

City of Pinole
Pinole/Hercules WPCP Project

Technical Memorandum 4
Construction Phasing

March 1, 2013

PRELIMINARY
FOR REVIEW ONLY



Prepared under the responsible charge of

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Contents

Executive Summary	1
Purpose.....	1
Background.....	1
Conclusions	1
Introduction	3
Existing Facilities	3
Proposed Facilities	5
Construction Phasing, Sequencing, and Schedule	9
Construction Cost	12
Cost	12

Figures

Figure 4-1. Pinole-Hercules WPCP Existing Process Schematic.....	5
Figure 4-2. Existing WPCP Site Plan.....	6
Figure 4-3. Proposed Facility Site Plan.....	7
Figure 4-4. Construction Schedule	11
Figure 4-5. Stage 1 Construction Staging and Sequencing.....	13
Figure 4-6. Stage 2 Construction Staging and Sequencing.....	14
Figure 4-7. Stage 3 Construction Staging and Sequencing.....	15

Tables

Table 4-1. Demolition Details	9
Table 4-2. Description of Construction Stages	10
Table 4-3. Cost Estimate for WPCP Upgrades.....	12

TM 4 CONSTRUCTION PHASING

Pinole/Hercules WPCP Project

March 1, 2013

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Executive Summary

Purpose

The purpose of this technical memorandum (TM) is to address construction sequencing and phasing for the proposed upgrades at the Pinole/Hercules Water Pollution Control Plant (WPCP). The total construction and project costs are included in this TM and were escalated to the determined mid-point of construction (January 2016).

Background

The WPCP was issued a renewed National Pollutant Discharge Elimination System (NPDES) permit in August 2012. To comply with new permit conditions upgrades are needed and will include a new Headworks and Influent Pump Station Facility, a new Primary Clarifier 3 (PC 3), expansion and retrofit of the Aeration Basins, two new Secondary Clarifiers, and a new Solids Handling Facility, and new effluent pumps.

The permit includes a compliance schedule for the WPCP upgrades. The compliance dates include: construction start date of September 1, 2014, a construction completion date of November 11, 2016, and an operational date for upgrades of June 1, 2017. The permit compliance schedule provides 27 months for construction and six months for start up and commissioning.

A project construction schedule was developed for the proposed upgrades, taking into consideration that the WPCP must remain in operation and in compliance with current permit conditions throughout construction. The developed construction schedule is compared to the compliance dates in the permit.

Conclusions

Construction of the WPCP upgrades was assumed to start on September 1, 2014 per the NPDES permit compliance schedule. Based on the construction sequencing and phasing plan developed the following conclusions can be made:

- ◆ The total construction duration is approximately 32 months. Because of sequencing constraints, startup and commissioning will occur throughout the construction period.

- ◆ The upgrades can be operational to meet the NPDES permit compliance schedule of June 1, 2017. Additional time is allocated for process troubleshooting and optimization.
- ◆ The estimated construction cost is \$33.1 million in 2016 dollars, which includes 20 percent construction contingency.
- ◆ The estimated total project cost in 2016 dollars is \$41.4 million, which includes a 25 percent allowance for design engineering, engineering services during construction, construction management, and permitting.

DRAFT

Introduction

The WPCP is regulated under NPDES Permit Number CA 0037796. A renewed permit was issued on August 12, 2012 and requires the WPCP to meet the following conditions:

- ◆ Eliminate blending and provide secondary treatment for flows up to 20 mgd.
- ◆ Reduce use of the Emergency Outfall (Shallow Water Outfall) to times when flows are greater than 14.6 mgd.

The following compliance schedule is included in the permit for construction of the upgrades:

- ◆ Begin Construction – September 1, 2014.
- ◆ Complete Construction – November 1, 2016.
- ◆ Plant Upgrades Operational – June 1, 2017.

The purpose of this TM is to establish construction phasing and sequencing for the recommended plant improvements and to present the total construction and project costs of the proposed upgrades. The principal components of this TM include:

- ◆ Description of the existing site and facilities.
- ◆ Proposed improvements and site plan.
- ◆ Construction phasing and sequencing, and schedule.
- ◆ Summary of project and construction costs.

Existing Facilities

The WPCP was constructed in 1955, and began operation with primary treatment in 1956. In the 1970s the WPCP was upgraded and expanded to incorporate secondary treatment. Subsequent modifications and improvements to the plant took place from 1980 through 2002.

The current permitted capacity of secondary treatment facilities is 10.3 mgd. Flows in excess of 10.3 mgd bypass secondary treatment and are blended with secondary effluent prior to disinfection and discharge to San Pablo Bay. Currently, the WPCP pumps up to 10.3 mgd to the Rodeo Sanitary District's outfall (Deep Water Outfall). Flows in excess of 10.3 mgd are discharged by gravity to an Emergency Outfall, which is located to the west of the WPCP site.

Figure 4-1 provides a process flow diagram of the existing WPCP facilities. Raw wastewater from the City of Pinole and City of Hercules is screened with a single mechanical bar screen (peak capacity of 6 mgd) and a manually cleaned bar screen (for flows in excess of 6 mgd). The influent pump station has a firm capacity of 15 mgd and pumps screened wastewater to the Primary Clarifier Distribution Box. The Primary Clarifier Distribution Box splits flows equally to the three primary clarifiers. Primary effluent is combined in the Primary Effluent

Distribution Box (PEDB) and flows up to approximately 10.3 mgd are routed to the two aeration trains. Flows in excess of 10.3 mgd overflow a weir in the PEDB, are combined with secondary effluent (in the PEDB), and are then routed to the chlorine contact basin. Mixed liquor from the aeration basins is routed to the Secondary Clarifier Distribution Box (SCDB) where it is split equally to the five secondary clarifiers.

Primary effluent flows greater than 10.3 mgd bypasses secondary treatment at the PEDB. An adjustable weir is located within the PEDB, and flows greater than 10.3 mgd overflow the weir, are blended with secondary effluent, and routed to the chlorine contact basin.

