City of Pinole

Pinole/Hercules WPCP Project

Technical Memorandum 8

Flow Equalization, Aeration Basins, Blowers, Secondary Clarifiers, and RAS/WAS Pumping

March 1, 2013

PRELIMINARY
FOR REVIEW ONLY

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Pinole/Hercules WPCP Project ***March 1, 2013***

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Executive Summary

Purpose

The purpose of this technical memorandum (TM) is as follows:

- Provide a review of the existing primary and secondary treatment facilities.
- Develop and evaluate alternatives to comply with the new Pinole/Hercules Water Pollution Control Plant's (WPCP) permit conditions.
- Establish preliminary design criteria for the preferred alternative that can be carried forward to the development of construction documents.

Background

Currently, the WPCP treats an average dry weather flow of approximately 3 million gallons per day (mgd). During the wet weather season, peak hour flows can be as high as 20 mgd due to infiltration and inflow (I/I) in the collection system. The secondary system is permitted to treat flows up to 10.3 mgd, and peak wet weather flows (PWWF) greater than 10.3 mgd bypass secondary treatment prior to being disinfected and discharged to San Pablo Bay. Up to approximately 10.3 mgd of treated effluent is pumped to the Rodeo Sanitary District's outfall (Deep Water Outfall) for discharge. Flows greater than 10.3 mgd are discharged by gravity to the WPCP's Emergency Outfall, which is located directly west of the plant site.

The WPCP's National Pollutant Discharge Elimination System (NPDES) permit requires secondary treatment for flows up to 20 mgd (elimination of blending) and discharge of up to 14.6 mgd of treated effluent to the Deep Water Outfall. Two secondary treatment alternatives were developed for consideration: (1) flow equalization for influent flows to minimize capacity of the secondary treatment system, and (2) no flow equalization such that all flows are treated as they enter the plant. The secondary treatment alternatives were developed to meet the following objectives:

- Meet new permit requirements.
- Improve process control of the secondary system and reduce operations and maintenance requirements.
- Improve sludge settleability to reduce dependence on chemical addition.
- Locate facilities within existing WPCP property while maintaining the City of Pinole's Corporation Yard at the WPCP.

Conclusions

Alternative 1 (Flow Equalization) was developed for various flow equalization volumes and secondary treatment capacities. For Alternative 1 to be feasible, the secondary system would need to be expanded to treat up to 17 mgd of peak flows and a 0.7 million gallon (MG) equalization basin would be needed. The aeration basins would be expanded and new aeration blowers installed. Secondary Clarifiers 3 through 5 (SC 3 through SC 5) would be reused, and Secondary Clarifiers 1 and 2 (SC 1 and SC 2) would be demolished and reconstructed as two 60-foot (ft) diameter secondary clarifiers. To accommodate the 60-ft diameter SC 1 and SC 2, Primary Clarifier 3 (PC 3) would be demolished and relocated to the east of Primary Clarifier 1 and 2 (PC 1 and PC 2). The existing digester gas flare would be relocated as well. The equalization basin would be located in the northeastern corner of the site, which is currently used as the City of Pinole's Corporation Yard which would be relocated offsite. Relocation of the Corporation Yard was determined by the Staff to be unacceptable; therefore, Alternative 1 was eliminated from consideration.

Alternative 2 (No Flow Equalization) is the recommended alternative and was developed to provide secondary treatment for peak hour flows up to 20 mgd. Alternative 2, which would enable the secondary treatment facilities to remain within the property boundary and maintain the Corporation Yard within the WPCP site, was developed as follows:

- Extension of the existing aeration basins by 90 ft.
- Installation of new aeration blowers in the existing Blower Building.
- Continued use of SC 3, SC 4, SC 5.
- Demolition of the existing peripheral feed clarifiers (SC 1 and SC 2) and construction of two 65-ft diameter secondary clarifiers.
- Relocation of the existing PC 3 to the east of existing PC 1 and PC 2.
- Resetting of the weirs at PC 1 and PC 2 and installation of three primary sludge pumps.
- Construction of a Secondary Clarifier Distribution Box.
- Replacement of return activated sludge (RAS) and waste activated sludge (WAS) pumps for SC 1 and SC 2.

Alternative 2 would provide nitrification and denitrification, as opposed to providing biochemical oxygen demand (BOD) removal only. Providing nitrification and denitrification was selected for the following reasons:

- Provides flexibility to meet future regulations that may require ammonia and/or nitrogen removal.
- Produces a higher quality effluent that reduces annual disinfection costs.
- Is a more stable process with improved sludge settleability that can reduce the WPCP's reliance on polymer addition to meet permit limits.

The estimated project cost for Alternative 2 is $19,128,000.

Introduction

The WPCP provides treatment of wastewater from the City of Pinole and the City of Hercules and operates under NPDES Permit Number CA 0037796. Upgrades at the WPCP are necessary to meet the provisions in the WPCP's revised NPDES Permit (issued in August 2012). TM 2 provides an overview of the new discharge permit provisions.

This TM is part of the preliminary design for treatment plant upgrades at the WPCP and specifically addresses improvements to the primary clarifiers, aeration basins, aeration blowers, secondary clarifiers, and return activated sludge (RAS) and waste activated sludge (WAS) pumping facilities. The objectives of TM 8 are as follows:

- Provide a review of existing primary and secondary treatment facilities.
- Develop and evaluate secondary treatment alternatives to comply with the new permit conditions.
- Establish preliminary design criteria for the preferred alternative that can be carried forward to the development of construction documents.

Existing Facilities

Figure 8-1 provides a process flow diagram of the existing treatment facilities at the WPCP. Currently, the WPCP treats an average dry weather flow of approximately 3 million gallons per day (mgd). Hourly peak wet weather flows (PWWF) can be as high as 20 mgd due to infiltration and inflow (I/I) in the collection system. TM 1 provides a detailed analysis of current and projected flows and loads to the WPCP.

Influent flows are screened and pumped to three primary clarifiers. The secondary system is permitted to treat flows up to 10.3 mgd. PWWFs greater than 10.3 mgd bypass secondary treatment and are blended with secondary effluent prior to disinfection and discharge to San Pablo Bay. Treated effluent flows up to 10.3 mgd are pumped to the Rodeo Sanitary District's outfall (Deep Water Outfall) for discharge. Flows greater than 10.3 mgd are discharged by gravity to the WPCP's Emergency Outfall, which is located directly west of the site.

Primary Clarifiers

All influent flows are currently routed to three primary clarifiers. PC 1 was constructed in the mid-1950s, PC 2 was constructed in the early 1970s, and PC 3 was constructed in the early 1980s. Table 8-1 provides details of the existing primary clarifiers. The primary clarifiers remove settleable solids and floatables from influent wastewater. The removal efficiency of the primary clarifiers at the WPCP is variable, but approximately 45 percent biochemical oxygen demand (BOD) and 63 percent total suspended solids (TSS) removal is achieved (Figures 8-2 and 8-3).

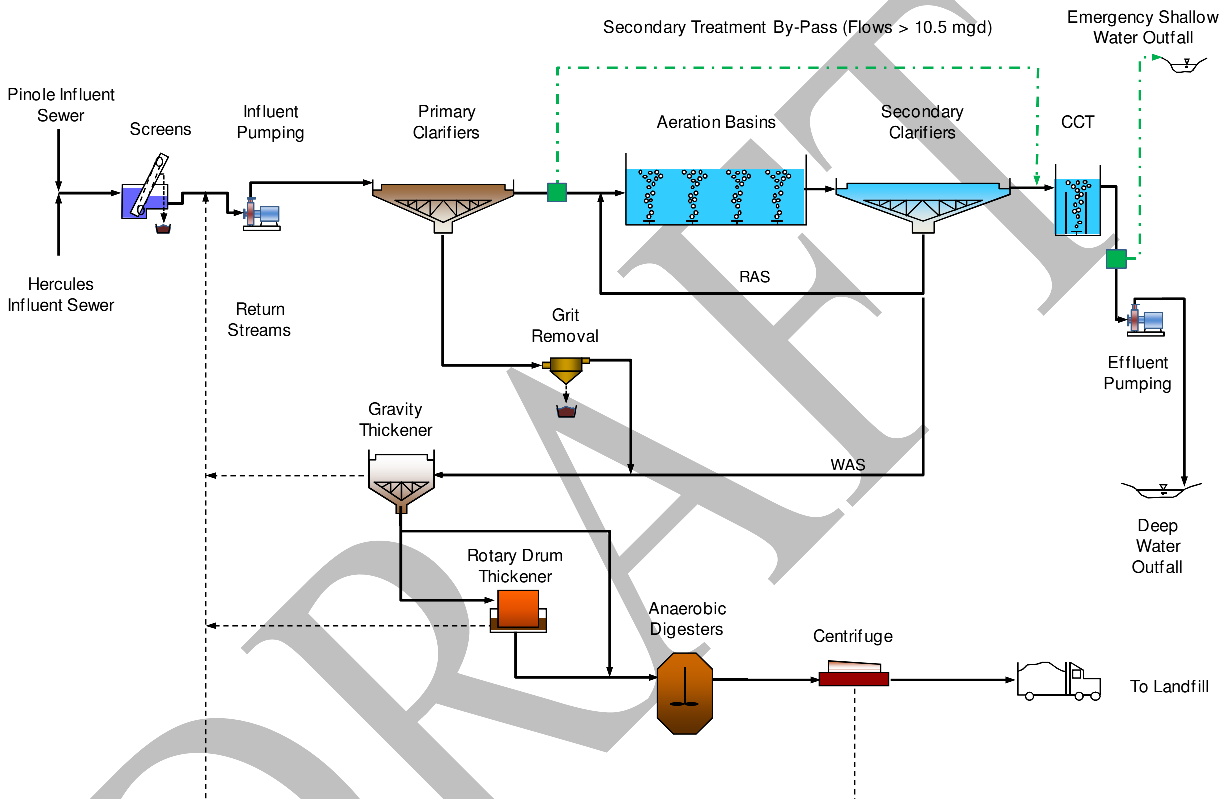


Figure 8-1. Existing Process Flow Diagram

Primary sludge is pumped from the clarifiers using recessed impeller, centrifugal pumps which operate on a timer with a run-time of 10 minutes, every 30 minutes. Chemical addition at the primary clarifiers to increase BOD and TSS removal is currently not used. Staff have indicated that while all PWWFs are passed through the primary clarifiers, the primary clarifier effluent weirs are submerged at flows greater than 12 mgd. In 2009, a stress test of the primary and secondary clarifiers was performed. The primary clarifiers became hydraulically overloaded at peak hour flows of approximately 4 mgd per primary clarifier (Pinole-Hercules WPCP Stress Test Results Memorandum, Lea Fisher, November 24, 2009). Based on this information, the peak capacity of the three primary clarifiers was assumed to be 12 mgd. The primary clarifier surface overflow rate (SOR) at 12 mgd is 2,500 gpd/ft^2, which is within standard design criteria for peak SORs (Design of Municipal Wastewater Treatment Plants Fourth Edition, Water Environment Federation, Manual of Practice 8).

