0 million gallons (MG) of storage will be required to support the full build-out of CLIBP. The storage tank(s) are proposed to be constructed at the southeast corner of the CLIBP property. The tanks will sit at ground level, with an approximate pad elevation of 175-feet. The proposed tank sizes and phasing are discussed later in this Study.

D. Pumping Capacity

Based on the pumping criteria identified herein, the minimum required pumping capacity per phase is summarized in **Table 8.**

Table 8 – Pumping Capacity				
	Water Demand (gpm)			
Phase	**MDD**	**PHD**	**Fire Flow (gpm)**	**Total Firm Pump Capacity (gpm)**
Phase 1A	198	279	4,000	4,198
Phase 1B	1,306	1,836		1,306
Phase 2	490	689		490
Phase 3	547	769		547
Total	**2,541**	**3,572**		**6,541**

A total of 6,600 gpm of firm capacity will be required to support the full build-out of CLIBP. The pump station is proposed to be constructed at the southeast corner of the CLIBP property, adjacent to the storage tanks. The pump station will sit an approximate pad elevation of 175 feet. The pump station will boost to an HGL of approximately 340 feet. The proposed pump sizes and phasing are discussed later in this Study.

E. Pipeline Capacity

A hydraulic model was built using the Innovyze InfoWater software to evaluate the capacity of the ultimate build-out of the backbone water infrastructure system to serve the CLIBP. The backbone piping layout was based upon the conceptual development layout as shown on Figure 2-1 of the Specific Plan.

The model was utilized to determine the pipe diameters required for each phase of the proposed development. The model was constructed as a static model and was organized into the following scenarios.

Phase 1A Average Day Demand

Phase 1A Max Day Demand
Phase 1A Max Day Demand and Fire Flow
Phase 1A Peak Hour Demand

Phase 1B Average Day Demand

Phase 1B Max Day Demand
Phase 1B Max Day Demand and Fire Flow
Phase 1B Peak Hour Demand

Phase 2 Average Day Demand

Phase 2 Max Day Demand
Phase 2 Max Day Demand and Fire Flow
Phase 2 Peak Hour Demand

Phase 3 Average Day Demand

Phase 3 Max Day Demand
Phase 3 Max Day Demand and Fire Flow
Phase 3 Peak Hour Demand

The project phase scenarios were built upon the previous phase, so the Phase 3 scenarios represent the ultimate build-out the system.

Pipelines are sized to meet the ultimate maximum day demand plus peak fire flow. The peak fire flows were simulated at the most critical nodes (i.e.: furthest away from the source, highest elevations, etc.). The Average Day Demand scenarios were utilized to ensure the maximum pressure requirements were satisfied. The model results have included as **Appendix B**.

F. CSD Integration

The proposed CLIBP water system will provide additional reliability and redundancy for the CSD water system. The well(s) that will serve the CLIBP will most likely be drilled within, or adjacent to, the existing CSD boundary. The first CLIBP well will be required to serve Phase 1A. A second well will be required to serve Phase 1B. The need for future wells beyond Phase 1B will be determined at a later date based on the well production at the time and the details of the development.

The well(s) will discharge into a dedicated transmission main that will convey the water to the proposed CLIBP tanks. Although the wells will be used to supply the CLIBP, it is recommended that the wells be designed with sufficient discharge pressure to be able to provide water directly to the CSD system. An interconnect facility with flow and pressure control will be required between the well discharge pipeline and the existing CSD system that will allow for well supply to directly feed the CSD. The location and details of this interconnection facility will need to be further developed once the location, water quality and quantity of the first CLIBP well is determined.

The Study currently recommends one pipeline to be constructed in Fink Road, which will deliver water supply from the CLIBP wells to the CLIBP tanks. It is recommended to construct a Pressure Reducing Station (PRS) at the site of the CLIBP Pump Station that has the ability to move water from the discharge of the CLIBP Pump Station back to the CSD, through the pipeline in Fink Road. This PRS will allow water stored in the CLIBP tanks to be moved back into the CSD system in the event of an emergency. However, it is noted that since there is only one pipeline currently recommended in Fink Road, whenever the PRS is activated to send water back to the CSD system, the CLIBP wells will not be able to fill the tanks until the PRS is deactivated. The operation of this facility will require utilizing a supervisory control and data acquisition (SCADA) system, and should be further analyzed once the locations, quantity and quality of the CLIBP well(s) are determined.

X. PROPOSED WATER SYSTEM RECOMMENDATIONS

A. Supply

Water for the CLIBP will be supplied by new wells to be drilled within, or adjacent to, the existing CSD boundary. Exploratory drilling at one well site will occur in mid-

May 2020, and will determine the quantity and quality of the water that is available to serve Phase 1A of the CLIBP development. The test well will be drilled to a depth of 750 feet bgs, and will testing will target the aquifers between 350 and 680-feet bgs.

For the purposes of this analysis, it was assumed that a new well with 500 gpm of capacity will be drilled immediately to the north of Bonita Elementary School to supply Phase 1A. It was assumed the well will include a vertical turbine pump that will discharge to a pipeline running south along Bonita Canyon Road to Fink Road. A transmission main in Fink Road will deliver the water to the southeast corner of the CLIBP property where the water will be stored and boosted into the CLIBP distribution system.

The proposed well shall be designed with a Total Dynamic Head (TDH) capable of delivering water directly into the CSD system and filling the CLIBP tanks. The well shall be designed to meet all DDW standards. It is assumed the well site will be enclosed within a block wall with access gates. The well and discharge piping will be located outdoors, with the electrical and telemetry cabinets located on-site below a shade structure. The well site should include a permanent on-site generator to provide back-up power.

A second well will likely be required to supply Phase 1B of the CLIBP development. Future wells may be required depending upon the production capabilities of the new well(s) and well field design considerations. **Exhibit 4** identifies the location of Well No. 1 for CLIBP, and shows a location for Well No. 2, however the location for Well No. 2 is only a place holder and needs to be investigated by hydrogeologists to determine the preferred location.

At this time, it is unknown if, and what level, of water treatment will be required. This Study provides space for a treatment facility to be located at the site of the CLIBP tanks and Pump Station.

B. Storage

A total of 4.0 MG of storage will be required to meet the ultimate build out of the CLIBP. It is recommended to phase construction of the storage tanks as they are needed. Development of Phase 1A requires 1.2 MG of storage. An additional 1.6 MG will be required for Phase 1B, and an additional 1.2 MG will be required for Phases 2 and 3.

It is assumed that all three (3) storage tanks will be constructed at the same location of the southeast corner of the CLIBP, as shown on **Exhibit 4**. The tanks shall be constructed with the same pad elevation and same water height. It is assumed that at-grade welded steel tanks will be constructed. The tanks shall be filled from the CLIBP well(s), and the wells shall be operated based upon the water level in the tanks. The tanks shall include pressure transducers and SCADA communication. The tanks shall be constructed with a separate inlet as well as outlets to promote circulation and maintain water quality.

It is assumed that the tanks will be designed with a 30-foot water height. The minimum diameter of each tank is as follows:

Phase 1A – 1.2 MG = 83 feet

Phase 1B – 1.6 MG = 96 feet

Phase 2/3 – 1.2 MG = 83 feet

C. Pumping

A pump station is required to boost the pressure to serve the CLIBP development. The proposed CLIBP Pump Station will be located adjacent to the CLIBP tanks, at the southeast corner of the development, as shown on **Exhibit 4**. The pump station pad elevation will be approximately 175-feet, and the pumps shall boost to an HGL of approximately 340-feet. The ultimate recommended total firm capacity of the pump station is 6,600-gpm. It is recommended that a pump station be designed that will meet the ultimate capacity of the CLIBP; however, only equip the pump station with pumps, motors, valves and electrical equipment required to supply each phase. Therefore, the building will initially (Phase 1A) be constructed large enough to accommodate future expansion, but it will not require the installation of the equipment until needed.

The firm pump capacity shall always be sufficient to deliver the maximum day demand plus fire flow with the largest pump out of service. The pumps required to supply Phase 1A must be able to supply the 4,000-gpm fire flow in addition to the normal daily demands which will range from 0 – 279 gpm. The pump type, size and configuration shall be determined during the preliminary design. An initial recommendation for Phase 1A would be to install five (5) pumps, two (2) 300-gpm pumps and three (3) 2,000-gpm pumps. The smaller pumps will be used to supply the normal daily demands (one duty and one back-up), and the larger pumps will supply the fire flow in a lead-lag-back-up operation. Installation of two (2) 4,000-

gpm pumps could also be considered; however, the three (3) 2,000-gpm pumps will provide more flexibility as the CLIBP develops.

The pump station shall be constructed with a CMU block building with a separate mechanical room and a separate electrical room. The pumps shall be operated with variable frequency drives (VFDs) to provide operational flexibility. The pump station shall include a permanent on-site generator to supply back-up power. The pumps will be operated based on maintaining downstream system pressure, and shall include a pressure-relief system to avoid surges and high pressure.

D. Pipelines

The backbone transmission piping system and internal looping system have been determined based upon results from the hydraulic model analysis. The backbone system includes piping that measures 12-inches in diameter and larger. The pipe network was approximated based upon the conceptual development plan presented in the Specific Plan. The total estimated length of pipeline per diameter and phase are summarized in **Table 9** and shown on **Exhibit 4.**

Table 9 – Backbone Pipelines		
Phase 1A		
18-inch Pipeline (Fink Road)	11,000	LF
18-inch Pipeline (Bell Road)	500	LF
18-inch Pipeline (Internal)	1,500	LF
12-inch Pipeline (Well #1 discharge)	900	LF
12-inch Pipeline (Fink Road)	1,400	LF
Phase 1B		
18-inch Pipeline (Bell Road)	5,000	LF
18-inch Pipeline (Internal)	1,600	LF
12-inch Pipeline (Well #2 discharge)	1,900	LF
12-inch Pipeline (Internal)	26,000	LF
Phase 2		
18-inch Pipeline (Bell Road)	5,300	LF
12-inch Pipeline (Bell Road/W. Marshall Road)	8,000	LF
12-inch Pipeline (Internal)	27,000	LF
Phase 3		
12-inch Pipeline (Internal)	17,000	LF

E. Connection to the CSD System

To provide reliability and redundancy to the existing CSD water system, the CLIBP and CSD systems are proposed to be interconnected. The preliminary recommendations identified herein will need to be further evaluated once the test well data has been analyzed and the water quality is known.

The CLIBP wells are proposed to be located within, or adjacent to, the current CSD service area. The CLIBP wells will normally serve CLIBP, however the well and discharge piping shall be designed with an interconnection to supply the CSD system from the CLIBP wells.