Grit removal is provided for primary sludge. The de-gritted primary sludge is co-thickened with waste activated sludge (WAS) in a gravity sludge thickener and a rotary drum thickener. The thickened sludge is pumped to the three anaerobic digesters. Digested solids are pumped to a fourth anaerobic digester that is used as a holding tank. The solids are pumped from the holding tank to dewatering, and dewatered solids are hauled offsite for beneficial reuse. The WPCP has a digester gas management system (cogeneration system and flare), odor control system, and standby power generation facilities. Figure 4-2 provides a site plan of the existing facilities.

Space is limited within the existing plant site as shown in Figure 4-2. The eastern portion of the plant site is currently used as the City of Pinole's Corporation Yard. The property that surrounds the WPCP is also owned by others and/or used for public facilities as follows:

- ◆ East and North: Property is owned by Contra Costa County Flood Control District (CCCFCD).
- ◆ South and East: Property is owned by the City of Pinole, and is currently a public park (Bayfront Park).
- ◆ West and South: Property immediately to the west and south is a public walking trail.

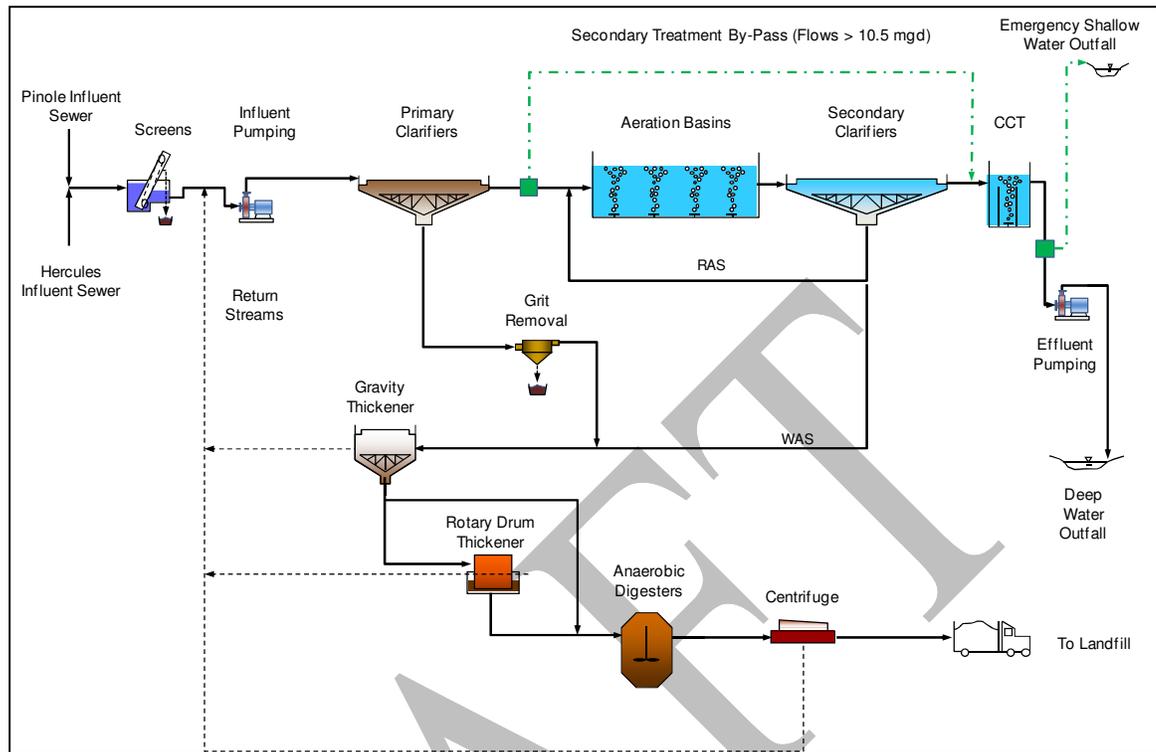


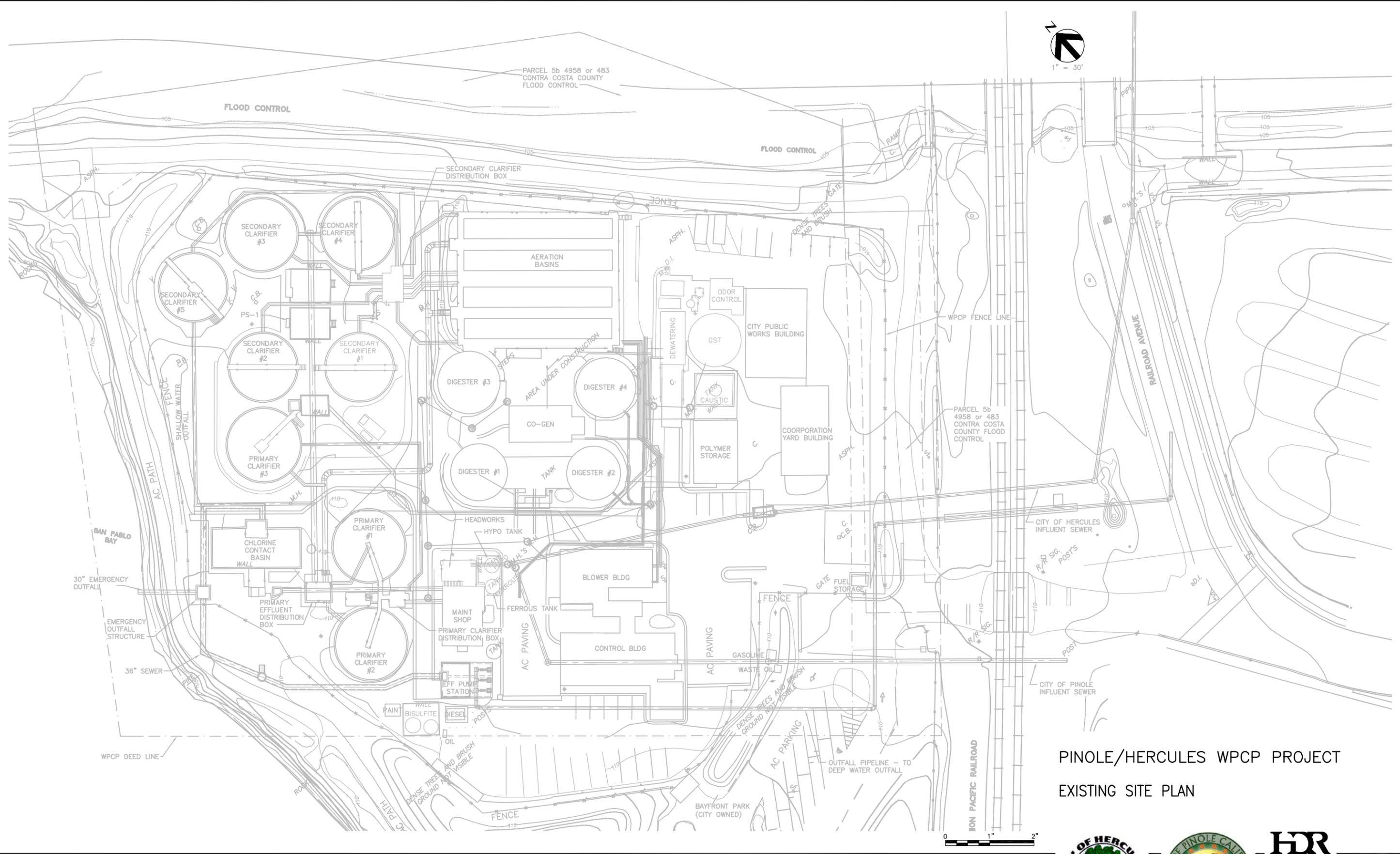
Figure 4-1. Pinole-Hercules WPCP Existing Process Schematic