Table 8-1. Existing Primary Clarifiers

Unit Process	Description
Number	3 (PC 1, PC 2, PC 3)
Diameter, each	45 ft
Surface Area, each	1,590 ft^2
Side Water Depth, each	8.3 ft
Surface Overflow Rate[1]	
Average Dry Weather Flow	629 gpd/ft^2
Peak Rated Capacity (12 mgd)	2,500 gpd/ft^2

1) All units in service

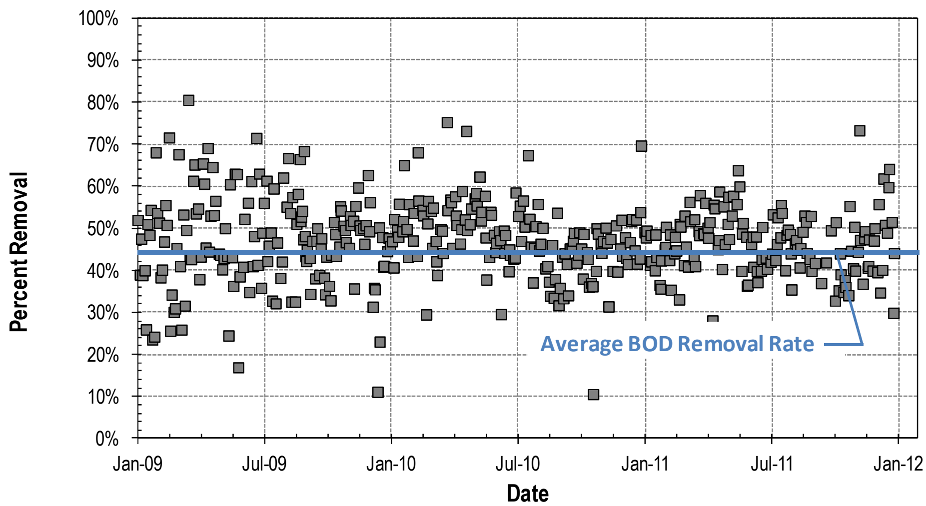


Figure 8-2. Existing Primary Clarifiers BOD Removal

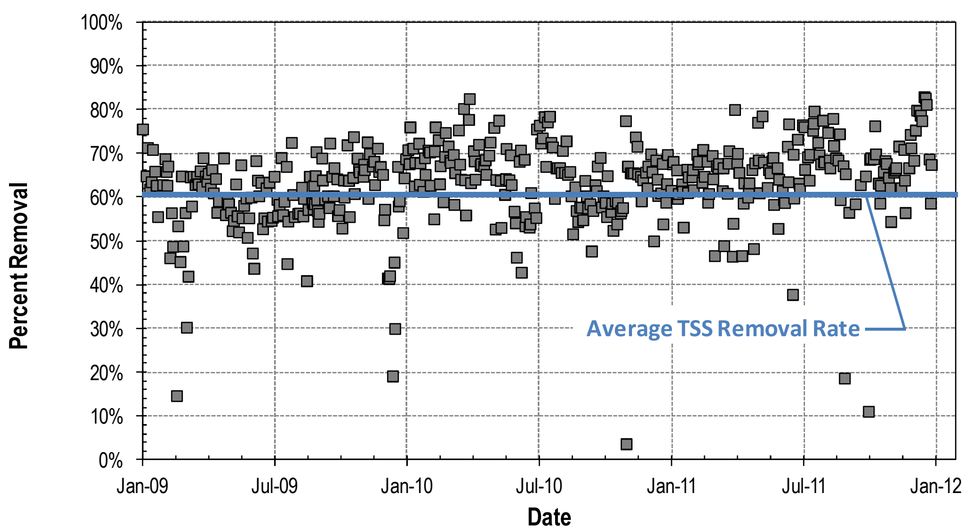


Figure 8-3. Existing Primary Clarifiers TSS Removal

Aeration Trains

There are four aeration trains, each having a volume of approximately 0.2 million gallons (MG). Aeration Trains 1 and 2 were initially constructed in the early 1970s and Aeration Trains 3 and 4 were constructed in the early 1980s. Aeration Trains 3 and 4 were constructed as a separate structure from Aeration Trains 1 and 2. The existing aeration trains can operate either in parallel or in-series, such that there are either four trains with a volume of 0.2 MG each operating in parallel or there are two trains with a volume of 0.4 MG operating in parallel (Figure 8-4). Influent channels and gates provide the ability to operate either in plug flow, step feed or contact stabilization modes. The aeration basins are currently operated as two trains in plug flow mode as indicated in Figure 8-4. Step feed and contact stabilization modes are seldom used and the existing gates on the influent channels are labor intensive to open and close.

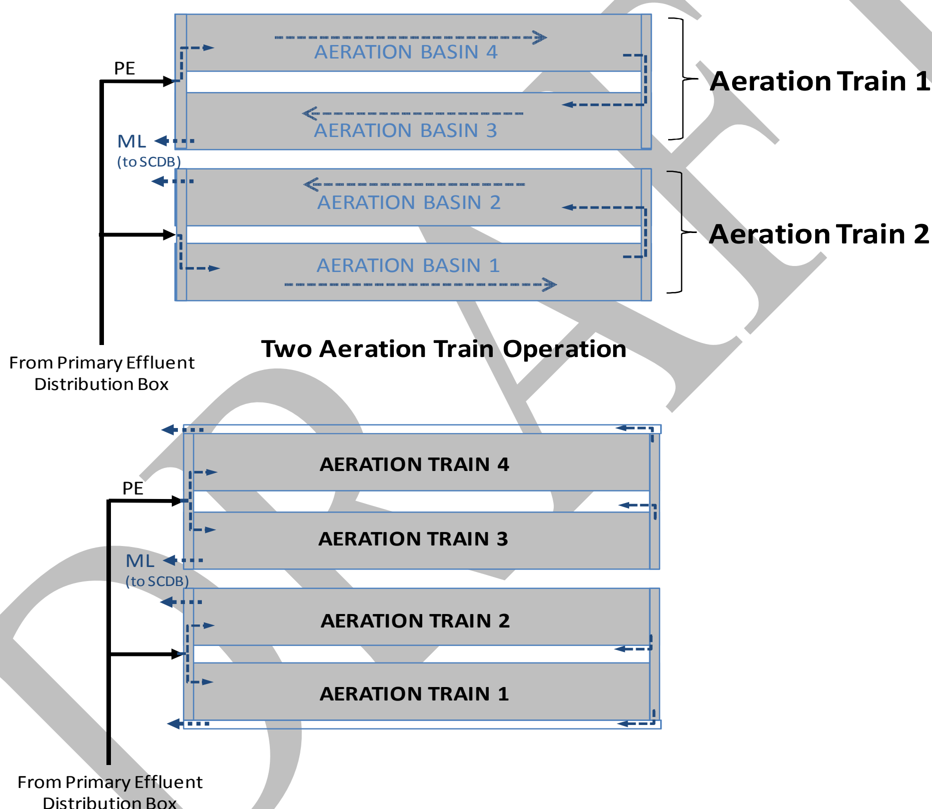
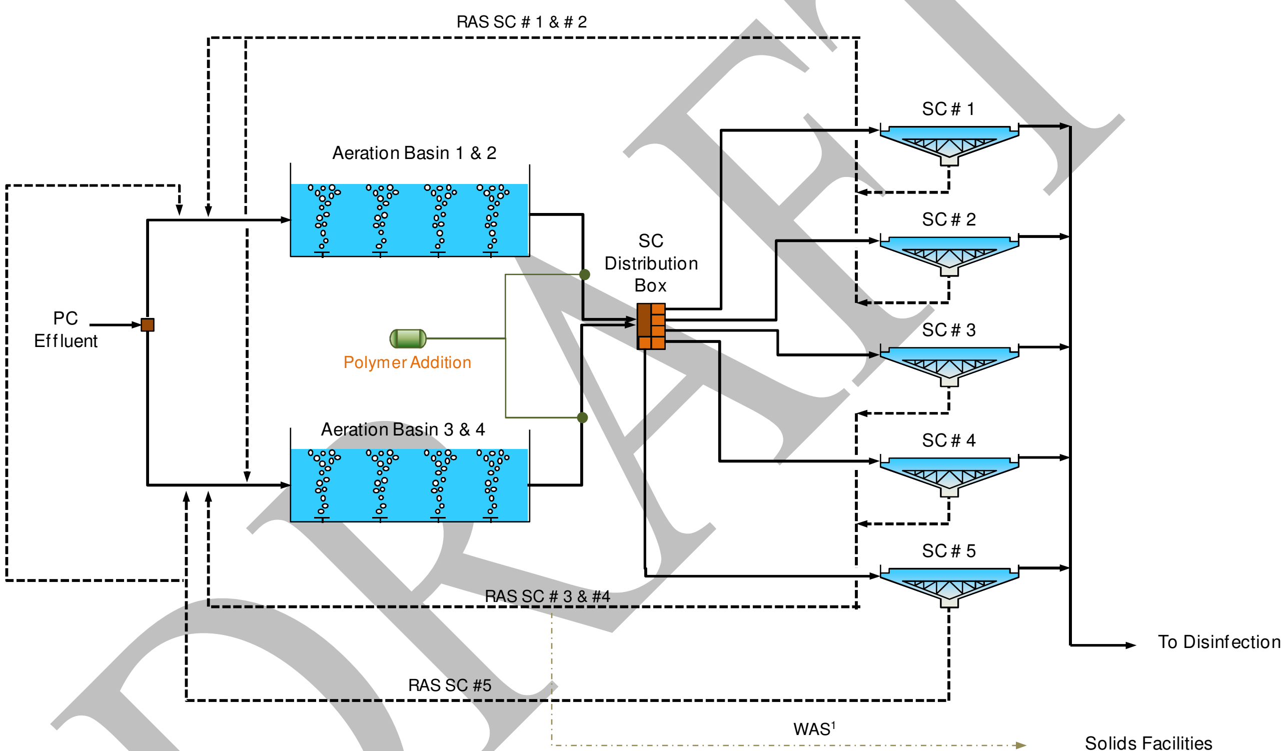


Figure 8-4. Existing Aeration Basin Diagram

Primary effluent is routed from the Primary Effluent Distribution Box (PEDB) to the inlet chamber of the two trains via a 42-inch pipeline. The PEDB has an adjustable weir to allow flows greater than 10.3 mgd to bypass secondary treatment. RAS is routed to the inlet chamber of the aeration trains via five, 8-inch pipelines (Figure 8-5).

The secondary system was designed to treat a BOD load of 5,500 lbs/day and a TSS load of 5,670 lbs/day. Aeration air is provided to the basins using three, 100-horsepower centrifugal blowers (two duty, one standby). The basins are equipped with fine bubble, ceramic dome diffusers. One blower operates during low flow time periods and a second blower is brought online based on a timer-controlled system.