In addition, a Pressure Reducing Station is recommended to be installed at the location of the CLIBP tank and pump station site that would allow stored water to be delivered back to the CSD, via the Fink Road transmission main, in an emergency event. This may be considered a temporary facility. Once the CSD completes the installation of their own storage tank and pump station, the need for this facility will be eliminated.

A preliminary hydraulic schematic showing the CSD and CLIBP water systems has been included as **Exhibit 5**.

XI. PRELIMINARY CONSTRUCTION COST ESTIMATE

A preliminary construction estimate has been prepared for the major water facilities and backbone infrastructure, and is summarized on **Table 10**. An opinion of the overall project cost is included in Appendix C

Table 10 - Preliminary Construction Cost Estimate

Water Facility	Unit		Unit Cost		Total Cost	Cost per Phase 1A	1B	2	3
Wells									
Well #1 - Phase 1A	1	EA	$ 1,500,000	/EA	$ 1,500,000	$ 1,500,000			
Well #2 - Phase 1B	1	EA	$ 1,500,000	/EA	$ 1,500,000		$ 1,500,000		
Tanks									
Tank #1 - Phase 1A	1,200,000	GAL	$ 1.25	/GAL	$ 1,500,000	$ 1,500,000			
Tank #2 - Phase 1B	1,600,000	GAL	$ 1.25	/GAL	$ 2,000,000		$ 2,000,000		
Tank #3 - Phase 2/3	1,200,000	GAL	$ 1.25	/GAL	$ 1,500,000			$ 1,500,000	
Pump Stations									
BPS #1 - Phase 1A	1	EA	$ 1,750,000	/LS	$ 1,750,000	$ 1,750,000			
BPS #1 - Phase 1B Expansion	1	EA	$ 750,000	/LS	$ 750,000		$ 750,000		
BPS #1 - Phase 2/3 Expansion	1	EA	$ 750,000	/LS	$ 750,000			$ 750,000	
Pressure Reducing Station to CSD	1	EA	$ 500,000	/LS	$ 500,000	$ 500,000			
Backbone Pipelines									
Phase 1A									
18-inch Pipeline (Fink Road)	11,000	LF	$ 220	/LF	$ 2,420,000	$ 2,420,000			
18-inch Pipeline (Bell Road)	500	LF	$ 220	/LF	$ 110,000	$ 110,000			
18-inch Pipeline (Internal)	1,500	LF	$ 200	/LF	$ 300,000	$ 300,000			
12-inch Pipeline (Well #1 discharge)	900	LF	$ 180	/LF	$ 162,000	$ 162,000			
12-inch Pipeline (Fink Road)	1,400	LF	$ 180	/LF	$ 252,000	$ 252,000			
Phase 1B									
18-inch Pipeline (Bell Road)	5,000	LF	$ 220	/LF	$ 1,100,000		$ 1,100,000		
18-inch Pipeline (Internal)	1,600	LF	$ 200	/LF	$ 320,000		$ 320,000		
12-inch Pipeline (Well #2 discharge)	1,900	LF	$ 180	/LF	$ 342,000		$ 342,000		
12-inch Pipeline (Internal)	26,000	LF	$ 120	/LF	$ 3,120,000		$ 3,120,000		
Phase 2									
18-inch Pipeline (Bell Road)	5,300	LF	$ 220	/LF	$ 1,166,000			$ 1,166,000	
12-inch Pipeline (Bell Road/W. Marshall Road)	8,000	LF	$ 180	/LF	$ 1,440,000			$ 1,440,000	
12-inch Pipeline (Internal)	27,000	LF	$ 120	/LF	$ 3,240,000			$ 3,240,000	
Phase 3									
12-inch Pipeline (Internal)	17,000	LF	$ 120	/LF	$ 2,040,000				$ 2,040,000
Subtotal					*$ 27,762,000*	*$ 8,494,000*	*$ 9,132,000*	*$ 8,096,000*	*$ 2,040,000*
Construction Contingency			*25%*		*$ 6,941,000*	*$ 2,124,000*	*$ 2,283,000*	*$ 2,024,000*	*$ 510,000*
Subtotal w/o Treatment					***$ 34,703,000***	***$ 10,618,000***	***$ 11,415,000***	***$ 10,120,000***	***$ 2,550,000***
Treatment									
Phase 1A	1	LS	$ 1,500,000	/LS	$ 1,500,000	$ 1,500,000			
Phase 1B Expansion	1	LS	$ 500,000	/LS	$ 500,000		$ 500,000		
Phase 2/3 Expansion	1	LS	$ 500,000	/LS	$ 500,000			$ 500,000	
Subtotal					*$ 2,500,000*	*$ 1,500,000*	*$ 500,000*	*$ 500,000*	*$ -*
Construction Contingency			*25%*		*$ 625,000*	*$ 375,000*	*$ 125,000*	*$ 125,000*	*$ -*
Subtotal Treatment					***$ 3,125,000***	***$ 1,875,000***	***$ 625,000***	***$ 625,000***	***$ -***
TOTAL WATER FACILITIES					***$ 37,828,000***	***$ 12,493,000***	***$ 12,040,000***	***$ 10,745,000***	***$ 2,550,000***

ATTACHMENTS

Exhibits:

Exhibit 1 – Project Location

Exhibit 2 – Phasing and Land Use

Exhibit 3 – Existing Topography

Exhibit 4 – Backbone Water System

Exhibit 5 – Hydraulic Schematic

Appendices:

Appendix A – Design Criteria for Water Distribution

Appendix B – Water Model Results

Model Node and Pipe Exhibit
Phase 1A – ADD: Node Results
Phase 1A – ADD: Pipe Results
Phase 1A – MDD + FF: Node Results
Phase 1A – MDD + FF: Pipe Results
Phase 3 – ADD: Node Results
Phase 3 – ADD: Pipe Results
Phase 3 – MDD + FF: Node Results
Phase 3 – MDD + FF: Pipe Results