Proposed Facilities

A summary of the proposed improvements at the WPCP is provided below and Figure 4-3 provides a site plan of the proposed upgrades:

- ◆ New influent flow meters to measure the City of Pinole's and City of Hercules' influent flows.
- ◆ New Influent Pump Station and Headworks Facility: The influent pump station will have a firm capacity of 20 mgd. Screening and grit removal is provided for flows up to 20 mgd. TM 5/6 describes details of the new facility.
- ◆ New Primary Clarifier 3 (PC 3): a new PC 3 will be constructed because the existing PC 3 will be demolished to accommodate a new, larger Secondary Clarifier 2 (SC 2). TM 8 provides additional details.
- ◆ Secondary Treatment: The existing aeration basins will be expanded to provide ammonia and nitrogen removal for future maximum month flows and loads. The secondary system will have a hydraulic capacity equal to 20 mgd. Three new aeration blowers will be installed in the existing Blower Building. TM 8 provides details of the new facilities that will be constructed.

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PINOLE/HERCULES WPCP PROJECT
EXISTING SITE PLAN

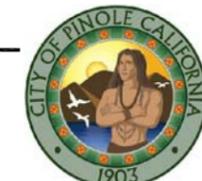
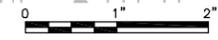
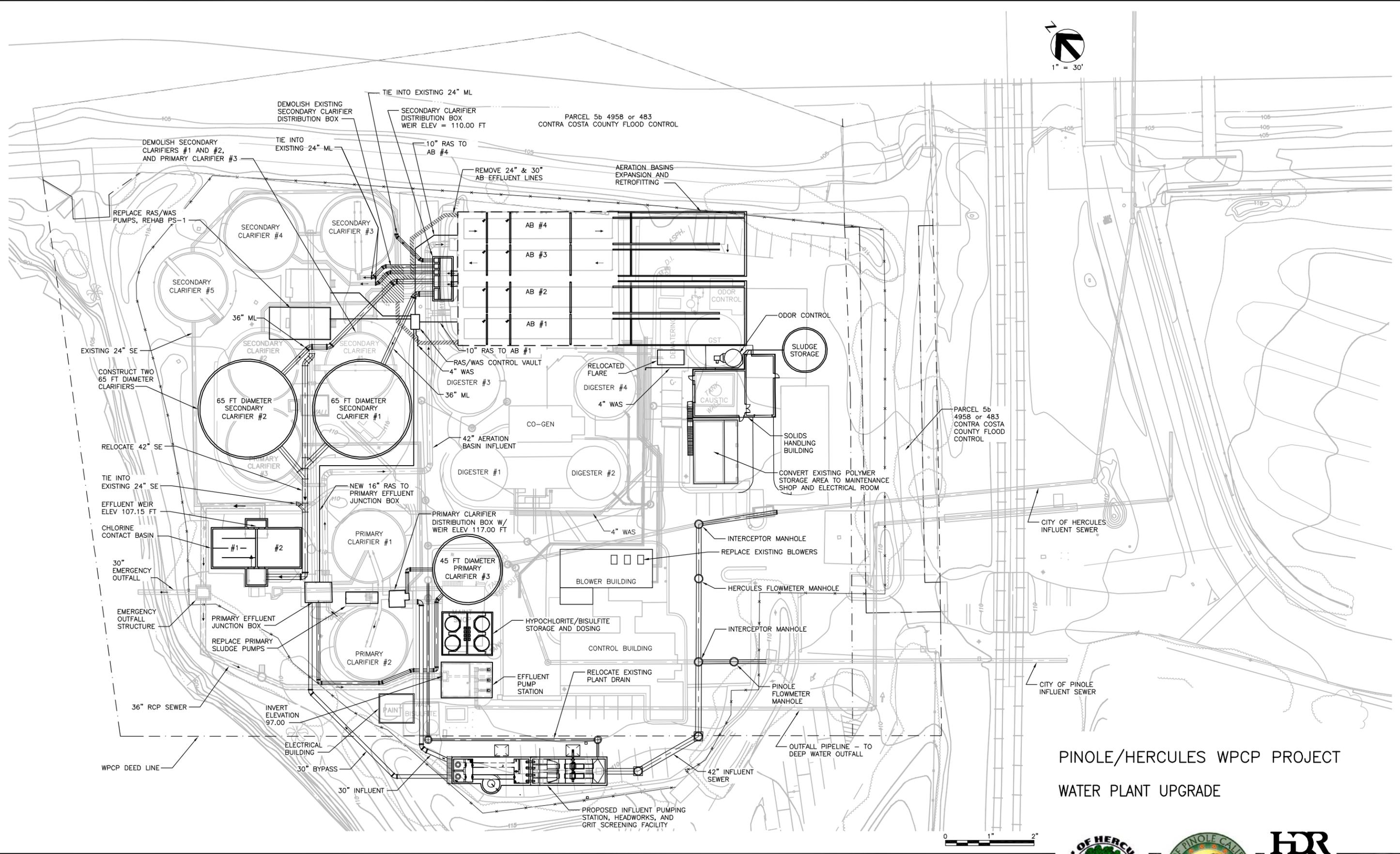
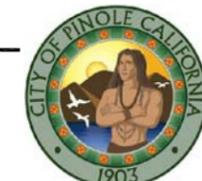
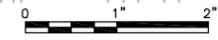