Staff collect process control samples once per day. A sample of mixed liquor is collected from each aeration train, combined, and then analyzed. Based on a review of historic operating data, the secondary system is typically operated at a 3.5 day solids residence time (SRT) and a mixed liquor suspended solids (MLSS) concentration of 2,000 milligram per Liter (mg/L) is maintained. The SRT and MLSS concentrations do vary as indicated in Figure 8-6 and Figure 8-7.



1-Sludge is typically wasted from SC #3 & #4 because these clarifiers have the highest underflow concentration

2 - Process samples are collected from the ML channel of both aeration basins. T he samples are mixed together prior to performing MLSS, and SVI analyses.

Figure 8-5. Secondary Clarifier and RAS/WAS Diagram (Typical Operation)

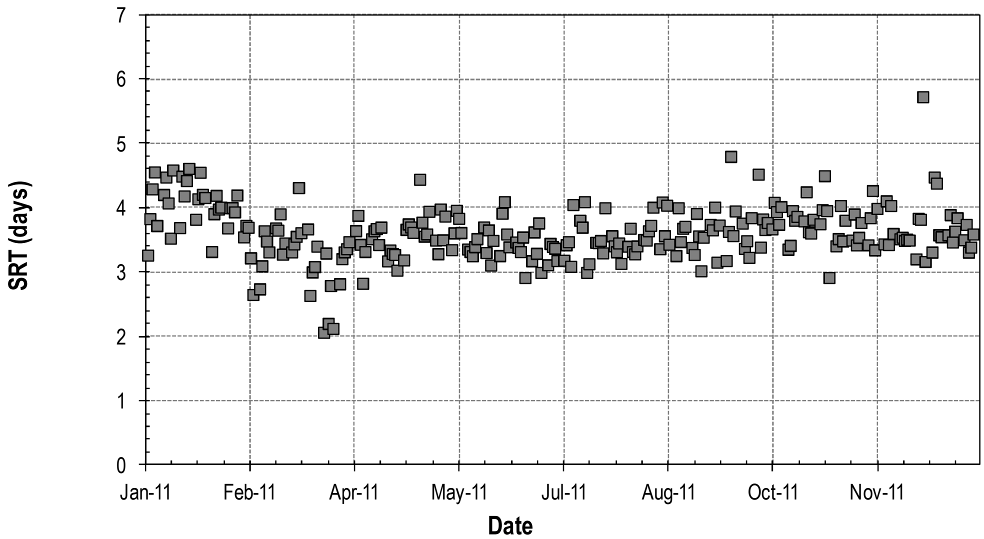


Figure 8-6. Historic Solids Residence Time

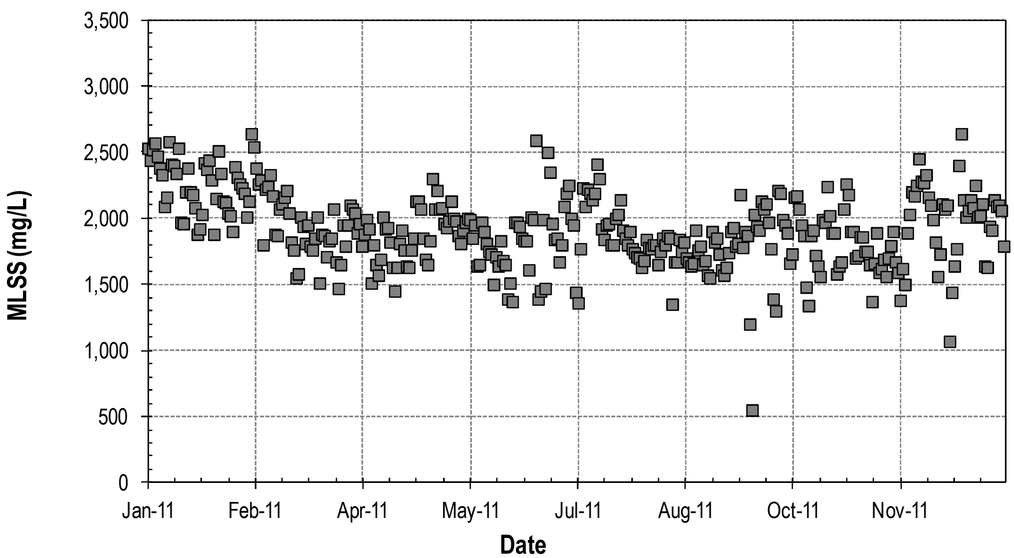


Figure 8-7. Historic MLSS Concentration

WPCP Staff provided sludge volume index (SVI) data from 2012 (Figure 8-8). The SVI measurements vary. As previously mentioned, to enhance sludge settleability and improve secondary effluent quality, polymer is currently added to the mixed liquor. On average, 10 to 15 gpd liquid polymer is used which costs the WPCP approximately $6,500 per month.

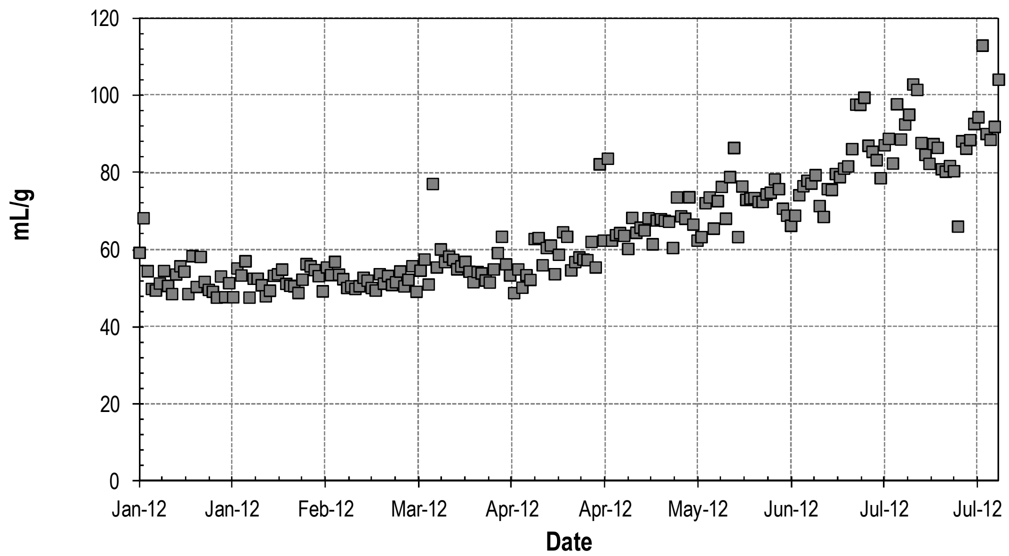


Figure 8-8. Historic Sludge Volume Index

Table 8-2. Existing Aeration Basins and Blowers

Unit Process	Description
Aeration Trains	
Permitted Capacity Average Dry Weather Flow Peak Wet Weather Flow	 3.52 mgd 10.5 mgd
Number of Trains[1]	2 basins
Volume per Train[1]	0.4 MG/each
Train Dimensions Length Width Maximum Side Water Depth	 100 ft 42 ft 14.9 ft
Diffuser Type	Fine Bubble (Ceramic Dome)
Average Solids Residence Time[2]	3.5 days
Average Mixed Liquor Suspended Solids (MLSS)[2]	2,000 mg/L
Polymer Consumption	10 -15 gallons per day
Sludge Volume Index (SVI)[3]	55 - 100
Aeration System	Fine bubble, ceramic dome
Aeration Blowers	
Number of Units	3 (2 duty, 1 standby)
Motor Size	100 hp, each

1. Typical operation mode is two trains operating in parallel.
2. Average of operational data from 2011.
3. Average of operational data from 2012.

Secondary Clarifiers

The WPCP currently has five secondary clarifiers located in the northwest corner of the site. Secondary Clarifiers 1 and 2 (SC1 and SC 2) were constructed in the early 1970s and are peripheral feed clarifiers. Secondary Clarifiers 3 and 4 (SC 3 and SC 4) were constructed in the early 1980s and are center feed clarifiers. Secondary Clarifier 5 (SC 5) was constructed in early 2000 and is a center feed, flocculator clarifier (see Table 8-3).

Two 30-inch pipelines route mixed liquor from each train to the secondary clarifier distribution box. The splitter box contains five, equally sized weirs that provide flow distribution to the secondary clarifiers. The secondary clarifiers are currently the limiting factor for the capacity of the secondary system. At 10.3 mgd the surface overflow rate (SOR) is approximately 1,300 gpd/square foot (ft^2) and the solids loading rate (SLR) is 32 lbs/day/ft^2. The 2009 stress test determined that the secondary clarifiers could be operated at an average SLR of 20 lbs/day/ft^2 and a peak SLR of 36 lbs/day/ft^2, with chemical addition (i.e., polymer) (Pinole/Hercules WPCP Stress Test Results Memorandum, Lea Fisher, November 24, 2009).

Table 8-3. Existing Secondary Clarifiers

Unit Process	Description
Secondary Clarifiers	
Number of Clarifiers	5
Type of Clarifier	SC 1 and 2 – Peripheral Feed SC 3 and 4 – Center Feed SC 5 – Center Feed, Flocculator
Diameter	45 ft
Side Water Depth SC 1 and 2 SC 3 and 4 SC 5	 11.7 ft 12.0 ft 17.8 ft
Clarifier Surface Area Total Surface Area	1,590 ft^2/each 7,950 ft^2
Surface Overflow Rate ADWF (3.0 mgd) PWWF (10.3 mgd)	 476 gpd/ft^2 1,295 gpd/ft^2
Solids Loading Rate[1] ADWF (3.0 mgd) PWWF (10.3 mgd)	 11 lbs/day/ft^2 32 lbs/day/ft^2

1. Assumes an MLSS of 2,000 mg/L and an RAS rate of 50 percent during PWWF and 75 percent during ADWF.
2. 2009 stress testing determined the peak SLR of the clarifiers to be 36 lbs/day/ft^2 with polymer addition

Return Activated Sludge and Waste Activated Sludge Facilities

The return activated sludge (RAS) and waste activated sludge (WAS) pumping facilities at the WPCP are located north of SC 1 and SC 2. As shown in Figure 8-5, RAS and WAS pumps are dedicated to each bank of clarifiers. The RAS pumps are vertical centrifugal pumps and the WAS pumps are horizontal centrifugal pumps. The site is configured such that solids can be wasted directly from the aeration basins; however, the typical mode of operation is to waste from the RAS lines. Table 8-4 provides a summary of the existing RAS and WAS pumps. The RAS pumps are flow-paced to the plant effluent flow meter and typically operate at 75 percent of the effluent flows. The WAS pumps operate to match a flow set point that is entered by the operators. Wasting is performed 24 hours per day, 7 days per week.

Staff indicated that wasting is typically performed off of one bank of clarifiers, depending on which clarifiers have the highest solids underflow concentration. As shown in Figure 8-5, the current operation primarily wastes off of SC 3 and SC 4. The wasting operation makes it difficult and labor intensive to maintain the desired SRT and even MLSS concentrations in the two trains.