Appendix C – Opinion of Overall Project Cost

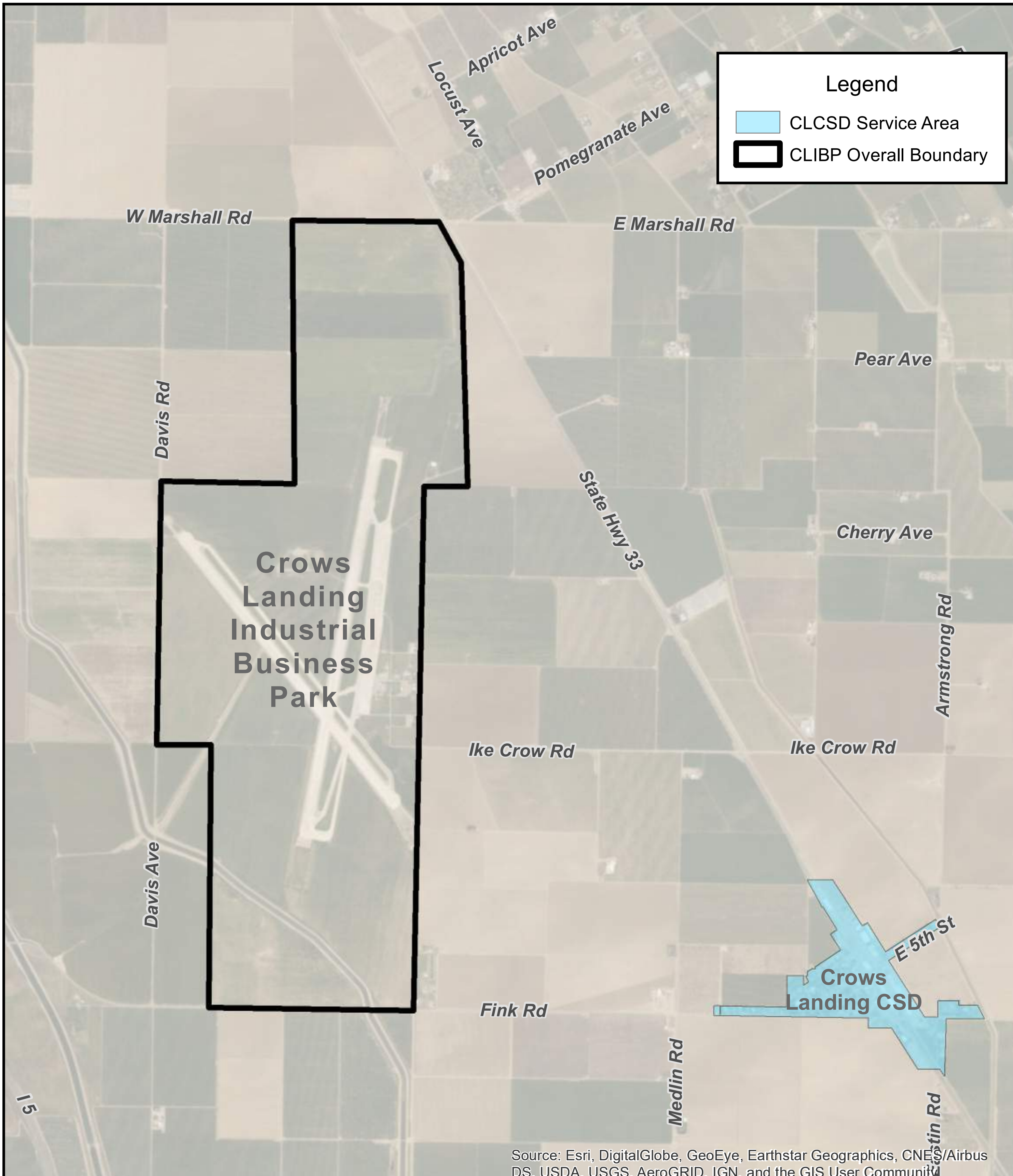

EXHIBIT 1

PROJECT LOCATION

CROWS LANDING INDUSTRIAL BUSINESS PARK

STANISLAUS COUNTY, CA

MARCH 2020

0 0.125 0.25 0.5

Miles

NORTH

WOOD RODGERS

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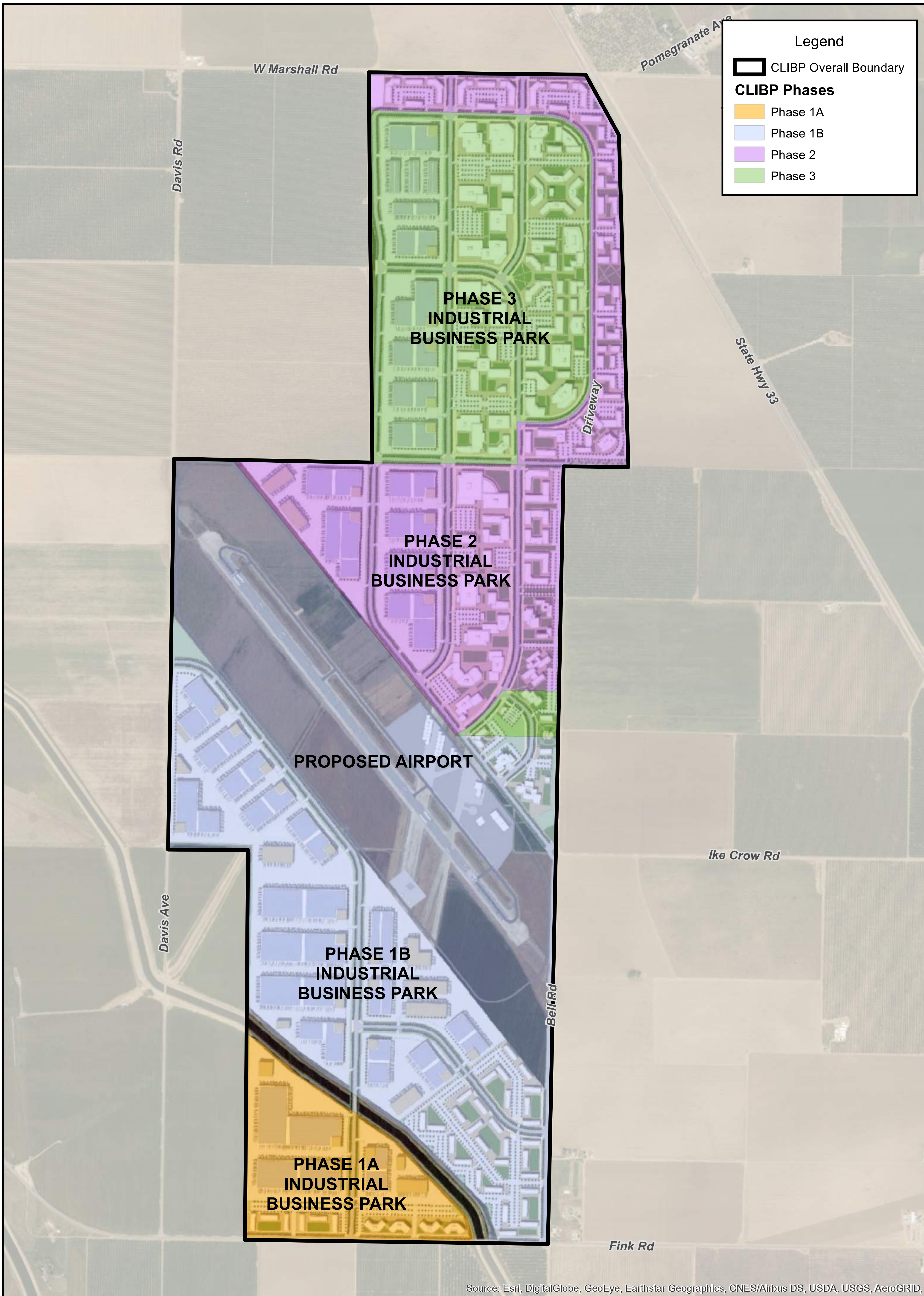

EXHIBIT 2
PHASING AND LAND USE
CROWS LANDING INDUSTRIAL BUSINESS PARK
STANISLAUS COUNTY, CA
MARCH 2020

WOOD RODGERS

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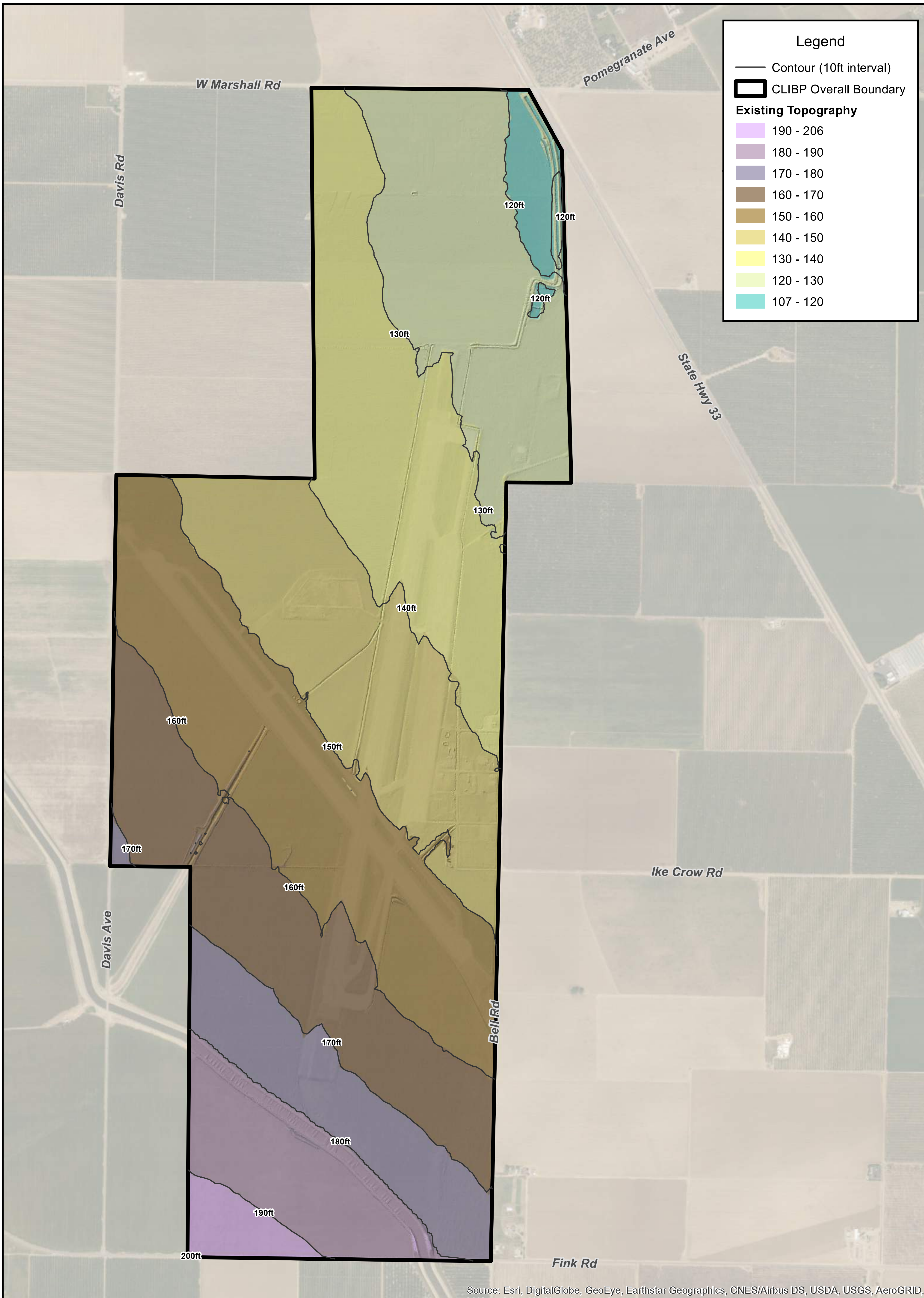

EXHIBIT 3

EXISTING TOPOGRAPHY

CROWS LANDING INDUSTRIAL BUSINESS PARK

STANISLAUS COUNTY, CA

MARCH 2020

0 300 600 1,200

Feet

NORTH

WOOD RODGERS

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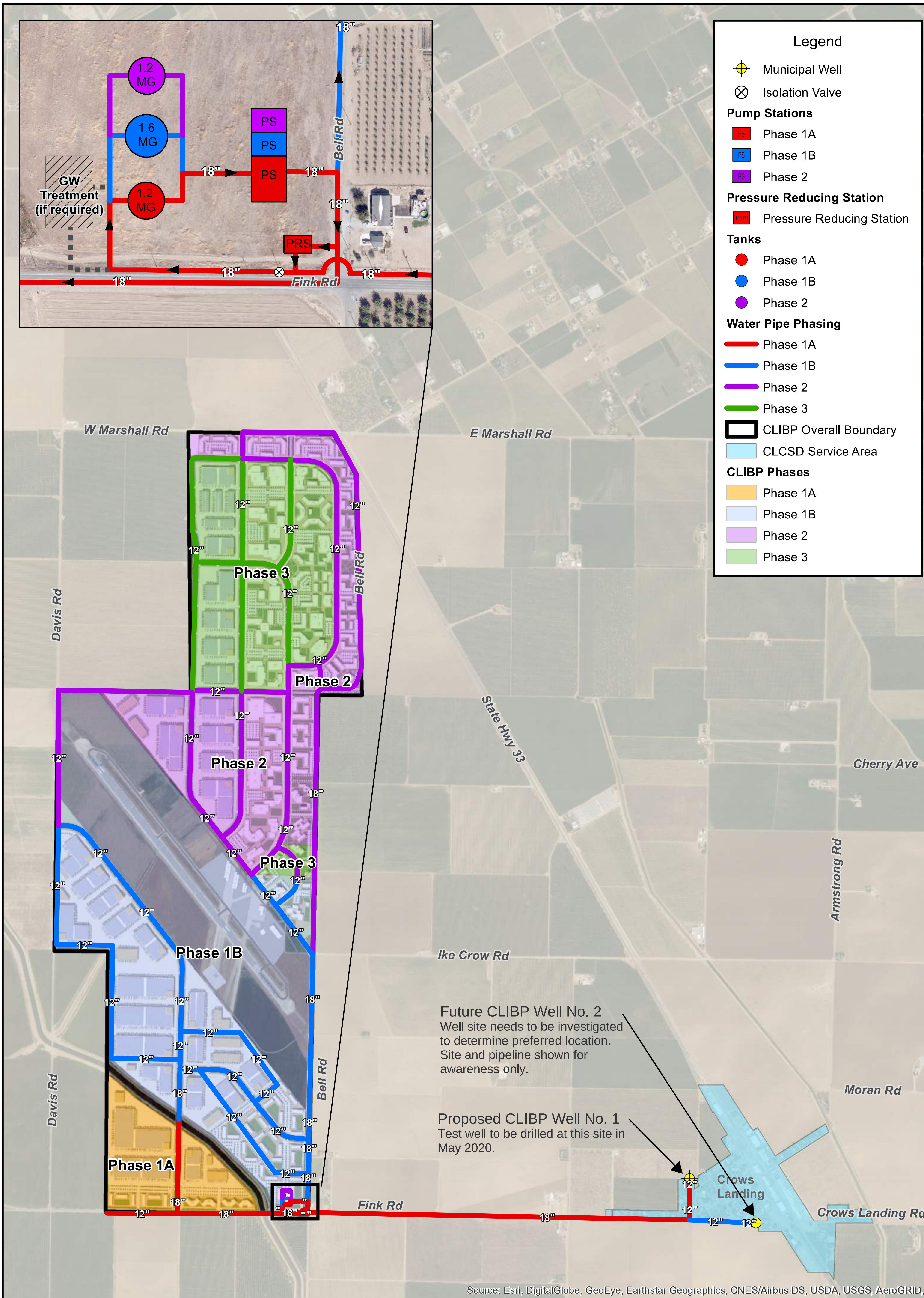