Figure 4-2



PINOLE/HERCULES WPCP PROJECT
WATER PLANT UPGRADE



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Figure 4-3

- ◆ Secondary Clarifiers: A new Secondary Clarifier Distribution Box will be constructed to split flows to five secondary clarifiers. Three of the existing secondary clarifiers (SC 3, SC 4 and SC 5) will be reused and SC 1 and SC 2 will be demolished and reconstructed as two, new 65-ft diameter secondary clarifiers. Four new RAS pumps and two new WAS pumps will be installed for the new SC 1 and SC 2. TM 8 provides additional details on the secondary clarifier modifications.
- ◆ Disinfection: The existing chlorine contact basin will be reused but new chlorination and dechlorination chemical feed pumps will be installed. TM 12 provides additional details on the new disinfection facilities.
- ◆ Effluent Pump Station: The existing Effluent Pump Station will be reused and the existing pumps will be demolished and replaced with larger pumps. The new pumps will have the capacity to deliver 13.9 to 14.2 mgd to the Deep Water Outfall. It was determined that 14.6 mgd can not be delivered to the Deep Water Outfall using the existing Outfall Pipeline because the pressure in the pipeline would exceed the pressure rating of the pipeline. TM 14 provides additional details of the proposed improvements at the Effluent Pump Station and the capacity constraints of the Outfall Pipeline.
- ◆ New Solids Handling Building and Solids Blend Tank: A New Solids Handling Facility and Blend Tank will be constructed because the existing facility will be demolished to accommodate the expanded aeration basins. The Blend Tank is a new feature at the WPCP and will provide operational flexibility and process improvements for solids handling and digester feeding.
- ◆ New Electrical Primary Service, Electrical Building and Standby Generator: A new primary service will be installed the WPCP to accommodate new electrical loads at the WPCP. A new electrical building will be constructed to house the motor control center of the new effluent pumps. A new standby generator is also needed for the new loads at the WPCP.

Construction will be phased to keep the existing plant operational and in compliance with the NPDES permit. There will be significant amount of demolition, new construction and relocation of existing structures, tanks, and yard piping involved in the proposed improvements. Table 4-1 summarizes the existing facilities that will be demolished, the reason for the demolition and the new location of the demolished structure/facility.

Table 4-1. Demolition Details

Facility to Be Demolished	Purpose for Demolition	New Location of Demolished Facility
Maintenance Shop	To accommodate Primary Clarifier 3 (PC 3)	Polymer Storage Building will be repurposed as a Maintenance Shop
Solids Handling Facility	To accommodate aeration basin expansion	East of anaerobic digesters.
Gravity Sludge Thickener	To accommodate aeration basin expansion	Gravity sludge thickener will be replaced with a solids blend tank located east of the new Solids Handling Building
Secondary Clarifier 1 (SC 1)	To accommodate new, larger (65 ft diameter) secondary clarifier	Existing SC 1 is replaced with new, larger SC 1 at the same location
Digester Gas Flare	To accommodate new, larger SC 1	East of Anaerobic Digester 4
Primary Clarifier 3 (PC 3)	To accommodate new, larger (65 ft diameter) secondary clarifier	East of Primary Clarifier 1 (PC 1) and Primary Clarifier 2 (PC 2)
Secondary Clarifier 2 (SC 2)	To accommodate new, larger (65 ft diameter) secondary clarifier	Existing SC 2 is replaced with new, larger SC 2 at the same location
Caustic Storage Area	To accommodate new Solids Handling Facility	Caustic Storage will not be replaced because it is no longer used
City of Pinole Corporation Yard Building	To accommodate new Solids Handling Facility	Corporation Yard Building will not be replaced onsite
Sodium Bisulfite Storage Area	Electrical Building	North of Effluent Pump Station

Construction Phasing, Sequencing, and Schedule

The proposed improvements will have several components that can be constructed simultaneously since they involve different and unrelated treatment processes. The constraints identified below were considered in developing the construction phasing and sequencing plan. An operational facility is defined as a facility that has been constructed and commissioned. Due to the constraints identified below, the sequencing and phasing plan assumes that startup and commissioning activities occur throughout construction rather than at the completion of construction, as indicated in the NPDES permit compliance schedule.

- ◆ **Influent Pump Station and Headworks:** The new Influent Pump Station and Headworks Facility must be operational prior to demolition of the existing Influent Pump Station and Headworks Facility.
- ◆ **Aeration Basins and Blowers:** Only one aeration train may be taken out of service during dry weather conditions. During the winter season, two aeration trains shall be operational. The new blowers shall be installed while the existing blowers remain in service. After the new blowers are commissioned, the existing blowers may be demolished.
- ◆ **Secondary Clarifiers:** One secondary clarifier may be taken out of service at a time. At all times during construction, a minimum of four secondary clarifiers shall be

operational. The new Secondary Clarifier Distribution Box, and new RAS/WAS pumps shall be commissioned at the same time as a new secondary clarifier.