Table 8-4. Existing RAS/WAS System

Unit Process	Description
SC 1 and 2	
RAS Pumps	
Number of Pumps	4
Capacity (per pump)	700 gpm
Motor Size (per pump)	5 hp
WAS Pumps	
Number of Pumps	1
Capacity (per pump)	140 gpm
Motor Size (per pump)	5 hp
SC 3 and 4	
RAS Pumps	
Number of Pumps	4
Capacity (per pump)	700 gpm
Motor Size (per pump)	7.5 hp
WAS Pumps	
Number of Pumps	1
Capacity (per pump)	140 gpm
Motor Size (per pump)	5 hp
SC 5	
RAS Pumps	
Number of Pumps	2
Capacity (per pump)	700 gpm
Motor Size (per pump)	7.5 hp
WAS Pumps	
Number of Pumps	1
Capacity (per pump)	140 gpm
Motor Size (per pump)	5 hp

Existing Operation

Chemical addition is necessary to comply with permit limits. The existing facilities do not provide adequate process control, which makes it difficult and costly to consistently produce a high quality effluent. Some of the key issues that lead to a lack of process control at the WPCP include the following:

- Inadequate control of aeration blowers: The timer-based control system does not bring aeration blowers online when the loads increase, but instead assumes that peak and minimum loading periods occur at the same time each day.
- Inadequate mixing of RAS with primary effluent: RAS and primary effluent mixing is critical to the activated sludge process. The existing system controls do not provide a way to maintain similar mixed liquor concentrations in each train or provide a reliable flow split of primary effluent and RAS between trains.
- Wasting of mixed liquor from all secondary clarifiers and aeration basins: The current configuration does not provide an easy way to waste sludge from all clarifiers and aeration basins. Instead solids are wasted from a bank of secondary clarifiers, which makes it difficult for staff to control the SRT and MLSS in the basins.

Based on a review of existing facilities, the objectives of the WPCP upgrades are as follows:

- Meet new permit requirements.
- Improve operational control of the secondary system.
- Reduce operations and maintenance (O&M) requirements.
- Improve sludge settleability to reduce dependence on chemical addition.
- Construct new facilities within the existing plant property line without relocation of the Corporation Yard.

Design Conditions

Flows and Loads

TM 1 provides a description of the historical analysis performed to develop design criteria for existing and projected flows and loads to the WPCP. Loading to the aeration basins was estimated assuming current primary clarifier removal efficiencies. Table 8-5 provides a summary of the projected flows and loads to the aeration basins and includes contributions from internal recycle streams from dewatering and thickening. It should be noted that limited data are available on the internal plant return stream quality and the ammonia loading to the secondary system (see TM 1 for additional information on available data). It is recommended that additional data be collected during final design to confirm the sizing of aeration basins and blowers.

The secondary facility will be designed to have a hydraulic capacity of 20 mgd. Based on the capacity of the existing primary clarifiers (12 mgd), flows greater than 12 mgd will bypass primary clarification. The bypass flow and primary effluent will combine at the PEDB and from there routed to the aeration basins.

Chemical addition at the primary clarifiers could be implemented to reduce loading to the aeration basins, particularly during wet weather events. Chemical enhanced primary treatment (CEPT) was not considered for the WPCP during alternatives development for the following reasons:

- Iron salt addition at the front of the plant can interfere with the transmissivity of secondary effluent, which would have a negative impact on ultraviolet (UV) disinfection now or in the future.
- The WPCP's reliance on chemical addition would increase.
- Chemical addition would add to the complexity of operations, particularly if it is designed for wet weather events, because the WPCP is staffed one shift per day, 5 days per week.

Table 8-5. Aeration Basin Flows and Loads

Condition	Flow (mgd)[1]	Concentration (mg/L)			Load (lbs/day)		
		BOD	TSS	TKN	BOD	TSS	TKN
Average Dry Weather Flow	4.1	170	115	52	5,847	3,932	1,778
Average Annual Flow	4.7	158	112	52	6,193	4,390	2,038
Maximum Month Flow	6.2	133	100	52	6,877	5,170	2,688
Maximum Week Flow	9.0	112	100	42	8,407	7,580	3,152
Maximum Day Flow	11.4	108	102	35	10,268	9,698	3,327
Peak Hour Flow	20	NA	NA	NA	NA	NA	NA

1. Includes internal plant recycle streams from dewatering and thickening. TKN concentrations for maximum month, maximum week and maximum day are estimates because historic TKN loading during high flow periods was unavailable.
2. NA – data not available
3. TKN = total Kjeldahl nitrogen

Sizing and Reliability

The secondary system will be designed for maximum month (MM) loads. The aeration blowers will be sized to meet maximum week (MW) air demands. Average dry weather flow (ADWF) air demands will also be considered to ensure aeration blowers have turn down capability to minimize energy consumption during lower loading periods. The secondary clarifiers will be designed for MW flows and loads, assuming no chemical addition and all units are operational. Table 8-6 provides the design SORs and SLRs used for secondary clarifier sizing.

Table 8-6. Secondary Clarifier Design Criteria

Condition	Surface Overflow Rate (gpd/ft²)	Solids Loading Rate (lbs/day/ft²)
Current Conditions[1]		
Average Dry Weather Flow	380	20
Peak Wet Weather Flow (10.3 mgd)	1,300	36
Design Conditions [2]		
Average Dry Weather Flow	<600	<20
Maximum Week Flow	<1,200	<35

1. Based on results of 2009 stress test. Values assume polymer addition. PWWF equals 10.3 mgd which is the permitted capacity of a secondary system.
2. Assumes all units in-service.
3. Design conditions are within standard design rates per WEF Manual of Practice (MOP) 8.

To provide adequate reliability at the WPCP, the aeration basins and secondary clarifiers will be sized such that ADWFs can be treated with one aeration basin and secondary clarifier out of service. It is assumed that during MM, MW, and maximum day (MD) conditions that all units (aeration basins and secondary clarifiers) will be in service. The secondary system will be designed to convey the maximum hourly PWWF of 20 mgd. Standby aeration blowers, RAS pumps, and WAS pumps will be provided.

Secondary Treatment Alternatives

Two alternatives were developed for consideration: (1) flow equalization of influent flows to minimize capacity of the secondary treatment system, and (2) no flow equalization such that all flows are treated as they enter the plant. The following sections provide a description and evaluation of each alternative.

Alternative 1: Flow Equalization

Alternative 1 provides flow equalization upstream of the secondary treatment system. Primary effluent and screened wastewater would be diverted during peak wet weather events to a new flow equalization basin until influent flows subside and then would be routed through to the secondary system. Flow equalization would minimize the expansion of secondary treatment facilities.

Diurnal flows from a storm event occurring on March 18 and 19, 2011 were used to size the equalization volumes. The equalization volume required is dependent on the capacity of the secondary treatment system. Three secondary treatment scenarios were reviewed (Table 8-7). Scenario A consists of providing secondary treatment for flows up to 11 mgd. Staff have indicated that they are currently able to treat a peak daily flow of 11 mgd through the secondary system and, therefore, Scenario A would require minimal upgrades to the secondary system. The equalization volume required for Scenario A is 10 MG. An equalization basin of this volume would need to be located offsite within Bayfront Park. Staff indicated that encroaching into the park was not acceptable from a community standpoint and, therefore, Scenario A was determined to be unfeasible.

Table 8-7. Flow Equalization Basin Sizing

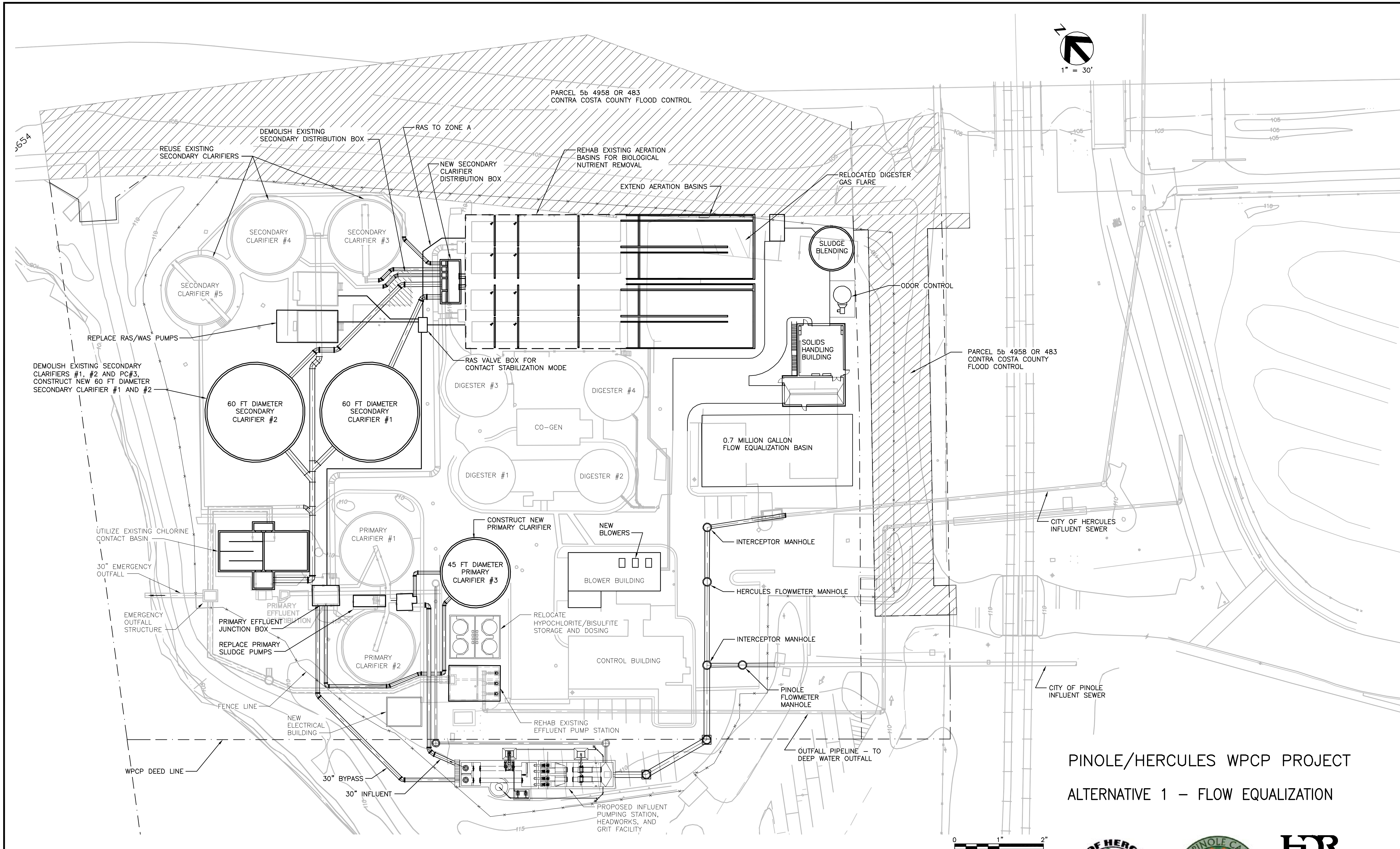
Scenario	Secondary Treatment		Flow Equalization	
	Capacity (mgd)	Clarifier Surface Area (ft^2)	Basin Volume (MG)	Basin Diameter [1] (ft)
Scenario A	11.0	7,950	10.0	340
Scenario B	14.6	10,400	3.3	195
Scenario C	17.0	10,900	0.7	90

1. Basin side water depth of 15 ft was assumed. Dimensions assume a circular equalization basin

Scenario B would increase the secondary treatment capacity to 14.6 mgd, and a 195-ft diameter equalization basin would be required (3.3 MG). In addition to the equalization basin, the aeration basins would need to be expanded and additional secondary clarifier surface area is recommended. Similar to Scenario A, there is inadequate land at the WPCP to construct this scenario. Due to the desire to stay within the WPCP site, this scenario was determined to be infeasible.