EXHIBIT 4

BACKBONE WATER SYSTEM

CROWS LANDING INDUSTRIAL BUSINESS PARK
STANISLAUS COUNTY, CA
MARCH 2020

0 450 900 1,800
Feet

NORTH

WOOD RODGERS

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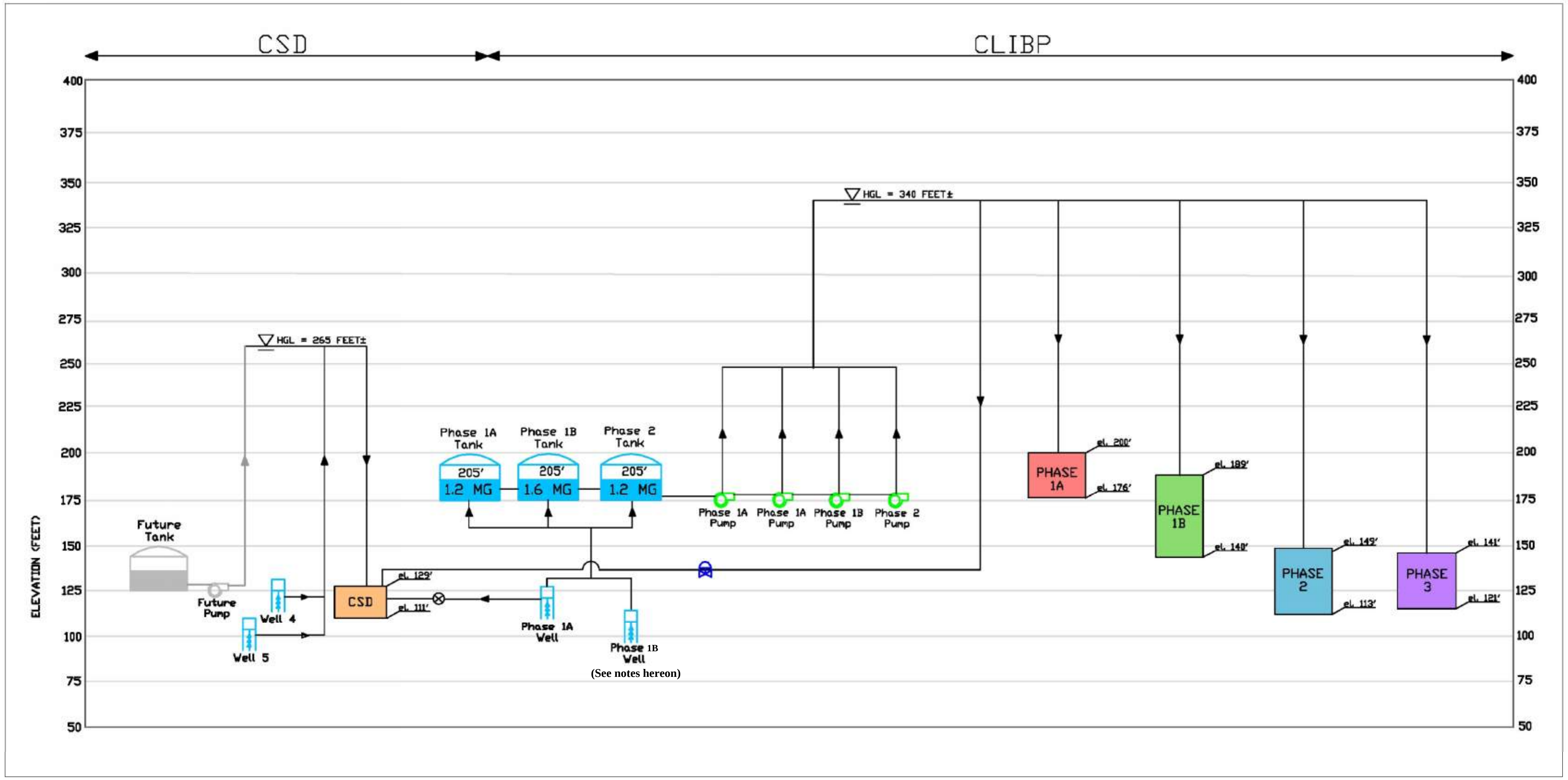
EXHIBIT 5

HYDRAULIC SCHEMATIC

CROWS LANDING INDUSTRIAL BUSINESS PARK

STANISLAUS COUNTY, CA
MARCH 2020



ABBREVIATIONS:
HYDRAULIC GRADE LINE (HGL)
COMMUNITY SERVICES DISTRICT (CSD)
CROW'S LANDING INDUSTRIAL BUSINESS PARK (CLIBP)

Notes:
1. The size, type and location of the interconnection facility between the CLIBP and the CSD systems needs to be determined after completion of the well design report (anticipated in late June 2020).
2. The location of Well No. 2 (to serve Phase 1B) needs to be investigated by a hydrogeologist to determine the optimal location. Shown hereon for reference and awareness only.

WOOD RODGERS

APPENDIX A

Crows Landing Industrial Business Park Water Distribution System Design Criteria		
Component	**Criteria[1,2,3]**	**Remarks / Issues**
Fire Flow Requirements (flow [gpm] @ duration [hours])		
Single-Family Residential	1500 gpm @ 2 hrs[1]	
Multi-Family Residential	2500 gpm @ 2 hrs[1]	
Commercial	4000 gpm @ 2 hrs (with approved automatic sprinkler system)[1]	
Industrial	4000 gpm @ 2 hrs (with approved automatic sprinkler system)[1]	
Institutional	4000 gpm @ 2 hrs (with approved automatic sprinkler system)[1]	
Water Supply Capacity		
Supply / Pumping Capacity	Provide firm supply capacity equal to maximum day demand[1]	Firm groundwater supply capacity is defined as 60% of the active operational groundwater production capacity for one day. An active well is defined as any well that is currently operational. Wells that are abandoned, or temporarily out of service due to mechanical breakdowns, routine maintenance, water quality or other operational issues, or wells that pump directly into tanks are not considered active.
Water Distribution System Capacity		
Maximum Day Demand plus Fire Flow	Provide firm capacity equal to maximum day demand plus fire flow[1]	Assumes two simultaneous fire flow events (one Multi-Family Residential fire flow and one Commercial fire flow).
Peak Hour Demand	Provide firm capacity equal to peak hour demand[1]	
Pumping Facility Capacity		
Pumping Capacity	Provide the greater of maximum day concurrent with fire flow or peak hour demand[1]	Assume firm pumping capacity. Firm pumping capacity is defined as the total booster pump station capacity with the largest pump out of service or 60% of the active operational groundwater production capacity from all wells for one day.
Backup Power	Equal to the firm capacity of the pumping facility[1]	On-site generator for critical stations. A pumping facility is defined as critical if it provides service to local service area(s) without sufficient emergency storage and that meet the following criteria: • A pumping facility that provides water from a supply turnout from an MID transmission main; • A facility that provides water from key groundwater supply wells (depends on capacity, quality, location, and/or local pressure cluster); or • All storage tank booster pump stations. Plug in portable generator for less critical stations.
Water Transmission Line Sizing		
Diameter	16-inches in diameter or larger[1]	Locate new transmission pipelines within designated utility corridors wherever possible.
Average Day Demand Condition		
Minimum Pressure [psi]	50 psi[1]	
Maximum Pressure [psi]	80 psi[1]	Will allow higher system pressures, up to 120 psi maximum. Some services with pressures over 80 psi may require individual pressure regaulators.
Maximum Head loss [ft/1000 ft]	2 ft/kft[1]	
Maximum Velocity [ft/sec]	5 fps[1]	
Maximum Day Demand Condition		
Minimum Pressure [psi]	40 psi[1]	
Maximum Head loss [ft/1000 ft]	7 ft/kft[1]	
Maximum Velocity [ft/sec]	7 fps[1]	
Maximum Day w/ Fire Flow Demand Condition		
Minimum Pressure [psi]	20 psi[1]	
Maximum Head loss [ft/1000 ft]	10 k ft/kft[1]	
Maximum Velocity [ft/sec]	10 fps[1]	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi[1]	
Maximum Head loss [ft/1000 ft]	7 ft/kft[1]	
Maximum Velocity [ft/sec]	7 fps[1]	
Hazen Williams "C" Factor	130 [1]	For PVC pipes, used in hydraulic modeling
Pipeline Material	PVC, Ductile Iron or equivalent[1]	
Water Distribution Line Sizing		
Diameter	Less than 16-inches in diameter[1]	Locate new transmission pipelines within designated utility corridors wherever possible
Diameter - 1/2 mile looped grid	12 inch or larger[2]	
Diameter - 1/4 mile looped grid	8 inch mains or larger[2]	
Average Day Demand Condition		
Minimum Pressure [psi]	50 psi[1]	
Maximum Pressure [psi]	80 psi[1]	
Maximum Head loss [ft/1000 ft]	3 ft/kft[1]	
Maximum Velocity [ft/sec]	5 fps[1]	