- ◆ **Solids Handling Facility:** The existing Solid Handling Facility shall be demolished after the new Solids Handling Building and Blend Tank are constructed and commissioned.

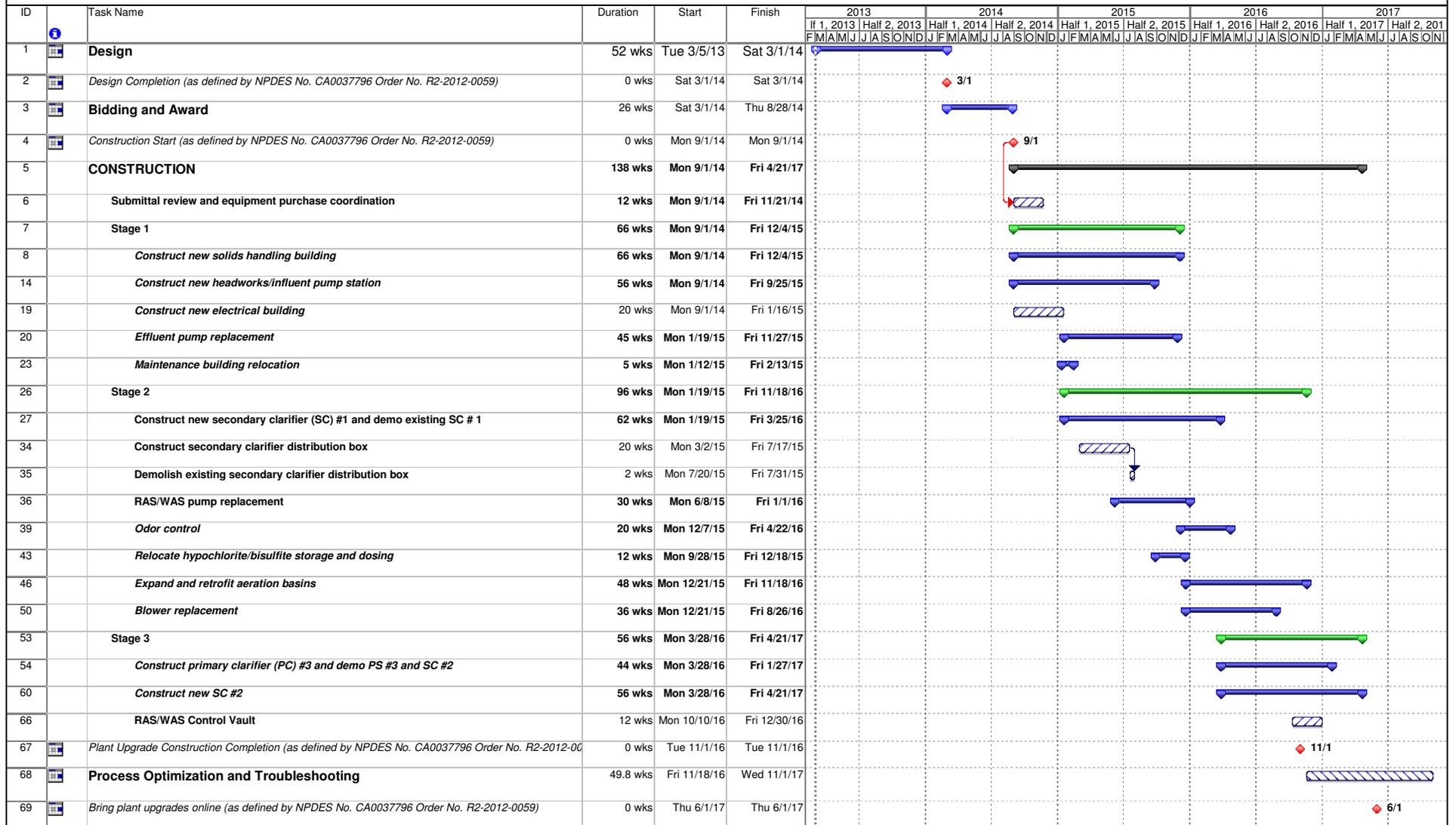
Table 4-2 describes the three construction stages assumed and Figure 4-4 provides the detailed construction schedule.

Table 4- 2. Description of Construction Stages

Stages	Construction and Modification of Major Structures	Demolition of Major Structures
Stage 1	Construction new Solids Handling Building	Demolish existing City Public Works Building
	Construct new Headworks	
	Construct new Electrical Building	
Stage 2	Construct Secondary Clarifier 1	Demolish existing Secondary Clarifier 1
	Expand and retrofit Aeration Basins	Demolish existing Solids Handling Building
Stage 3	Construct Primary Clarifier 3	Demolish existing Headworks
	Construct Secondary Clarifier 2	Demolish existing Primary Clarifier 3 and Secondary Clarifier 2

Construction was assumed to start on September 1, 2014 per the compliance schedule in the NPDES permit and the estimated duration for construction is two years and seven months. Process optimization and troubleshooting would begin at the conclusion of Stage 2 construction and would last approximately one year. As shown in Figure 4-4, construction and commissioning activities would be completed by June 1, 2017 and process optimization and troubleshooting would extend to November 1, 2017. The midpoint of construction is estimated as January 2016.

City of Pinole/Hercules WPCP Plant Upgrades Construction Sequence and Schedule



Project: TM 4_ Construction schedule
Date: Fri 3/1/13

Subtask Construction Duration Rolled Up - Construction Stages Start up and Commissioning

Critical Task Milestone Rolled Up Task

Figure 4-4

Construction Cost

Table 4-3 provides an overview of the estimated construction costs and the total project costs. The project costs were escalated to 2016 dollars because that is the estimated midpoint of construction.