Scenario C would increase secondary treatment capacity to 17 mgd and would provide a 90-ft diameter equalization basin (volume of 0.7 MG). In lieu of a new equalization basin, SC 3, SC 4 and SC 5 could be converted into equalization basins to provide 0.7 MG of storage. The walls of SC 3, SC 4, and SC 5 would need to be raised to provide a side water depth of 20 ft. Three, new 60-ft clarifiers would be located in the eastern area of the site. There is insufficient land within the WPCP site to construct the three new secondary clarifiers and property acquisition from the Contra Costa County Flood Control District (CCCFCD) would be needed.

Alternatively, SC 3, SC 4, and SC 5 could be retained as secondary clarifiers and SC 1 and SC 2 could be replaced with two new 60-ft diameter clarifiers. The digester gas flare and PC 3 would be relocated to the locations shown in Figure 8-9. A 80-ft by 80-ft equalization basin could be located on the eastern side of the site. The disadvantage of this alternative is that additional secondary clarifier capacity is required in addition to equalization volume, which minimizes the cost savings of this alternative. The Corporation Yard would also need to be relocated offsite.



PINOLE/HERCULES WPCP PROJECT

ALTERNATIVE 1 – FLOW EQUALIZATION

Figure 8-9

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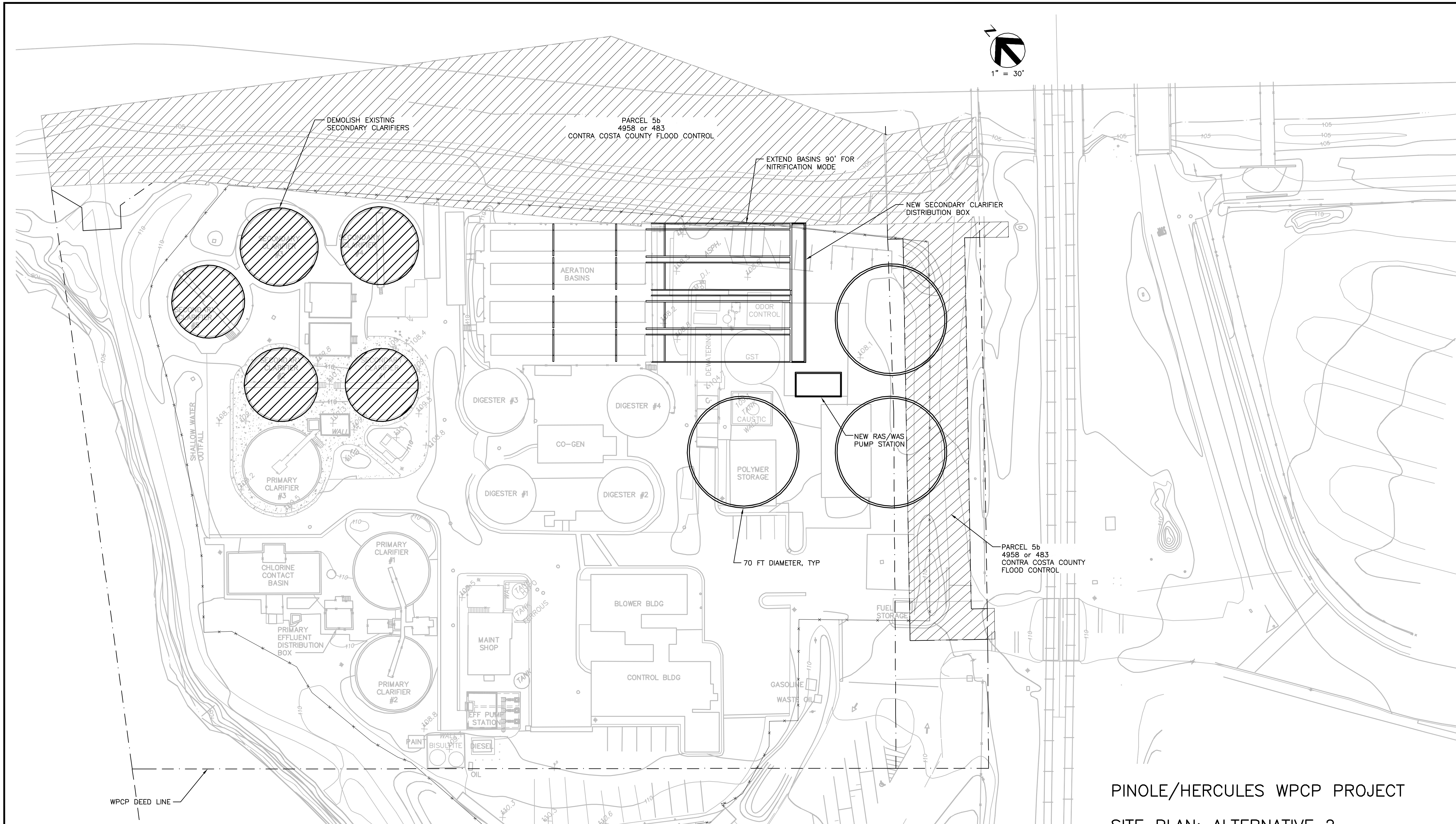
Alternative 2: Increase Secondary Treatment Capacity, No Flow Equalization

Under this alternative, secondary treatment would be provided for the design flows and loads (Table 8-5) and equalization of influent flows would not be provided. The aeration basins were sized for two modes of operation: Carbonaceous Mode and Nitrification Mode. In Carbonaceous Mode the aeration basins would be extended 55 ft to the east and, in Nitrification Mode, the basins would be extended 90 ft to the east. The aeration basin extension will fit within the WPCP site for both operational modes.

The existing aeration blowers (located in the Blower Building) would also require replacement. There is adequate space in this building to install new blowers prior to demolishing the existing blowers. The existing aeration air header would be reused and rerouted to distribute air to the extended basins.

The secondary clarifiers currently limit the rated capacity of the secondary system. To treat peak flows up to 11 mgd, WPCP Staff rely on polymer addition. For this alternative, it was assumed that a minimum secondary clarifier surface area of 11,400 ft^2 be provided. To provide adequate clarifier surface area, three 70-ft diameter secondary clarifiers could be constructed on the eastern portion of the site and the existing secondary clarifiers could be abandoned. Construction of new secondary clarifiers offers easier construction and also provides new clarifiers of the same size and design. New RAS and WAS pumping could also be provided in a common wet well to simplify sludge wasting. Given the property boundaries, the new circular secondary clarifiers will not fit within the WPCP site (Figure 8-10). Rectangular secondary clarifiers were also reviewed as a more compact alternative to circular clarifiers. Four rectangular clarifiers would be required, each having dimensions of 15 ft by 190 ft. While the rectangular clarifiers would be more compact than the circular clarifiers, property acquisition would still be required. Rectangular clarifiers were removed from further consideration because of associated O&M issues and because they do not fit within the existing WPCP site. Because new secondary clarifiers cannot be implemented within the WPCP site, it is not feasible. The new secondary clarifiers would encroach into CCCFCD property and Staff determined that this was not a viable option.

For this reason, an alternate concept was developed and includes reuse of the existing secondary clarifiers. SC 1 and SC 2 (peripheral feed clarifiers) are the oldest of the secondary clarifiers and have poor performance relative to SC 3, SC 4, and SC 5. Therefore, it was determined that adequate secondary clarifier area could be provided if SC 3, SC 4 and SC 5 were reused. SC 1 and SC 2 would be demolished (sequentially) and replaced with new, larger (65-ft diameter) secondary clarifiers. As shown in Figure 8-11, PC 3 and the digester flare would require relocation to accommodate the larger secondary clarifiers. Construction is more difficult with this scenario because SC 1 and SC 2 will need to be constructed sequentially to maximize the number of operational secondary clarifiers available for WPCP Staff. This option can be constructed within the existing WPCP site and, therefore, is a feasible option.



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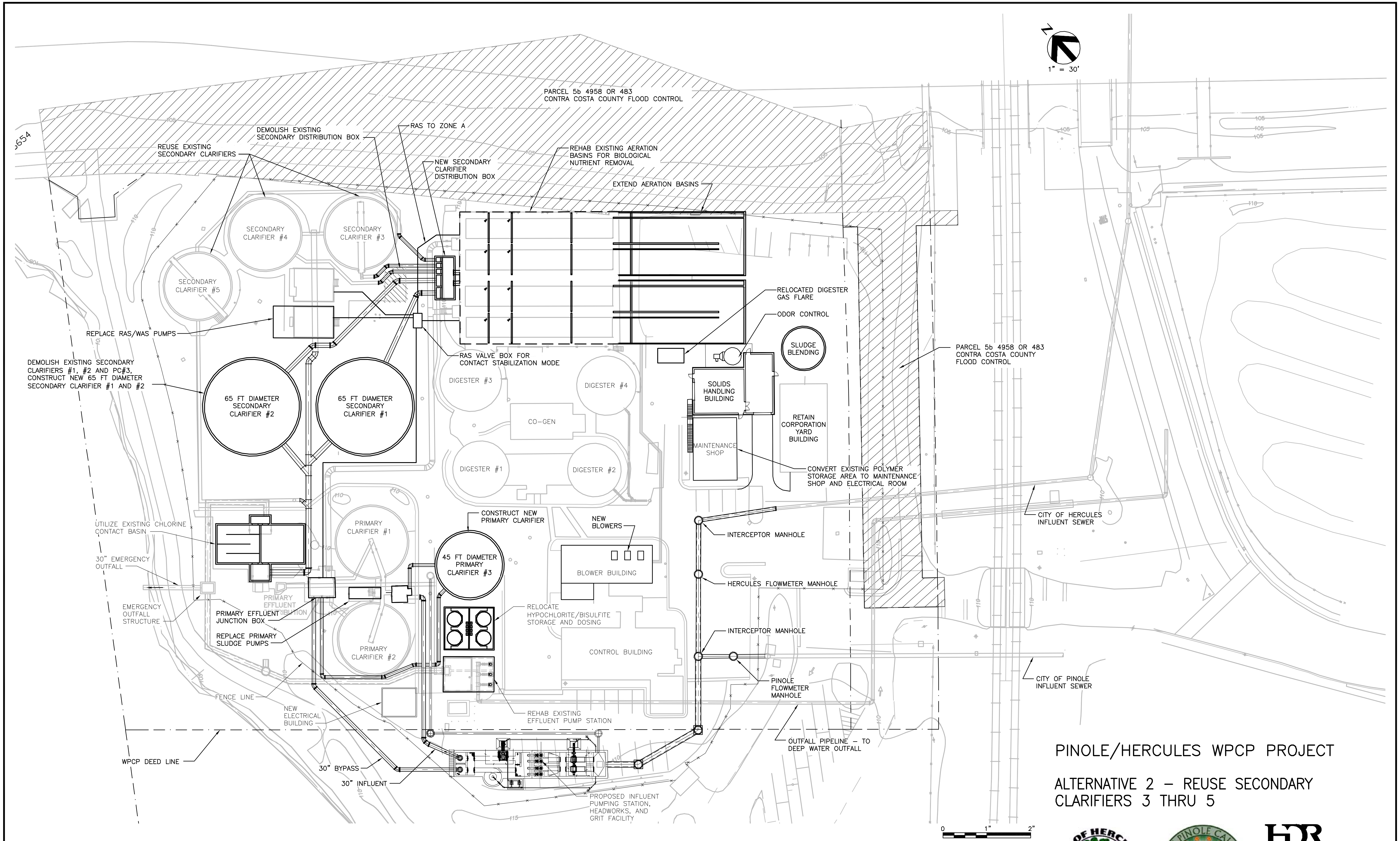
PINOLE/HERCULES WPCP PROJECT