APPENDIX A

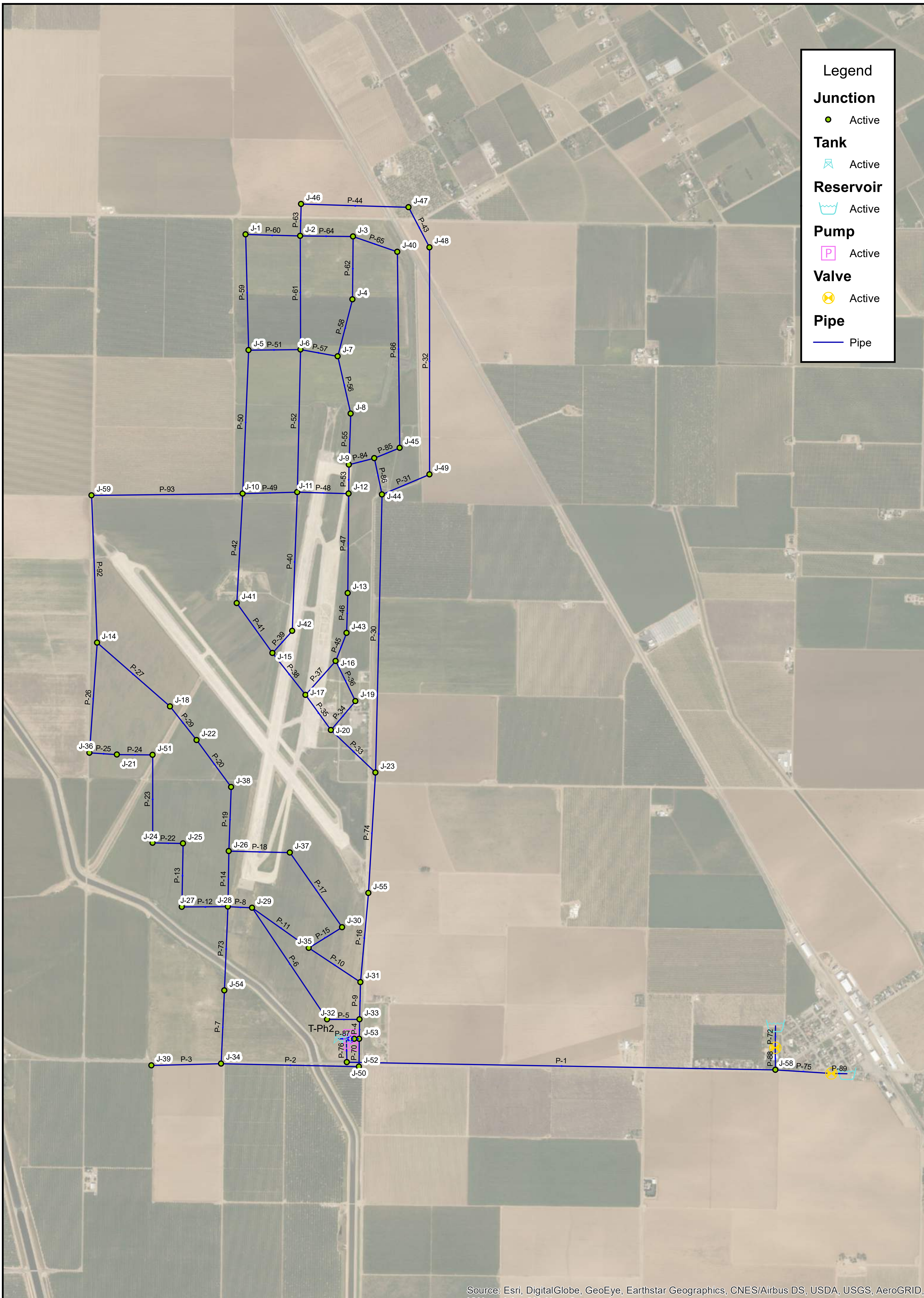
Crows Landing Industrial Business Park Water Distribution System Design Criteria		
Component	**Criteria[1,2,3]**	**Remarks / Issues**
Maximum Day Demand Condition		
Minimum Residual System Pressure [psi] (at fire node)	40 psi[1]	
Maximum Head loss [ft/1000 ft]	7 ft/kft[1]	
Maximum Velocity [ft/sec]	7 fps[1]	
Maximum Day w/ Fire Flow Demand Condition		
Minimum Residual System Pressure [psi] (at fire node)	20 psi[1]	
Maximum Head loss [ft/1000 ft]	10 ft/kft[1]	
Maximum Velocity [ft/sec]	12 fps[1]	
Peak Hour Demand Condition		
Minimum Pressure [psi]	40 psi[1]	
Maximum Head loss [ft/1000 ft]	7 ft/kft[1]	
Maximum Velocity [ft/sec]	7 fps[1]	
Minimum Pipe Diameter		
Distribution to cul-de-sac / dead end street	8-inch[1]	
Distribution to fire hydrants	6-inch[1]	
Hazen Williams "C" Factor	120 (Ductile Iron, Steel); 130 (PVC)[1]	For consistency in hydraulic modeling.
Pipeline Material	PVC, Ductile Iron, or Steel[1]	
Storage Volume		
Operational	.25 x MDD[1]	Equivalent to about 1/2 average day criteria
Emergency	1.00 x ADD[1]	
Fire	1.26 MG (Two simultaneous fire events, multi-family residential (non-sprinklered, 2,500 gpm @ 2 hours) and industrial (fire events; see remarks for required fire flow volumes)[1]	Varies depending on land use, sprinklered vs. non-sprinklered and associated required fire flow duration. Highest fire flow demand in any particular area controls size of required storage.
Emergency Groundwater Storage Credit (EGWSC)	Equal to 85% of the active well production capacity for one day equipped with back-up power[1]	The minimum emergency groundwater storage credit is equal to zero. The maximum emergency groundwater storage credit is equal to the recommended emergency storage capacity or 85% of the City's active well production capacity for one day equipped with back up power supply, whichever is lower.
Total Water Storage and System Peaking Capacity	Operational + Fire + Emergency - EGWSC[1]	
Peaking Factors		
PHD/MDD	--	
MHD/MDD	--	
MDD/ADD	--	
MDD	1.75 x ADD[1]	
PHD	2.46 x ADD[1]	
Unit Water Use Factors		
Residential	3.00 AFY/Acre[1]	
Residential (Low)	N/A	
Residential (Medium)	N/A	
Residential (High)	N/A	
Village Residential	2.75 AFY/Acre[1]	
Neighborhood Village	N/A	
Estate Residential	N/A	
Downtown Residential	N/A	
Redevelopment Planning District	4 AFY/Acre[1]	
Business-Commercial-Residential	3.75 AFY/Acre[1]	
Commercial	2.75 AFY/Acre[1]	
Downtown Core	4 AFY/Acre[1]	
Regional Commercial	1.75 AFY/Acre[1]	
General Commercial	N/A	
Highway Service Commercial	N/A	
Neighborhood Commercial	N/A	
Medical Professional Office	N/A	
Industrial	1.75 AFY/Acre[1]	
Industrial - Light	N/A	
Industrial - Heavy	N/A	
Park	N/A	
Public/Quasi-Public	N/A	
Mixed Use	3.75 AFY/Acre[1]	
Business Park	1.00 AFY/Acre[1]	
Open Space	0.00 AFY/Acre[3]	

APPENDIX A

Crows Landing Industrial Business Park Water Distribution System Design Criteria		
Component	**Criteria[1,2,3]**	**Remarks / Issues**
Salida Community Plan	2.75 AFY/Acre[1]	
North Ceres	3.00 AFY/Acre[3]	
Single Family Detached	--	
Single Family Attached	--	
Multi Family Residential 2-4 Units	--	
Multi Family Residential 5 Units or More	--	
Commercial, Industrial, & Others	--	
Other Criteria		
Maximum number of residential lots that can be served by a non-looped water pipeline	25 lots[1]	If a non-looped water line goes out-of-service, all associated residences lose water service.

Acronyms
ADD - Average day demand
PHD -Peak hour demand
MDD - Max day demand
MHD - Minimum Hour Demand
FF - Fire Flow
N/A - Not Available

City of Modesto Notes
1) Data per City of Modesto 2017 Water Master Plan
2) Data per City of Modesto Standard Specifications dated September 2014
3) Data per Water System Engineer's Report Appendices B & D dated May 2010



APPENDIX B

INFOWATER MODEL PIPES AND JUNCTIONS

CROWS LANDING INDUSTRIAL BUSINESS PARK DRAFT WATER STUDY

CROWS LANDING, CA

MARCH 2020

0 500 1,000 2,000
Feet

NORTH

WOOD RODGERS

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Phase 1A - ADD: Node Results

ID	Label	Demand	Elevation	Head	Pressure
		gpm	ft	ft	psi
54	J-34	0	194.23	349.71	67.37
59	J-39	22.66	200.82	349.71	64.51
70	J-50	0	181.29	200.04	8.13
72	J-52	0	175.39	349.73	75.54
73	J-53	0.00	172.56	349.73	76.77
74	J-54	90.64	182.78	349.71	72.33
76	J-56	0	173.62	349.73	76.31
78	J-58	0	122.63	200.83	33.88

Phase 1A - ADD: Pipe Results

ID	Label	FROM NODE	TO NODE	LENGTH	DIAMETER	ROUGHNESS	FLOW	VELOCITY	HEADLOSS	HL/1000	STATUS	FLOW REVERSAL COUNT	HL/1000	HL/1000	VELOCITY	VELOCITY
				FT	IN		GPM	FT/S	FT	FT/K-FT			>=16	<16	>=16	<16
1	P-1	78	70	8,058.70	18	130	500	0.63	0.79	0.1	Open	0	0.10	-	0.63	-
2	P-2	72	54	2,588.68	18	130	113.3	0.14	0.02	0.01	Open	0	0.01	-	0.14	-
3	P-3	54	59	1,313.45	12	130	22.66	0.06	0	0	Open	0	-	0.00	-	0.06
7	P-7	54	74	1,374.62	18	130	90.64	0.11	0.01	0	Open	0	0.00	-	0.11	-
73	P-70	72	73	520.56	18	130	-113.3	0.14	0	0.01	Open	0	0.01	-	0.14	-
74	P-71	73	76	96.2	18	130	-113.3	0.14	0	0.01	Open	0	0.01	-	0.14	-
77	P-72	RES9002	V8000	838.96	12	130	500	1.42	0.59	0.7	Open	0	-	0.70	-	1.42
81	P-76	70	6	444.58	18	130	500	0.63	0.04	0.1	Open	0	0.10	-	0.63	-
82	P-77	6	U7004	75	18	130	0	0	0	0	Open	0	0.00	-	0.00	-
83	P-78	U7004	76	75	18	130	0	0	0	0	Open	0	0.00	-	0.00	-
85	P-80	6	U7002	75	18	130	113.3	0.14	0	0.01	Open	0	0.01	-	0.14	-
86	P-81	U7002	76	75	18	130	113.3	0.14	0	0.01	Open	0	0.01	-	0.14	-
P112	P-88	V8000	78	838.96	12	130	500	1.42	0.59	0.7	Open	0	-	0.70	-	1.42

Phase 1A - MDD+FF: Node Results

ID	Label	Demand	Elevation	Head	Pressure
		gpm	ft	ft	psi
54	J-34	0	194.23	333.74	60.45
59	J-39	39.65	200.82	333.73	57.59
70	J-50	0	181.29	200	8.11
72	J-52	0	175.39	346.72	74.24
73	J-53	0.00	172.56	349.33	76.59
74	J-54	4158.62	182.78	326.97	62.48
76	J-56	0	173.62	349.81	76.35
78	J-58	0	122.63	200	33.53