Table 4-3. Cost Estimate for WPCP Upgrades

No.	Description	Cost
1	Headworks ¹	\$ 4,990,000
2	Electrical ^{1,2}	\$ 2,120,000
3	Secondary Treatment ^{1,3}	\$ 13,001,000
4	Chlorine Disinfection ¹	\$ 785,100
5	Effluent Pump Station ¹	\$ 1,031,000
6	Solids Handling ¹	\$ 3,336,000
7	Outfall Pipeline Improvements ¹	\$ 254,000
	Subtotal in 2012 dollars ¹	\$ 25,517,100
	Construction Contingency ^{1,4}	\$ 4,513,800
	Total Construction Costs in 2012 dollars	\$ 30,030,900
	Total Construction Costs in 2016 dollars ⁵ (escalated to midpoint of construction)	\$ 33,148,000
	Engineering and Administration ⁶	\$ 8,287,000
	Total Project Costs in 2016 dollars	\$ 41,435,000

- (1) Construction costs in 2012 dollars.
- (2) Includes costs for new primary service, new standby generator and new electrical building.
- (3) Secondary treatment includes costs for aeration basin and blower upgrades, new secondary clarifiers, and primary clarifier improvements and relocation.
- (4) 20 percent construction contingency on Divisions 2 through 16.
- (5) Costs escalated to 2016 dollars using a rate of 2.5 percent per year.
- (6) Engineering and administration cost is 25 percent of total construction cost. Costs are presented in 2016 dollars.



- STAGE 1:
- 1 REMOVE OR DEMOLISH EXISTING CAUSTIC STORAGE TANK.
 - 2 DEMOLISH PUBLIC WORKS BUILDING.
 - 3 CONSTRUCT NEW SOLIDS HANDLING BUILDING.
 - 4 CONSTRUCT NEW INFLUENT PUMPING STATION, HEADWORKS AND GRIT SCREENING FACILITY.
 - 5 TEMPORARILY RELOCATE BISULFITE AND HYPOCHLORITE TANKS TO NEW LOCATION AND SITE CLEANING.
 - 6 MODIFY ELECTRICAL WORK IN POLYMER BUILDING.
 - 7 CONSTRUCT SLUDGE STORAGE TANK.
 - 8 CONSTRUCT INFLUENT SEWER, INTERCEPTOR MANHOLES AND YARD PIPING IN PRIMARY TREATMENT AREA.
 - 9 CONSTRUCT NEW ELECTRICAL BUILDING.
 - 10 REPLACE PUMPS AT EFFLUENT PUMPING STATION.
 - 11 REMOVE POLYMER STORAGE AND SITE CLEARING.
 - 12 RELOCATE MAINTENANCE SHOP TO EXISTING POLYMER BUILDING.

LEGEND:
 DEMOLITION

PARCEL 5b
 4958 or 483
 CONTRA COSTA COUNTY FLOOD CONTROL

PARCEL 5b
 4958 or 483
 CONTRA COSTA COUNTY FLOOD CONTROL

CITY OF HERCULES
 INFLUENT SEWER

CITY OF PINOLE
 INFLUENT SEWER

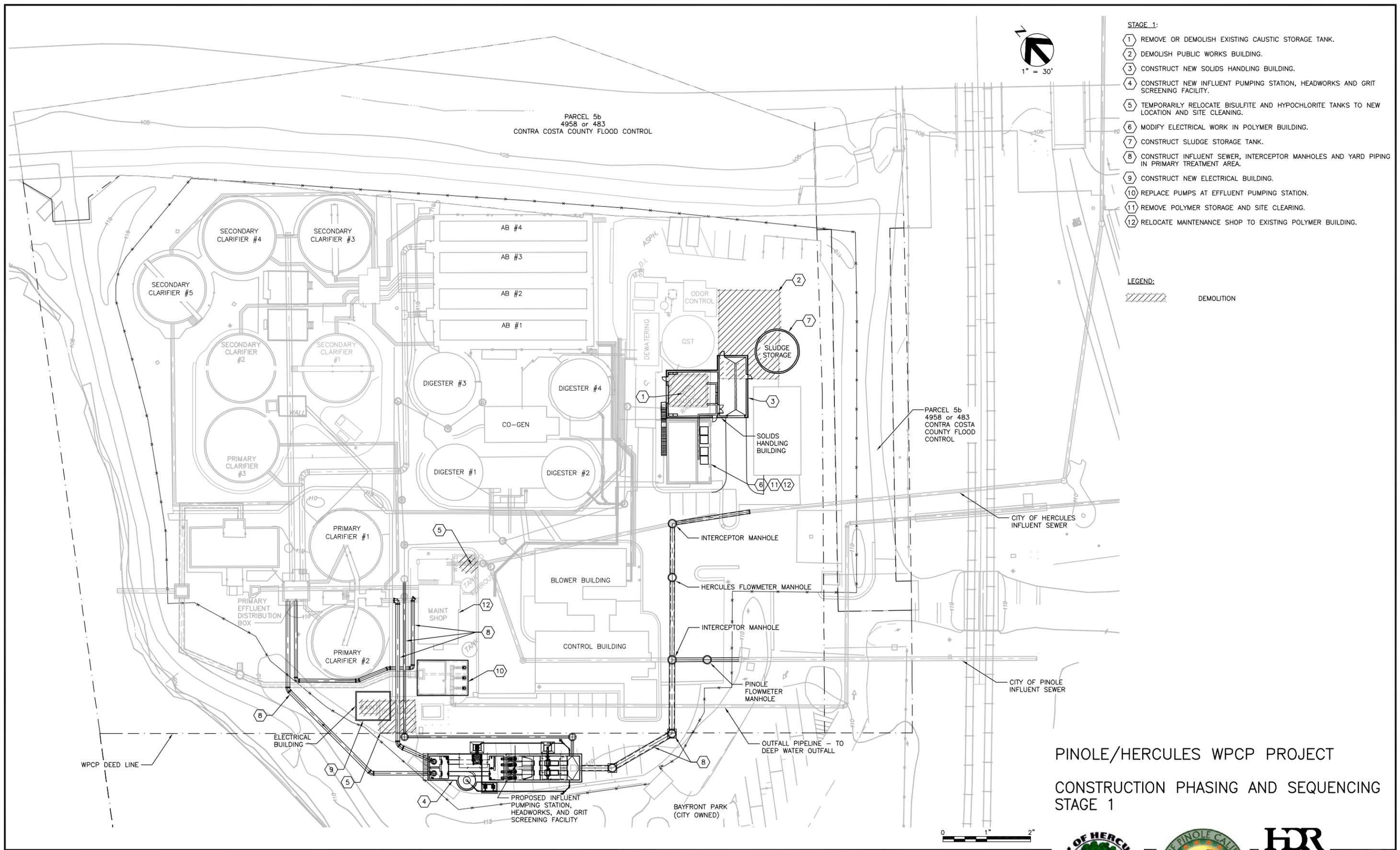
BAYFRONT PARK
 (CITY OWNED)