SITE PLAN: ALTERNATIVE 2
NEW CIRCULAR SECONDARY CLARFIERS

0 1" 2"

CITY OF HERCULES CALIFORNIA — CITY OF PINOLE CALIFORNIA 1903 — HDR

Figure 8–10



PINOLE/HERCULES WPCP PROJECT

ALTERNATIVE 2 - REUSE SECONDARY CLARIFIERS 3 THRU 5

Figure 8-11

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Evaluation of Alternatives

Alternative 1 is feasible if Scenario C is implemented. It requires construction of a 0.7 MG storage tank on the eastern side of the site and construction of two secondary clarifiers (60-ft diameter each) to replace existing SC 1 and SC 2. While this can be implemented within the WPCP site, relocation of the Corporation Yard is required. Staff indicated a preference to retain the Corporation Yard within the WPCP site. Additionally, Alternative 1 increases construction at the plant because, in addition to aeration basin extension, relocation of PC 3, and construction of new SC 1 and SC 2, a flow equalization basin is also needed. For these reasons Alternative 1 was not selected for further consideration.

The facilities for Alternative 2 can be constructed within the existing WPCP site and do not require relocation of the Corporation Yard. Alternative 2 is the recommended option because it can be constructed within the existing plant site without relocation of the Corporation Yard.

Design Criteria for Selected Alternative

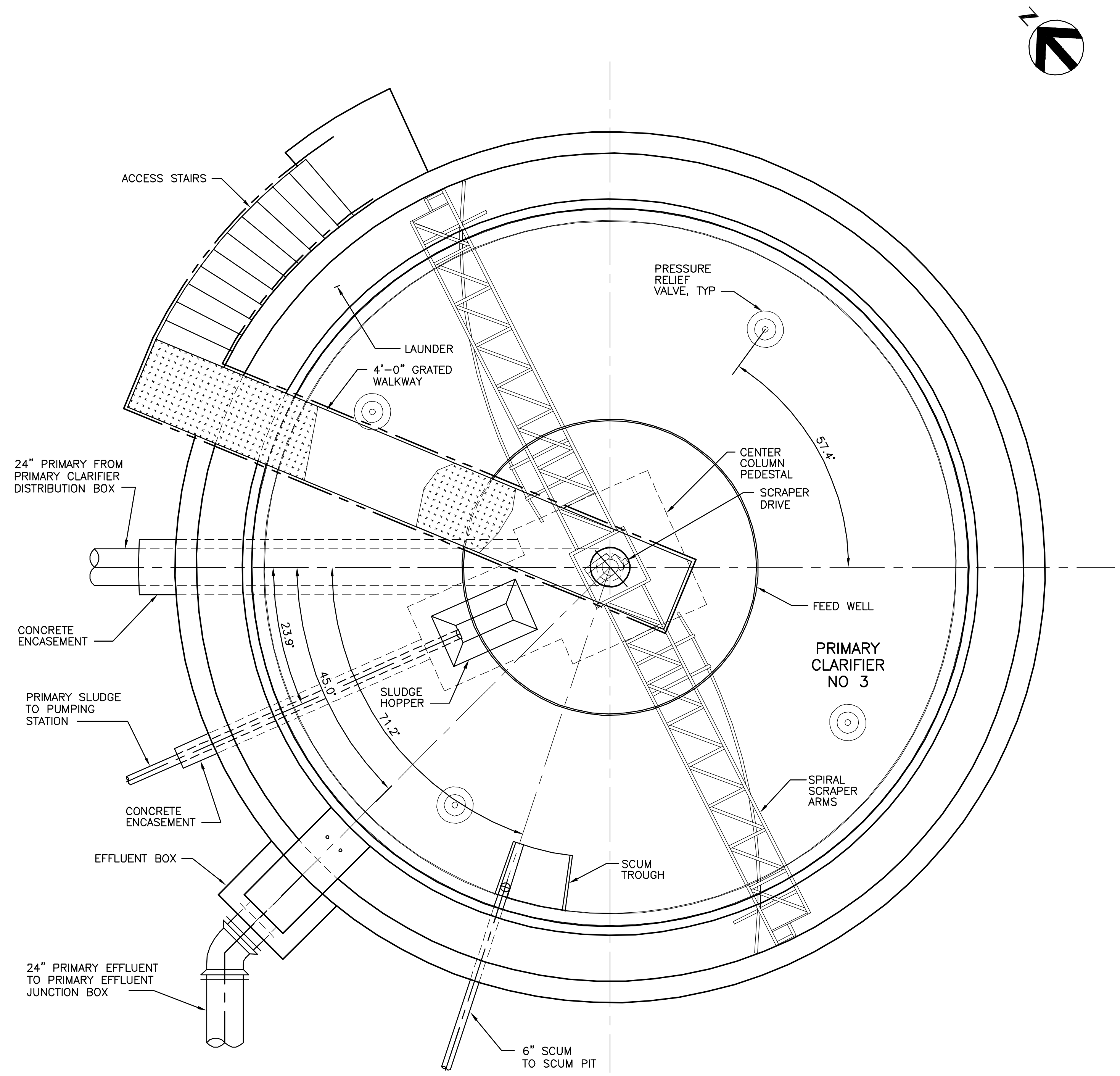
The following section provides details on design criteria for Alternative 2. Figure 8-11 provides the site plan for the preferred alternative.

Primary Clarification

A primary clarifier bypass pipeline will be constructed that will convey screened and degritted influent flows greater than 12 mgd directly to the PEDB (refer to TM 5/6 – Headworks and Grit Removal). The combined flows will be routed from the PEDB to the aeration trains.

The existing PC 3 will be demolished to provide land for the new, larger SC 2. PC 3 will be relocated to the east of PC 1 and PC 2 (Figure 8-11). The decision to replace PC 3 rather than permanently abandon it and bypass primary clarification at 8 mgd was made primarily due to the age of PC 1 and PC 2, which are over 50 and 30 years old respectively. The condition and age of these two clarifiers is uncertain and, to provide adequate reliability, a third primary clarifier is recommended.

PC 3 will be constructed as a 45-ft diameter clarifier with a side water depth of 12 ft (see Figures 8-12 and 8-13). In addition to construction of the new primary clarifier, the primary sludge pumps for all three primary clarifiers will be replaced with positive displacement pumps (refer to TM 13 – Solids Handling for additional details on pump replacement). Based on discussions with the WPCP Staff, the weirs on PC 1 and PC 2 may need resetting and costs were allocated for this improvement. Costs were not included for concrete rehabilitation and/or coating of PC 1 and PC 2.



PLAN

1/4" = 1'-0"

PINOLE/HERCULES WPCP PROJECT

PRIMARY CLARIFIER NO 3 PLAN

0 1" 2"

HDR

Figure 8–12

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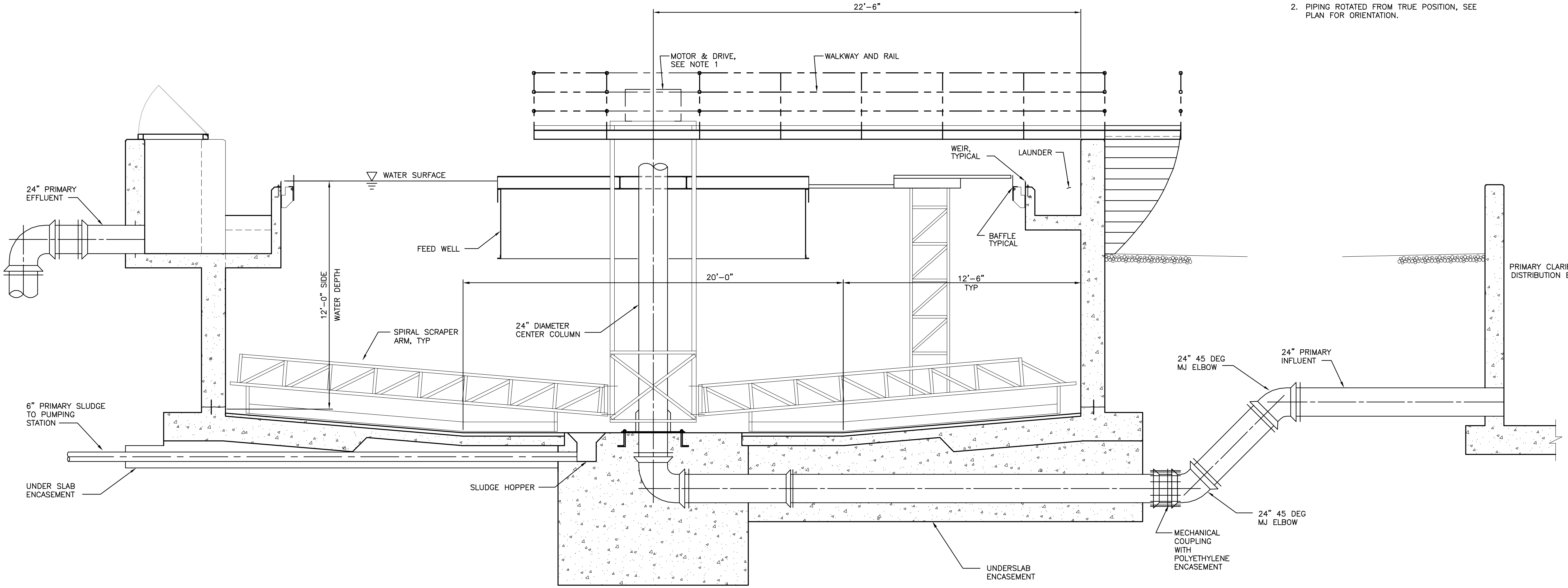
NOTES:

1. MOTOR AND DRIVE TO BE LOCATED ABOVE WALKWAY.
2. PIPING ROTATED FROM TRUE POSITION, SEE PLAN FOR ORIENTATION.



SECTION
3/8" = 1'-0"

PINOLE/HERCULES WPCP PROJECT

PRIMARY CLARIFIER NO 3 SECTION

0 1" 2"

HDR

Figure 8-13

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Aeration Basin Influent

Currently, RAS is returned to the inlet channel of each aeration train and primary effluent also enters the trains at this point. There is minimal mixing of primary effluent and RAS. Furthermore, RAS from a bank of secondary clarifiers is typically always returned to the same aeration train. To improve mixing of primary effluent and RAS, RAS will be routed to the PEDB in a 16-inch pipeline. RAS will combine with primary effluent in the PEDB prior to being routed to the aeration basins via the existing 42-inch pipeline. The hydraulics were reviewed to confirm that the 42-inch pipeline has an adequate capacity to convey the RAS and primary effluent.