Phase 1A - MDD+FF: Pipe Results

ID	Label	FROM NODE	TO NODE	LENGTH	DIAMETER	ROUGHNESS	FLOW	VELOCITY	HEADLOSS	HL/1000	STATUS	FLOW REVERSAL COUNT	HL/1000	HL/1000	VELOCITY	VELOCITY
				FT	IN		GPM	FT/S	FT	FT/K-FT			>=16	<16	>=16	<16
1	P-1	78	70	8,058.70	18	130	31.45	0.04	0	0	Open	0	0	-	0.04	-
2	P-2	72	54	2,588.68	18	130	4,198.27	5.29	12.98	5.01	Open	0	5.01	-	5.29	-
3	P-3	54	59	1,313.45	12	130	39.65	0.11	0.01	0.01	Open	0	-	0.01	-	0.11
7	P-7	54	74	1,374.62	18	130	4,158.62	5.24	6.77	4.93	Open	0	4.93	-	5.24	-
73	P-70	72	73	520.56	18	130	-4,198.27	5.29	2.61	5.01	Open	0	5.01	-	5.29	-
74	P-71	73	76	96.2	18	130	-4,198.27	5.29	0.48	5.01	Open	0	5.01	-	5.29	-
77	P-72	RES9002	V8000	838.96	12	130	31.45	0.09	0	0	Open	0	-	0	-	0.09
81	P-76	70	6	444.58	18	130	31.45	0.04	0	0	Open	0	0	-	0.04	-
82	P-77	6	U7004	75	18	130	1,999.95	2.52	0.1	1.27	Open	0	1.27	-	2.52	-
83	P-78	U7004	76	75	18	130	1,999.95	2.52	0.1	1.27	Open	0	1.27	-	2.52	-
85	P-80	6	U7002	75	18	130	198.37	0.25	0	0.02	Open	0	0.02	-	0.25	-
86	P-81	U7002	76	75	18	130	198.37	0.25	0	0.02	Open	0	0.02	-	0.25	-
P112	P-88	V8000	78	838.96	12	130	31.45	0.09	0	0	Open	0	-	0	-	0.09

Phase 3 - ADD: Node Results

ID	Label	Demand	Elevation	Head	Pressure
		gpm	ft	ft	psi
1	J-1	39.06	132.57	348.7	93.65
12	J-8	39.06	126.82	348.71	96.15
14	J-9	19.99	129.42	348.75	95.03
16	J-10	19.99	138.56	348.73	91.06
17	J-11	19.99	133.68	348.73	93.18
18	J-12	19.99	130.19	348.73	94.7
2	J-2	19.99	126.89	348.7	96.11
23	J-13	19.99	134.78	348.73	92.71
24	J-14	39.27	162.28	348.85	80.84
25	J-15	19.99	145.79	348.73	87.93
26	J-16	39.06	140.87	348.74	90.07
27	J-17	19.99	144.94	348.74	88.31
29	J-18	39.27	158.77	348.92	82.39
3	J-3	19.99	121.74	348.7	98.34
30	J-19	39.27	140.85	348.76	90.09
31	J-20	39.27	146.84	348.78	87.5
32	J-21	39.27	166.86	348.86	78.86
33	J-22	39.27	158.76	348.97	82.42
36	J-23	0	142.47	349.02	89.5
37	J-24	39.27	171.58	348.98	76.87
38	J-25	39.27	169.27	349.04	77.9
39	J-26	39.27	164.62	349.27	80
41	J-27	39.27	176.11	349.21	75.01
43	J-28	39.27	170.46	349.38	77.53
44	J-29	39.27	169.27	349.41	78.05
45	J-30	39.27	161.39	349.36	81.45
5	J-4	39.06	121.49	348.7	98.45
51	J-31	0	166.17	349.55	79.46
52	J-32	39.27	174.31	349.63	75.96
53	J-33	0	170.58	349.71	77.62
54	J-34	0	194.23	349.57	67.31
55	J-35	39.27	167.73	349.41	78.72
56	J-36	39.27	170.92	348.85	77.1
57	J-37	39.27	158.14	349.29	82.83
58	J-38	39.27	158.32	349.08	82.66
59	J-39	22.66	200.82	349.57	64.45
60	J-40	19.99	117.93	348.71	100
61	J-41	19.99	145.31	348.73	88.14
62	J-42	19.99	143.07	348.73	89.11
63	J-43	39.06	137.69	348.74	91.45
64	J-44	0	127.36	348.78	95.94
65	J-45	19.99	124.22	348.75	97.29
66	J-46	0	126.89	348.71	96.11
67	J-47	0	121.74	348.73	98.35
68	J-48	0	117.93	348.73	100.01
69	J-49	0	122.89	348.77	97.88
7	J-5	39.06	133.64	348.7	93.19
70	J-50	0	181.29	200.05	8.13
71	J-51	39.27	168.45	348.88	78.18
72	J-52	0	175.39	349.79	75.57
73	J-53	0	172.56	349.84	76.81
74	J-54	90.64	182.78	349.46	72.22
75	J-55	0	154.74	349.33	84.32
76	J-56	0	173.62	349.9	76.38
77	J-57	19.99	127.15	348.76	96.02
78	J-58	0	122.63	200.93	33.93
8	J-6	39.06	128.27	348.7	95.51
9	J-7	39.06	124.11	348.7	97.32
J-115	J-59	0	0	348.79	151.13

Phase 3 - ADD: Pipe Results

ID	Label	FROM NODE	TO NODE	LENGTH	DIAMETER	ROUGHNESS	FLOW	VELOCITY	HEADLOSS	HL/1000	STATUS	FLOW REVERSAL COUNT	HL/1000	HL/1000	VELOCITY	VELOCITY
				FT	IN		GPM	FT/S	FT	FT/K-FT			>=16	<16	>=16	<16
1	P-1	78	70	8,058.70	18	130	531.45	0.67	0.88	0.11	Open	0	0.11	-	0.67	-
10	P-10	51	55	1,164.07	12	130	193.18	0.55	0.14	0.12	Open	0	-	0.12	-	0.55
11	P-11	55	44	1,305.29	12	130	6.17	0.02	0	0	Open	0	-	0	-	0.02
12	P-12	43	41	864.6	12	130	252.54	0.72	0.17	0.2	Open	0	-	0.2	-	0.72
13	P-13	41	38	1,193.44	12	130	213.27	0.6	0.17	0.14	Open	0	-	0.14	-	0.6
14	P-14	43	39	1,042.42	12	130	187.99	0.53	0.12	0.11	Open	0	-	0.11	-	0.53
15	P-15	55	45	735.6	12	130	147.74	0.42	0.05	0.07	Open	0	-	0.07	-	0.42
16	P-16	51	75	1,680.54	18	130	593.22	0.75	0.22	0.13	Open	0	0.13	-	0.75	-
17	P-17	45	57	1,712.54	12	130	108.46	0.31	0.07	0.04	Open	0	-	0.04	-	0.31
18	P-18	57	39	1,147.26	12	130	69.19	0.2	0.02	0.02	Open	0	-	0.02	-	0.2
19	P-19	39	58	1,206.89	12	130	217.9	0.62	0.18	0.15	Open	0	-	0.15	-	0.62
2	P-2	72	54	2,588.68	18	130	464.46	0.59	0.22	0.08	Open	0	0.08	-	0.59	-
20	P-20	58	33	1,097.30	12	130	178.63	0.51	0.11	0.1	Open	0	-	0.1	-	0.51
22	P-22	38	37	567.8	12	130	173.99	0.49	0.06	0.1	Open	0	-	0.1	-	0.49
23	P-23	37	71	1,654.05	12	130	134.72	0.38	0.1	0.06	Open	0	-	0.06	-	0.38
24	P-24	71	32	667.9	12	130	95.44	0.27	0.02	0.03	Open	0	-	0.03	-	0.27
25	P-25	32	56	520.77	12	130	56.17	0.16	0.01	0.01	Open	0	-	0.01	-	0.16
26	P-26	56	24	2,072.65	12	130	16.9	0.05	0	0	Open	0	-	0	-	0.05
27	P-27	24	29	1,825.97	12	130	-100.08	0.28	0.07	0.04	Open	0	-	0.04	-	0.28
29	P-29	29	33	801.24	12	130	-139.35	0.4	0.05	0.07	Open	0	-	0.07	-	0.4
3	P-3	54	59	1,313.45	12	130	22.66	0.06	0	0	Open	0	-	0	-	0.06
30	P-30	36	64	5,228.36	18	130	334.05	0.42	0.24	0.05	Open	0	0.05	-	0.42	-
31	P-31	64	69	971.15	12	130	48.09	0.14	0.01	0.01	Open	0	-	0.01	-	0.14
32	P-32	69	68	4,270.83	12	130	48.09	0.14	0.04	0.01	Open	0	-	0.01	-	0.14
33	P-33	36	31	1,156.79	12	130	259.18	0.74	0.24	0.21	Open	0	-	0.21	-	0.74
34	P-34	31	30	716.9	12	130	104.27	0.3	0.03	0.04	Open	0	-	0.04	-	0.3
35	P-35	31	27	816.78	12	130	115.63	0.33	0.04	0.05	Open	0	-	0.05	-	0.33
36	P-36	30	26	841.25	12	130	64.99	0.18	0.01	0.02	Open	0	-	0.02	-	0.18
37	P-37	27	26	855.25	12	130	28.66	0.08	0	0	Open	0	-	0	-	0.08
38	P-38	27	25	999.18	12	130	66.98	0.19	0.02	0.02	Open	0	-	0.02	-	0.19
39	P-39	25	62	557.84	12	130	27.34	0.08	0	0	Open	0	-	0	-	0.08
4	P-4	73	53	365.34	18	130	987.42	1.24	0.13	0.34	Open	0	0.34	-	1.24	-
40	P-40	62	17	2,607.80	12	130	7.35	0.02	0	0	Open	0	-	0	-	0.02
41	P-41	25	61	1,157.16	12	130	19.65	0.06	0	0	Open	0	-	0	-	0.06
42	P-42	61	16	2,062.04	12	130	-0.35	0	0	0	Open	0	-	0	-	0
43	P-43	68	67	848.05	12	130	48.09	0.14	0.01	0.01	Open	0	-	0.01	-	0.14
44	P-44	67	66	2,021.80	12	130	48.09	0.14	0.02	0.01	Open	0	-	0.01	-	0.14
45	P-45	26	63	563.58	12	130	54.59	0.15	0.01	0.01	Open	0	-	0.01	-	0.15
46	P-46	63	23	752.98	12	130	15.54	0.04	0	0	Open	0	-	0	-	0.04
47	P-47	23	18	1,869.18	12	130	-4.46	0.01	0	0	Open	0	-	0	-	0.01
48	P-48	18	17	963.89	12	130	49.35	0.14	0.01	0.01	Open	0	-	0.01	-	0.14
49	P-49	17	16	1,028.98	12	130	-10.01	0.03	0	0	Open	0	-	0	-	0.03
5	P-5	53	52	612.91	12	130	201.03	0.57	0.08	0.13	Open	0	-	0.13	-	0.57
50	P-50	16	7	2,697.75	12	130	47.35	0.13	0.02	0.01	Open	0	-	0.01	-	0.13
51	P-51	7	8	974.01	12	130	-6.69	0.02	0	0	Open	0	-	0	-	0.02
52	P-52	17	8	2,680.36	12	130	46.71	0.13	0.02	0.01	Open	0	-	0.01	-	0.13
53	P-53	18	14	544.3	12	130	-73.8	0.21	0.01	0.02	Open	0	-	0.02	-	0.21
55	P-55	14	12	958.93	12	130	94.25	0.27	0.03	0.03	Open	0	-	0.03	-	0.27
56	P-56	12	9	1,104.42	12	130	55.19	0.16	0.01	0.01	Open	0	-	0.01	-	0.16
57	P-57	8	9	714.15	12	130	3.45	0.01	0	0	Open	0	-	0	-	0.01
58	P-58	9	5	1,102.81	12	130	19.59	0.06	0	0	Open	0	-	0	-	0.06
59	P-59	7	1	2,172.63	12	130	14.99	0.04	0	0	Open	0	-	0	-	0.04
6	P-6	52	44	2,529.40	12	130	161.75	0.46	0.22	0.09	Open	0	-	0.09	-	0.46
60	P-60	1	2	1,026.37	12	130	-24.07	0.07	0	0	Open	0	-	0	-	0.07
61	P-61	2	8	2,135.42	12	130	2.49	0.01	0	0	Open	0	-	0	-	0.01
62	P-62	5	3	1,182.34	12	130	-19.47	0.06	0	0	Open	0	-	0	-	0.06
63	P-63	2	66	599.9	12	130	-48.09	0.14	0.01	0.01	Open	0	-	0.01	-	0.14
64	P-64	2	3	994.85	12	130	1.53	0	0	0	Open	0	-	0	-	0
65	P-65	3	60	850.09	12	130	-37.93	0.11	0.01	0.01	Open	0	-	0.01	-	0.11
66	P-66	60	65	3,687.74	12	130	-57.92	0.16	0.05	0.01	Open	0	-	0.01	-	0.16
7	P-7	54	74	1,374.62	18	130	441.8	0.56	0.11	0.08	Open	0	0.08	-	0.56	-
73	P-70	72	73	520.56	18	130	-464.46	0.59	0.04	0.08	Open	0	0.08	-	0.59	-
74	P-71	73	76	96.2	18	130	-1,451.88	1.83	0.07	0.7	Open	0	0.7	-	1.83	-
77	P-72	RES9002	V8000	838.96	12	130	31.45	0.09	0	0	Open	0	-	0	-	0.09
78	P-73	74	43	1,575.95	18	130	351.16	0.44	0.08	0.05	Open	0	0.05	-	0.44	-
79	P-74	75	36	2,268.20	18	130	593.22	0.75	0.3	0.13	Open	0	0.13	-	0.75	-
8	P-8	44	43	453.6	12	130	128.64	0.36	0.03	0.06	Open	0	-	0.06	-	0.36
80	P-75	V8002	78	1,903.05	12	130	500	1.42	1.34	0.7	Open	0	-	0.7	-	1.42
81	P-76	70	6	444.58	18	130	531.45	0.67	0.05	0.11	Open	0	0.11	-	0.67	-
82	P-77	6	U7004	75	18	130	0	0	0	0	Closed	0	0	-	0	-
83	P-78	U7004	76	75	18	130	0	0	0	0	Open	0	0	-	0	-
85	P-80	6	U7002	75	18	130	1451.88	1.83	0.05	0.7	Open	0	0.7	-	1.83	-
86	P-81	U7002	76	75	18	130	1451.88	1.83	0.05	0.7	Open	0	0.7	-	1.83	-
9	P-9	53	51	703.47	18	130	786.4	0.99	0.16	0.23	Open	0	0.23	-	0.99	-
P104	P-84	14	77	100	12	130	-188.05	0.53	0.01	0.11	Open	0	-	0.11	-	0.53
P106	P-85	77	65	100	12	130	77.92	0.22	0	0.02	Open	0	-	0.02	-	0.22
P108	P-86	77	64	100	12	130	-285.96	0.81	0.02	0.25	Open	0	-	0.25	-	0.81
P110	P-87	T5000	6	20	36	130	6.37	0	0	0	Open	0	0	-	0	-
P112	P-88	V8000	78	838.96	12	130	31.45	0.09	0	0	Open	0	-	0	-	0.09
P114	P-89	RES9000	V8002	1,903.05	12	130	500	1.42	1.34	0.7	Open	0	-	0.7	-	1.42
P122	P-90	6	U7008	75	18	130	0	0	0	0	Closed	0	0	-	0	-
P124	P-91	U7008	76	75	18	130	0	0	0	0	Open	0	0	-	0	-
P126	P-92	24	J-115	2,770.00	12	130	77.7	0.22	0.06	0.02	Open	0	-	0.02	-	0.22
P128	P-93	J-115	16	2,830.00	12	130	77.7	0.22	0.06	0.02	Open	0	-	0.02	-	0.22
P130	P-94	T5002	T5000	20	36	130	6.37	0	0	0	Open	0	0	-	0	-