PINOLE/HERCULES WPCP PROJECT
 CONSTRUCTION PHASING AND SEQUENCING
 STAGE 1



Figure 4-5

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- STAGE 2:
- 1 TEMPORARILY RELOCATE WASTE GAS BURNER.
 - 2 DEMOLISH EXISTING SECONDARY CLARIFIER NUMBER 1.
 - 3 CONSTRUCT NEW SECONDARY CLARIFIER NUMBER 1.
 - 4 CONSTRUCT SECONDARY CLARIFIER DISTRIBUTION BOX.
 - 5 CONSTRUCT YARD PIPING IN SECONDARY TREATMENT AREA.
 - 6 DEMOLISH EXISTING SECONDARY CLARIFIER DISTRIBUTION BOX.
 - 7 REPLACE RAS/WAS PUMPS AND EXPAND RAS/WAS PUMP STATION 1.
 - 8 DEMOLISH EXISTING SOLIDS HANDLING AND DEWATERING FACILITY.
 - 9 CONSTRUCT NEW ODOR CONTROL UNIT AT SOLIDS HANDLING FACILITY.
 - 10 RELOCATE WASTE GAS BURNER.
 - 11 DEMOLISH EXISTING HEADWORKS AND MAINTENANCE SHOP.
 - 12 RELOCATE BISULFITE AND HYPOCHLORITE TANKS TO NEW LOCATION AND SITE CLEARING.
 - 13 EXPAND AND RETROFIT AERATION BASINS.
 - 14 REPLACE BLOWERS AT EXISTING BLOWER BUILDING.
 - 15 EXTEND EXISTING AND CONSTRUCT NEW LOW PRESSURE AIR LINE TO EXPANDED AERATION BASINS.

LEGEND:
 DEMOLITION

PARCEL 5b 4958 or 483
 CONTRA COSTA COUNTY FLOOD CONTROL

PARCEL 5b
 4958 or 483
 CONTRA COSTA
 COUNTY FLOOD
 CONTROL

CITY OF HERCULES
 INFLUENT SEWER

CITY OF PINOLE
 INFLUENT SEWER

PINOLE/HERCULES WPCP PROJECT
 CONSTRUCTION PHASING AND SEQUENCING
 STAGE 2

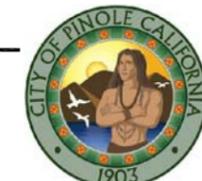
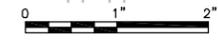
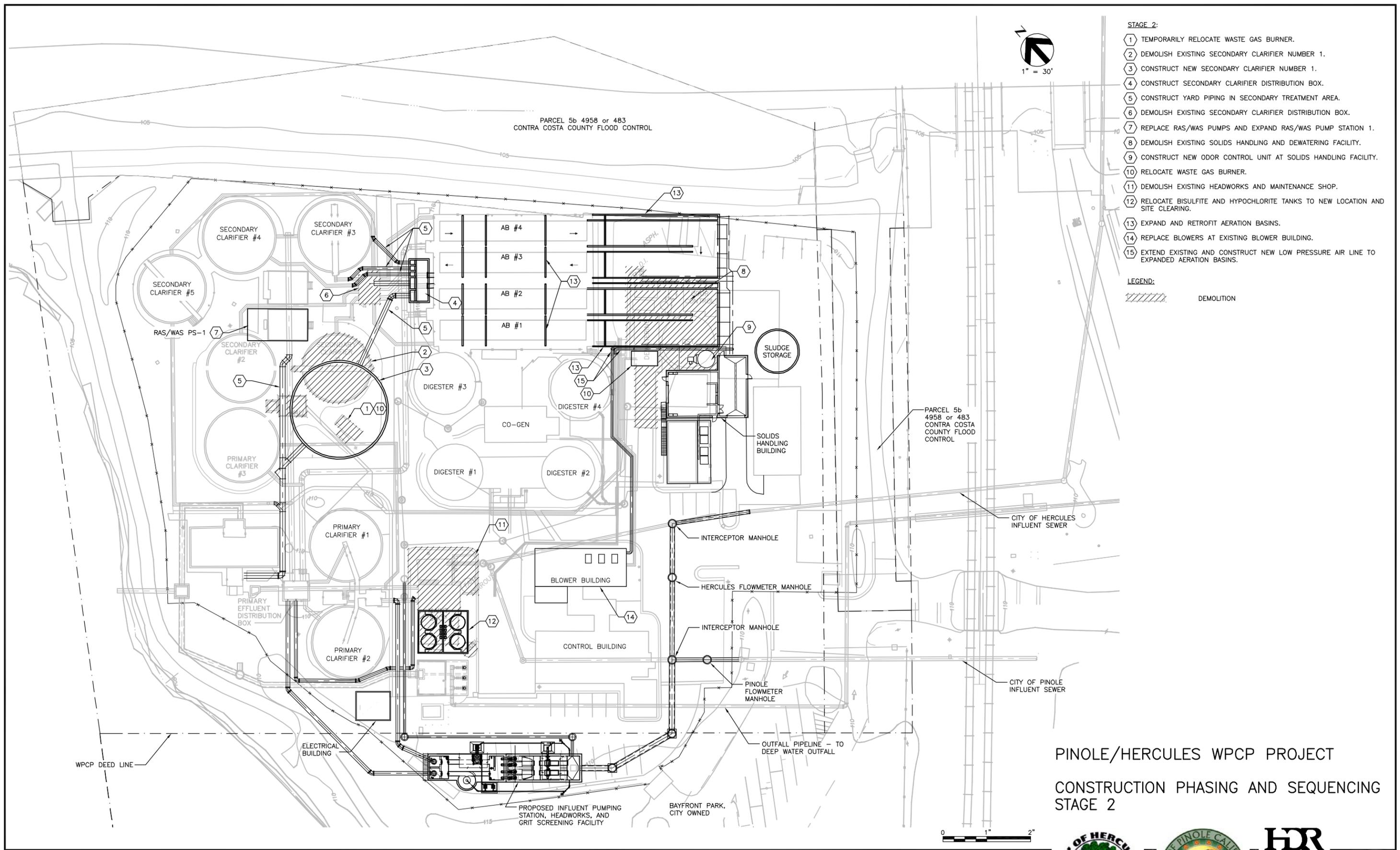