To provide better control of the flow split between the two aeration trains, modifications to the aeration basin influent piping was assumed. The modifications include installation of two flow control valves, two flow meters, and adequate straight pipe length for accurate flow meter measurements.

Aeration Basins, Blowers, Secondary Clarifiers and RAS/WAS Pumping

The secondary system will be designed to operate with two aeration trains. Influent flow will enter the trains on the west side and mixed liquor will exit the trains on the west side. This configuration is similar to the current operation and was maintained because the secondary clarifiers will remain on the west side.

Two operational modes were considered during preliminary design: Carbonaceous Mode and Nitrification Mode. The design criteria for the aeration basins, blowers, secondary clarifiers and RAS/WAS pumping vary depending on the selected mode of operation. This section provides the design criteria for the basins, blowers, clarifiers and RAS/WAS pumping under each operational mode. The subsequent sections provide an economic and non-economic evaluation of the two modes.

Carbonaceous Mode

Carbonaceous Mode will consist of operating the activated sludge system at a 3-day SRT for BOD removal only. Two anaerobic zones (i.e., anaerobic selector) will be provided that total approximately 20 percent of the total basin volume. The anaerobic selector was included to improve sludge settleability and effluent quality. Submersible mixers will be installed in each anaerobic zone to keep solids in suspension. Three oxic zones will be provided and installed with fine bubble diffusers. To treat the projected flows and loads, the aeration basins will be extended by 55 ft to the east. TM 3 provides additional details on process modeling and aeration blower sizing and Table 8-9 provides a summary of key design criteria under this mode of operation. The existing influent step feed channels will be extended so that step feed and contact stabilization operational modes are available.

Table 8-8. Carbonaceous Mode Design Criteria

Item	Criteria
Number of Trains	2
Total Volume per Train Aerobic Volume Anaerobic Volume	0.7 MG 0.6 MG 0.1 MG
Aeration Train Dimensions Length Width Side Water Depth	 155 ft 42 ft 14.8 ft
SRT[1]	3 days
F:M Ratio (lbs BOD/lb MLVSS)[2] ADWF Maximum Month Loading	 0.40 0.30
MLSS at Maximum Month Loading	2,600 mg/L
Aeration System	Fine Bubble, Membrane
Air Demand at Maximum Week Loading	7,000 scfm
Aeration Blowers Number Type Average Air Flow per Unit Discharge Pressure Motor Size	 3 High Speed Turbo 2,600 scfm 10 psig 150 hp, each
Waste Activated Sludge Rate at Maximum Month Loading	5,600 lbs/day
Secondary Clarifier Surface Area Required	10,400 ft^2
SC 1 and SC 2 Diameter	60-ft
SOR at Maximum Week Flows SC 1/SC 2 SC 3 through 5	 1,000 gpd/ft^2 690 gpd/ft^2
SLR at Maximum Week Flows SC 1/SC 2 SC 3 through 5	 34 $lbs/day/ft^2$ 23 $lbs/day/ft^2$
RAS Pumps Number Capacity TDH Motor Size	 4 1,900 gpm/each 20 ft 20 hp/each
WAS Pumps Number Capacity TDH Motor Size	 2 400 gpm/each 30 ft 7.5 hp/each

1. Total SRT (anoxic and oxic zones)
2. Two aeration trains in-service

MLVSS = Mixed Liquor Volatile Suspended Solids

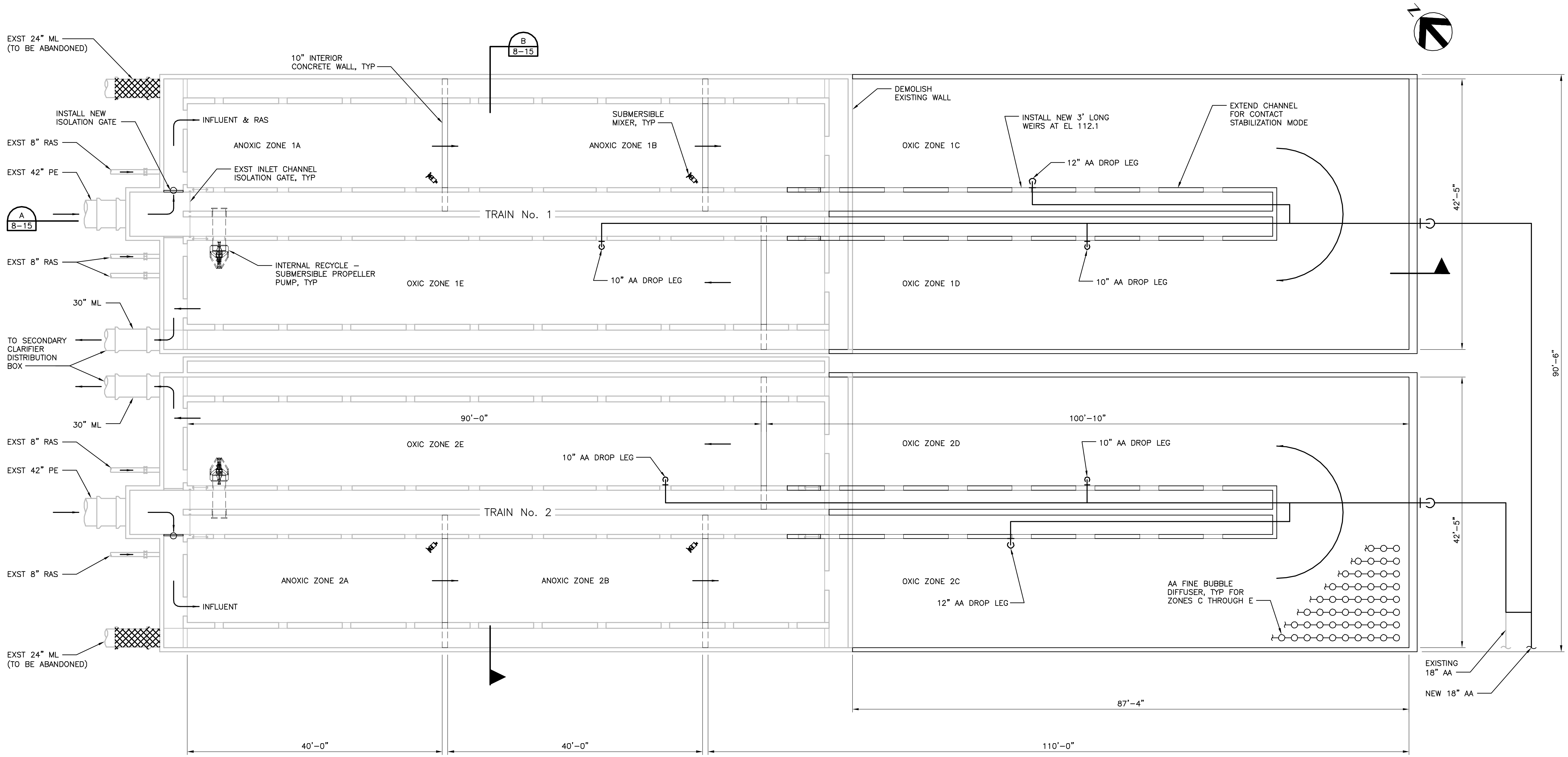
Three new high speed turbo blowers (150 hp each) will replace the existing blowers and were sized to meet air demands for maximum week loading conditions. The new blowers would be installed in the Blower Building and the existing 18-inch aeration header will be reused and a second 18-inch aeration header will be installed parallel to the existing. The air headers will extend to the three aeration zones in each train. Each aeration zone will have an air flow control valve, a dropleg and a dissolved oxygen meter. The air flow control valve will modulate to maintain a dissolved oxygen setpoint.

Because the mixed liquor concentration is lower in Carbonaceous Mode than Nitrification Mode, a smaller secondary clarifier surface area is required. SC 1 and SC 2 would be constructed as two, 60-ft diameter secondary clarifiers. Mixed liquor will be distributed to each secondary clarifier with a new Secondary Clarifier Distribution Box. SC 1 and SC 2 will treat the majority of flows during ADWF and PWWF conditions. Approximately 60 percent of flows during wet weather conditions will be routed to SC 1 and SC 2.

The RAS and WAS pumps for SC 1 and SC 2 will be replaced. A total of four new RAS pumps would be installed with a capacity of 1,900 gpm, each. A total of 2 WAS pumps would be installed with a capacity of 400 gpm, each. WAS piping will be reconfigured to enable wasting from the RAS header to facilitate operations.

Nitrification Mode

Nitrification Mode will include operating the activated sludge system at a longer SRT to provide BOD and ammonia removal. The basins will be extended 90 ft to the east and each train will have two anoxic zones that total 20 percent of the total aeration basin volume for denitrification. Submersible mixers will be installed in the anoxic zones to keep solids in suspension. Table 8-10 provides a summary of the key design criteria. Three oxic zones will be provided and fine bubble diffusers will be installed in each oxic zone. A submersible propeller pump will be installed in the last aeration zone for internal mixed liquor return. The mixed liquor pump will be flow paced to influent flows and is designed for a return rate of 200 percent of influent flows. Mixed liquor will be returned through the wall from the last aeration zone to the first anoxic zone. Figures 8-14 and 8-15 provide plan and section views of the aeration basins.