Phase 3 - MDD+FF: Node Results

ID	Label	Demand	Elevation	Head	Pressure
		gpm	ft	ft	psi
1	J-1	4068.35	132.57	291.87	69.03
12	J-8	68.35	126.82	311.23	79.9
14	J-9	34.99	129.42	314.06	80
16	J-10	34.99	138.56	314.21	76.11
17	J-11	34.99	133.68	313.86	78.07
18	J-12	34.99	130.19	314.1	79.69
2	J-2	34.99	126.89	304.77	77.07
23	J-13	34.99	134.78	315.34	78.24
24	J-14	68.73	162.28	333.04	73.99
25	J-15	34.99	145.79	315.04	73.34
26	J-16	68.35	140.87	316.44	76.08
27	J-17	34.99	144.94	316.46	74.32
29	J-18	68.73	158.77	335.57	76.61
3	J-3	34.99	121.74	307.4	80.45
30	J-19	68.73	140.85	317.2	76.41
31	J-20	68.73	146.84	318	74.17
32	J-21	68.73	166.86	335.04	72.87
33	J-22	68.73	158.76	336.88	77.18
36	J-23	0	142.47	324.69	78.96
37	J-24	68.73	171.58	338.07	72.14
38	J-25	68.73	169.27	338.99	73.54
39	J-26	68.73	164.62	341.65	76.71
41	J-27	68.73	176.11	341.25	71.56
43	J-28	68.73	170.46	343.15	74.82
44	J-29	68.73	169.27	343.2	75.36
45	J-30	68.73	161.39	342.45	78.45
5	J-4	68.35	121.49	307.8	80.73
51	J-31	0	166.17	342.87	76.56
52	J-32	68.73	174.31	345.61	74.22
53	J-33	0	170.58	346.32	76.15
54	J-34	0	194.23	345.65	65.61
55	J-35	68.73	167.73	342.79	75.85
56	J-36	68.73	170.92	334.56	70.9
57	J-37	68.73	158.14	341.89	79.62
58	J-38	68.73	158.32	338.99	78.28
59	J-39	39.65	200.82	345.64	62.75
60	J-40	34.99	117.93	308.57	82.61
61	J-41	34.99	145.31	314.7	73.4
62	J-42	34.99	143.07	314.8	74.41
63	J-43	68.35	137.69	315.91	77.22
64	J-44	0	127.36	315.04	81.32
65	J-45	34.99	124.22	314.13	82.29
66	J-46	0	126.89	305.48	77.38
67	J-47	0	121.74	307.86	80.65
68	J-48	0	117.93	308.86	82.73
69	J-49	0	122.89	313.89	82.76
7	J-5	68.35	133.64	306.49	74.9
70	J-50	0	181.29	200.05	8.13
71	J-51	68.73	168.45	335.8	72.51
72	J-52	0	175.39	348.17	74.86
73	J-53	0	172.56	348.68	76.31
74	J-54	158.62	182.78	344.37	70.02
75	J-55	0	154.74	335.13	78.16
76	J-56	0	173.62	349.77	76.33
77	J-57	34.99	127.15	314.29	81.09
78	J-58	0	122.63	200.93	33.93
8	J-6	68.35	128.27	307.75	77.77
9	J-7	68.35	124.11	308.33	79.82
J-115	J-59	0	0	323.73	140.27