Figure 4-6

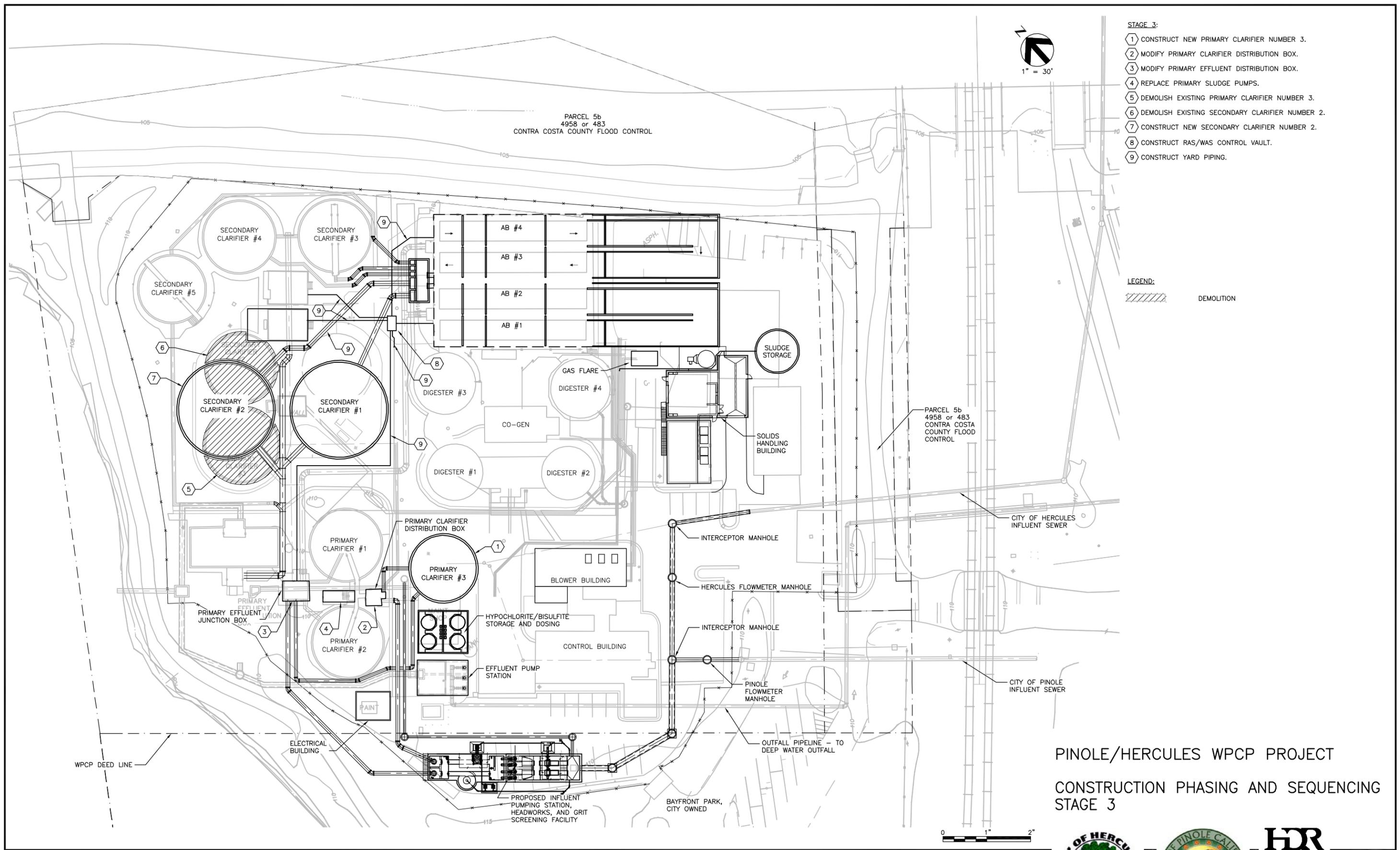
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- STAGE 3:
- ① CONSTRUCT NEW PRIMARY CLARIFIER NUMBER 3.
 - ② MODIFY PRIMARY CLARIFIER DISTRIBUTION BOX.
 - ③ MODIFY PRIMARY EFFLUENT DISTRIBUTION BOX.
 - ④ REPLACE PRIMARY SLUDGE PUMPS.
 - ⑤ DEMOLISH EXISTING PRIMARY CLARIFIER NUMBER 3.
 - ⑥ DEMOLISH EXISTING SECONDARY CLARIFIER NUMBER 2.
 - ⑦ CONSTRUCT NEW SECONDARY CLARIFIER NUMBER 2.
 - ⑧ CONSTRUCT RAS/WAS CONTROL VAULT.
 - ⑨ CONSTRUCT YARD PIPING.

LEGEND:
 DEMOLITION



PINOLE/HERCULES WPCP PROJECT
 CONSTRUCTION PHASING AND SEQUENCING
 STAGE 3

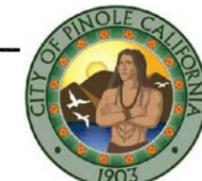
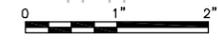


Figure 4-7

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