Phase 3 - MDD+FF: Pipe Results

ID	Label	FROM NODE	TO NODE	LENGTH	DIAMETER	ROUGHNESS	FLOW	VELOCITY	HEADLOSS	HL/1000	STATUS	FLOW REVERSAL COUNT	HL/1000	HL/1000	VELOCITY	VELOCITY
				FT	IN		GPM	FT/S	FT	FT/K-FT			>=16	<16	>=16	<16
1	P-1	78	70	8,058.70	18	130	531.45	0.67	0.88	0.11	Open	0	0.11	-	0.67	-
10	P-10	51	55	1,164.07	12	130	141.83	0.4	0.08	0.07	Open	0	-	0.07	-	0.4
11	P-11	55	44	1,305.29	12	130	-325.53	0.92	0.41	0.32	Open	0	-	0.32	-	0.92
12	P-12	43	41	864.6	12	130	923.93	2.62	1.89	2.19	Open	0	-	2.19	-	2.62
13	P-13	41	38	1,193.44	12	130	855.2	2.43	2.26	1.9	Open	0	-	1.9	-	2.43
14	P-14	43	39	1,042.42	12	130	735.71	2.09	1.5	1.44	Open	0	-	1.44	-	2.09
15	P-15	55	45	735.6	12	130	398.63	1.13	0.34	0.46	Open	0	-	0.46	-	1.13
16	P-16	51	75	1,680.54	18	130	4,009.33	5.05	7.74	4.6	Open	0	4.6	-	5.05	-
17	P-17	45	57	1,712.54	12	130	329.9	0.94	0.56	0.33	Open	0	-	0.33	-	0.94
18	P-18	57	39	1,147.26	12	130	261.17	0.74	0.24	0.21	Open	0	-	0.21	-	0.74
19	P-19	39	58	1,206.89	12	130	928.14	2.63	2.66	2.21	Open	0	-	2.21	-	2.63
2	P-2	72	54	2,588.68	18	130	1,732.06	2.18	2.52	0.97	Open	0	0.97	-	2.18	-
20	P-20	58	33	1,097.30	12	130	859.41	2.44	2.1	1.91	Open	0	-	1.91	-	2.44
22	P-22	38	37	567.8	12	130	786.47	2.23	0.92	1.62	Open	0	-	1.62	-	2.23
23	P-23	37	71	1,654.05	12	130	717.74	2.04	2.27	1.37	Open	0	-	1.37	-	2.04
24	P-24	71	32	667.9	12	130	649.01	1.84	0.76	1.14	Open	0	-	1.14	-	1.84
25	P-25	32	56	520.77	12	130	580.28	1.65	0.48	0.93	Open	0	-	0.93	-	1.65
26	P-26	56	24	2,072.65	12	130	511.55	1.45	1.52	0.73	Open	0	-	0.73	-	1.45
27	P-27	24	29	1,825.97	12	130	-721.95	2.05	2.53	1.39	Open	0	-	1.39	-	2.05
29	P-29	29	33	801.24	12	130	-790.68	2.24	1.31	1.64	Open	0	-	1.64	-	2.24
3	P-3	54	59	1,313.45	12	130	39.65	0.11	0.01	0.01	Open	0	-	0.01	-	0.11
30	P-30	36	64	5,228.36	18	130	2,448.22	3.09	9.65	1.85	Open	0	1.85	-	3.09	-
31	P-31	64	69	971.15	12	130	661.36	1.88	1.14	1.18	Open	0	-	1.18	-	1.88
32	P-32	69	68	4,270.83	12	130	661.36	1.88	5.03	1.18	Open	0	-	1.18	-	1.88
33	P-33	36	31	1,156.79	12	130	1,561.12	4.43	6.69	5.78	Open	0	-	5.78	-	4.43
34	P-34	31	30	716.9	12	130	641.34	1.82	0.8	1.11	Open	0	-	1.11	-	1.82
35	P-35	31	27	816.78	12	130	851.04	2.41	1.54	1.88	Open	0	-	1.88	-	2.41
36	P-36	30	26	841.25	12	130	572.61	1.62	0.76	0.9	Open	0	-	0.9	-	1.62
37	P-37	27	26	855.25	12	130	83.49	0.24	0.02	0.03	Open	0	-	0.03	-	0.24
38	P-38	27	25	999.18	12	130	732.57	2.08	1.42	1.42	Open	0	-	1.42	-	2.08
39	P-39	25	62	557.84	12	130	384.46	1.09	0.24	0.43	Open	0	-	0.43	-	1.09
4	P-4	73	53	365.34	18	130	4,808.73	6.06	2.35	6.45	Open	0	6.45	-	6.06	-
40	P-40	62	17	2,607.80	12	130	349.47	0.99	0.94	0.36	Open	0	-	0.36	-	0.99
41	P-41	25	61	1,157.16	12	130	313.12	0.89	0.34	0.3	Open	0	-	0.3	-	0.89
42	P-42	61	16	2,062.04	12	130	278.13	0.79	0.49	0.24	Open	0	-	0.24	-	0.79
43	P-43	68	67	848.05	12	130	661.36	1.88	1	1.18	Open	0	-	1.18	-	1.88
44	P-44	67	66	2,021.80	12	130	661.36	1.88	2.38	1.18	Open	0	-	1.18	-	1.88
45	P-45	26	63	563.58	12	130	587.75	1.67	0.53	0.95	Open	0	-	0.95	-	1.67
46	P-46	63	23	752.98	12	130	519.4	1.47	0.57	0.75	Open	0	-	0.75	-	1.47
47	P-47	23	18	1,869.18	12	130	484.41	1.37	1.24	0.66	Open	0	-	0.66	-	1.37
48	P-48	18	17	963.89	12	130	289.85	0.82	0.25	0.26	Open	0	-	0.26	-	0.82
49	P-49	17	16	1,028.98	12	130	-340.05	0.96	0.35	0.34	Open	0	-	0.34	-	0.96
5	P-5	53	52	612.91	12	130	657.57	1.87	0.71	1.17	Open	0	-	1.17	-	1.87
50	P-50	16	7	2,697.75	12	130	1,067.87	3.03	7.72	2.86	Open	0	-	2.86	-	3.03
51	P-51	7	8	974.01	12	130	-694.78	1.97	1.26	1.29	Open	0	-	1.29	-	1.97
52	P-52	17	8	2,680.36	12	130	944.38	2.68	6.11	2.28	Open	0	-	2.28	-	2.68
53	P-53	18	14	544.3	12	130	159.57	0.45	0.05	0.08	Open	0	-	0.08	-	0.45
55	P-55	14	12	958.93	12	130	1,086.34	3.08	2.83	2.95	Open	0	-	2.95	-	3.08
56	P-56	12	9	1,104.42	12	130	1,017.99	2.89	2.89	2.62	Open	0	-	2.62	-	2.89
57	P-57	8	9	714.15	12	130	-543.04	1.54	0.58	0.82	Open	0	-	0.82	-	1.54
58	P-58	9	5	1,102.81	12	130	406.6	1.15	0.53	0.48	Open	0	-	0.48	-	1.15
59	P-59	7	1	2,172.63	12	130	1,694.30	4.81	14.62	6.73	Open	0	-	6.73	-	4.81
6	P-6	52	44	2,529.40	12	130	588.84	1.67	2.4	0.95	Open	0	-	0.95	-	1.67
60	P-60	1	2	1,026.37	12	130	-2,374.05	6.73	12.9	12.57	Open	0	-	12.57	-	6.73
61	P-61	2	8	2,135.42	12	130	-724.28	2.05	2.98	1.39	Open	0	-	1.39	-	2.05
62	P-62	5	3	1,182.34	12	130	338.25	0.96	0.4	0.34	Open	0	-	0.34	-	0.96
63	P-63	2	66	599.9	12	130	-661.36	1.88	0.71	1.18	Open	0	-	1.18	-	1.88
64	P-64	2	3	994.85	12	130	-1,023.40	2.9	2.63	2.65	Open	0	-	2.65	-	2.9
65	P-65	3	60	850.09	12	130	-720.14	2.04	1.17	1.38	Open	0	-	1.38	-	2.04
66	P-66	60	65	3,687.74	12	130	-755.13	2.14	5.56	1.51	Open	0	-	1.51	-	2.14
7	P-7	54	74	1,374.62	18	130	1,692.40	2.13	1.28	0.93	Open	0	0.93	-	2.13	-
73	P-70	72	73	520.56	18	130	-1,732.06	2.18	0.51	0.97	Open	0	0.97	-	2.18	-
74	P-71	73	76	96.2	18	130	-6,540.79	8.25	1.1	11.39	Open	0	11.39	-	8.25	-
77	P-72	RES9002	V8000	838.96	12	130	31.45	0.09	0	0	Open	0	-	0	-	0.09
78	P-73	74	43	1,575.95	18	130	1,533.79	1.93	1.22	0.78	Open	0	0.78	-	1.93	-
79	P-74	75	36	2,268.20	18	130	4,009.33	5.05	10.44	4.6	Open	0	4.6	-	5.05	-
8	P-8	44	43	453.6	12	130	194.58	0.55	0.06	0.12	Open	0	-	0.12	-	0.55
80	P-75	V8002	78	1,903.05	12	130	500	1.42	1.34	0.7	Open	0	-	0.7	-	1.42
81	P-76	70	6	444.58	18	130	531.45	0.67	0.05	0.11	Open	0	0.11	-	0.67	-
82	P-77	6	U7004	75	18	130	2,000.76	2.52	0.1	1.27	Open	0	1.27	-	2.52	-
83	P-78	U7004	76	75	18	130	2,000.76	2.52	0.1	1.27	Open	0	1.27	-	2.52	-
85	P-80	6	U7002	75	18	130	2,539.28	3.2	0.15	1.98	Open	0	1.98	-	3.2	-
86	P-81	U7002	76	75	18	130	2,539.28	3.2	0.15	1.98	Open	0	1.98	-	3.2	-
9	P-9	53	51	703.47	18	130	4,151.16	5.23	3.45	4.91	Open	0	4.91	-	5.23	-
P104	P-84	14	77	100	12	130	-961.75	2.73	0.24	2.36	Open	0	-	2.36	-	2.73
P106	P-85	77	65	100	12	130	790.12	2.24	0.16	1.64	Open	0	-	1.64	-	2.24
P108	P-86	77	64	100	12	130	-1,786.86	5.07	0.74	7.43	Open	0	-	7.43	-	5.07
P110	P-87	T5000	6	20	36	130	30.08	0.01	0	0	Open	0	0	-	0.01	-
P112	P-88	V8000	78	838.96	12	130	31.45	0.09	0	0	Open	0	-	0	-	0.09
P114	P-89	RES9000	V8002	1,903.05	12	130	500	1.42	1.34	0.7	Open	0	-	0.7	-	1.42
P122	P-90	6	U7008	75	18	130	2,000.76	2.52	0.1	1.27	Open	0	1.27	-	2.52	-
P124	P-91	U7008	76	75	18	130	2,000.76	2.52	0.1	1.27	Open	0	1.27	-	2.52	-
P126	P-92	24	J-115	2,770.00	12	130	1,164.78	3.3	9.31	3.36	Open	0	-	3.36	-	3.3
P128	P-93	J-115	16	2,830.00	12	130	1,164.78	3.3	9.51	3.36	Open	0	-	3.36	-	3.3
P130	P-94	T5002	T5000	20	36	130	30.08	0.01	0	0	Open	0	0	-	0.01	-

APPENDIX C - Opinion of Overall Project Cost

Cost Classification		a. Total Cost	b. Costs Not Allowable for Participation	c. Total Allowable Costs
1	Administrative and Legal Expenses	$ 499,700.00	$ -	$ 499,700.00
2	Land, Structures, ROW, Appraisals, etc.	$ 99,940.00	$ -	$ 99,940.00
3	Relocation Expenses and Payments	$ -	$ -	$ -
4	Architectural and Engineering Fees	$ 1,388,449.00	$ -	$ 1,388,449.00
5	Other Architectural and Engineering Fees	$ -	$ -	$ -
6	Project Inspection Fees	$ 499,700.00	$ -	$ 499,700.00
7	Site Work	$ 1,499,100.00	$ -	$ 1,499,100.00
8	Demolition and Removal	$ 99,940.00	$ -	$ 99,940.00
9	Construction	$ 7,495,500.00	$ -	$ 7,495,500.00
10	Equipment	$ -	$ -	$ -
11	Miscellaneous	$ 899,460.00	$ -	$ 899,460.00
12	***SUBTOTAL (items 1-11)***	***$ 12,481,789.00***	***$ -***	***$ 12,481,789.00***
13	Contingencies (20%)	$ 2,496,357.80	$ -	$ 2,496,357.80
14	***SUBTOTAL***	***$ 14,978,146.80***	***$ -***	***$ 14,978,146.80***
15	Project (Program) Income	$ -	$ -	$ -
16	**TOTAL PROJECT COSTS (subtract 15 from 14)**	**$ 14,978,146.80**	**$ -**	**$ 14,978,146.80**