PINOLE/HERCULES WPCP PROJECT

AERATION BASINS PLAN – NITRIFICATION MODE

Figure 8–14

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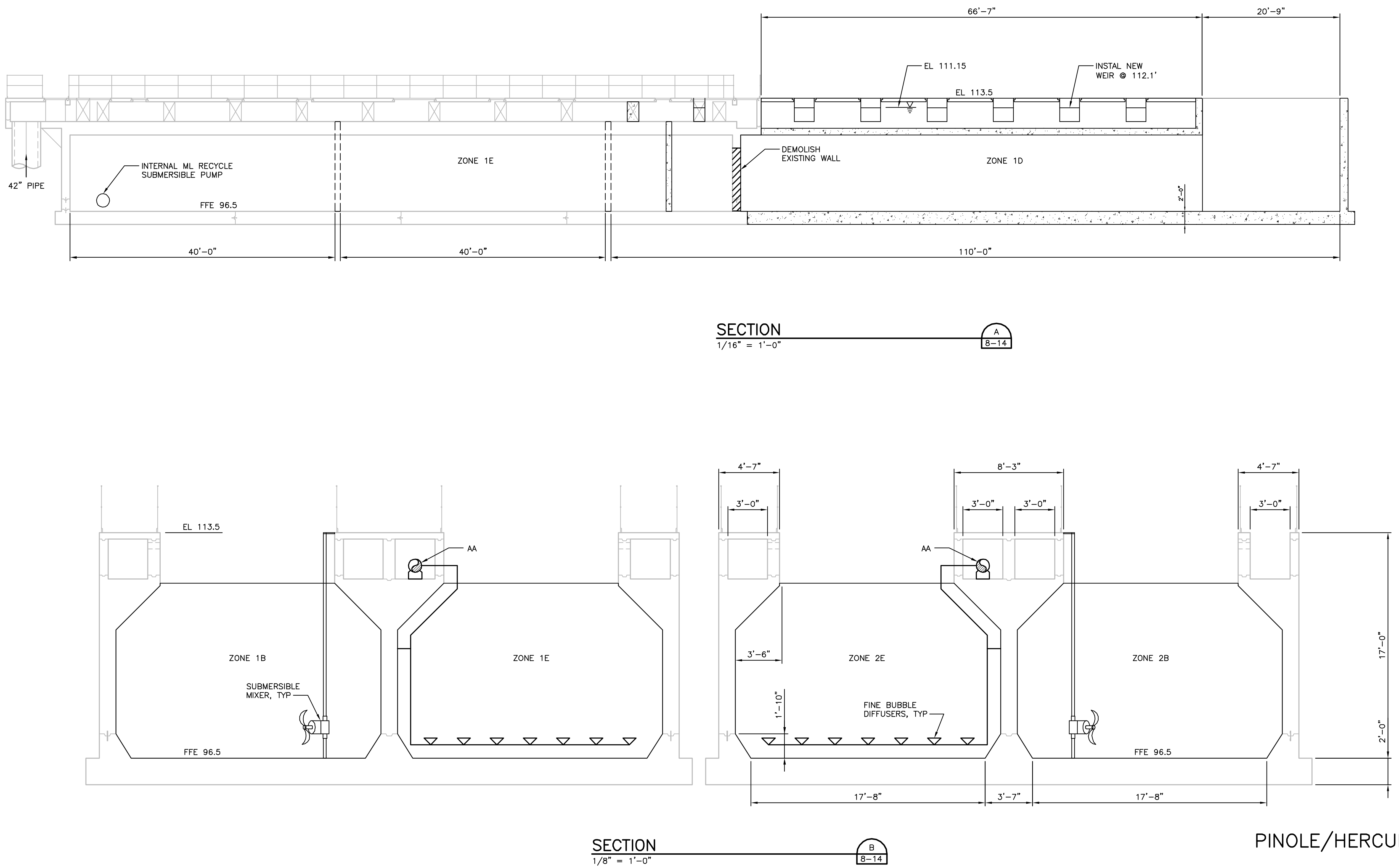

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PINOLE/HERCULES WPCP PROJECT

AERATION BASINS SECTION
NITRIFICATION MODE

0 1" 2"

CITY OF HERCULES CALIFORNIA — CITY OF PINOLE CALIFORNIA 1903 — HDR

Figure 8–15

Table 8-9. Nitrification Mode Design Criteria

Item	Criteria
Number of Aeration Trains	2
Aeration Train Dimensions	
Length	190 ft
Width	42 ft
Side Water Depth	14.8 ft
Total Volume per Train	0.9 MG
Aerobic Volume	0.7 MG
Anoxic Volume	0.2 MG
SRT[1]	6.5 days
MLSS at Maximum Month Loading	2,500 mg/L
Internal Mixed Liquor Recycle Rate	200% of influent flow
Internal Mixed Liquor Recycle Pumping Rate at MM Conditions	4,300 gpm
Internal Mixed Liquor Recycle Pump Motor Size	20 hp
Aeration System	Fine Bubble, Membrane
Air Demand at Maximum Week Loading	7,900 scfm
Aeration Blowers	
Number	3
Type	High Speed Turbo
Average Air Flow per Unit	3,000 scfm
Discharge Pressure	10 psig
Motor Size	200 hp, each
Waste Activated Sludge Rate at Maximum Month Loading	4,900 lbs/day
Flow Set Point for Contact Stabilization Mode	11 mgd
Secondary Clarifier Surface Area Required (total)	11,400 ft^2
SC 1 and SC 2 Diameter	65-ft
SOR at Maximum Week Flows	
SC 1/SC 2	835 gpd/ft^2
SC 3 through 5	710 gpd/ft^2
SLR at Maximum Week Flows	
SC 1/SC 2	34 $lbs/day/ft^2$
SC 3 through 5	29 $lbs/day/ft^2$
RAS Pumps	
Number	4
Capacity	1,900 gpm/each
TDH	20 ft
Motor Size	20 hp/each
WAS Pumps	
Number	2
Capacity	350 gpm/each
TDH	30 ft
Motor Size	5 hp/each

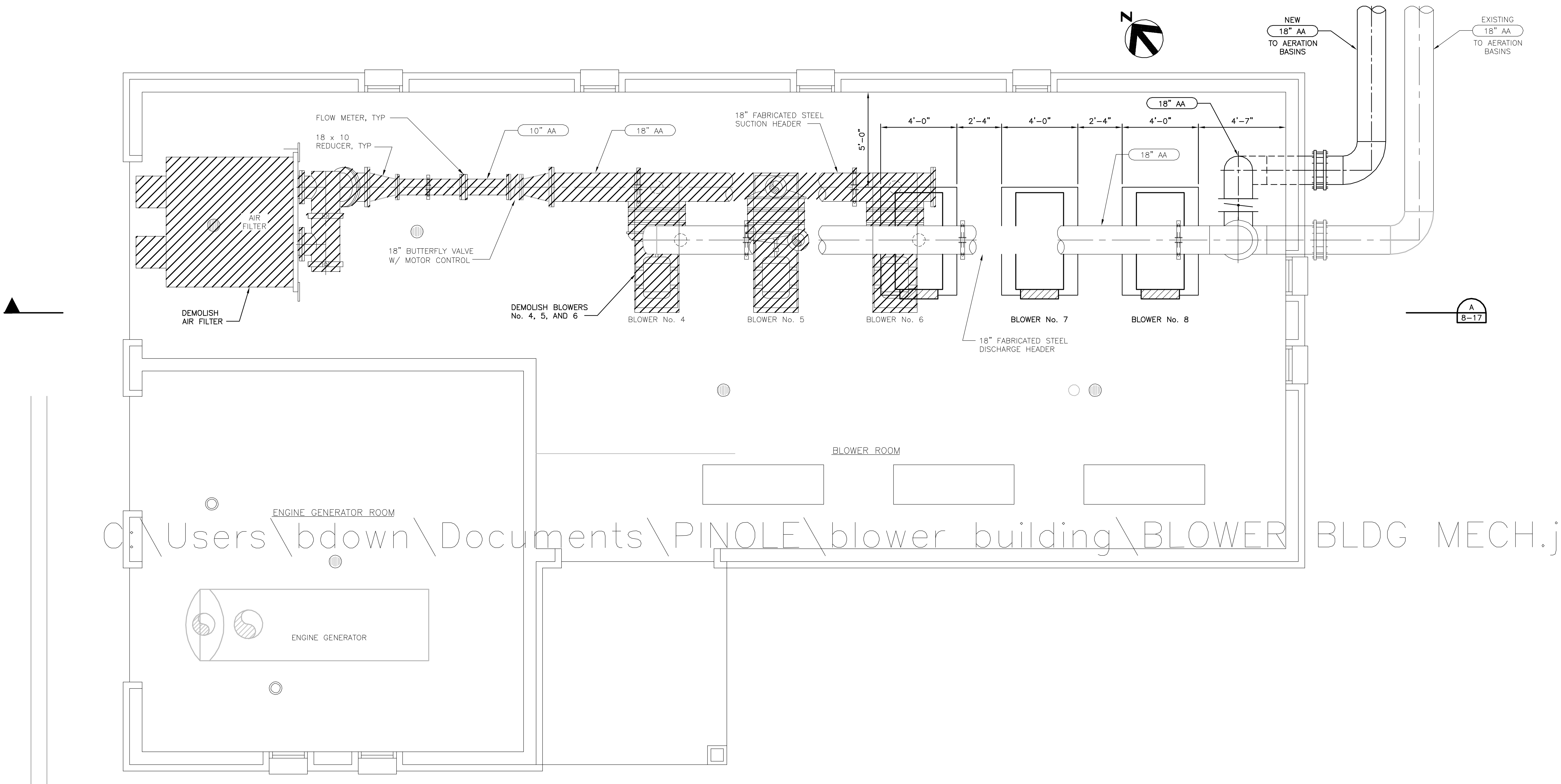
1. Assumes wrap around configuration
2. Total SRT (anoxic and oxic zones)

Similar to Carbonaceous Mode, three new high speed turbo blowers (200 hp each) will replace the existing blowers. The new blowers will be installed in the Blower Building and will have the ability to meet MW air demands (Figures 8-16 and 8-17). The existing aeration header would be reused and a second 18-inch header will be installed. Both aeration headers will be routed to the three aeration zones in each train. Similar to Carbonaceous Mode, air flow to the each oxic zone will be controlled using modulating valves to maintain a dissolved oxygen setpoint.

In Nitrification Mode, the MLSS concentration is higher than in Carbonaceous Mode, which impacts the sizing of the secondary clarifiers. To reduce the secondary clarifier sizing for Nitrification Mode, the aeration trains will be designed with the ability to operate in contact stabilization mode during peak flow events. In contact stabilization mode, RAS is diverted to the front of the train and primary effluent is routed to the second and third aeration zones, using the existing step feed channels in the basins. Contact stabilization mode will lower the mixed liquor concentration exiting the train thereby reducing solids loading to the clarifiers. It is assumed that contact stabilization mode will be manually initiated by Staff at 11 mgd.

SC 1 and SC 2 will be reconstructed as two, 65-ft diameter secondary clarifiers (Figures 8-18 and Figure 8-19). Mixed liquor would be distributed using weirs to each secondary clarifier with a new Secondary Clarifier Distribution Box. Approximately 60 percent of flows during wet weather conditions would be routed to SC 1 and SC 2.

RAS and WAS pumps for SC 1 and SC 2 will require replacement. As indicated in 8-10, a total of four new RAS pumps would be installed with a capacity of 1,900 gpm. A total of 2 WAS pumps will be installed with a capacity of 350 gpm. WAS piping will be reconfigured to enable wasting from the RAS header to facilitate operations.



BLOWER BUILDING PLAN
3/16" = 1'-0"

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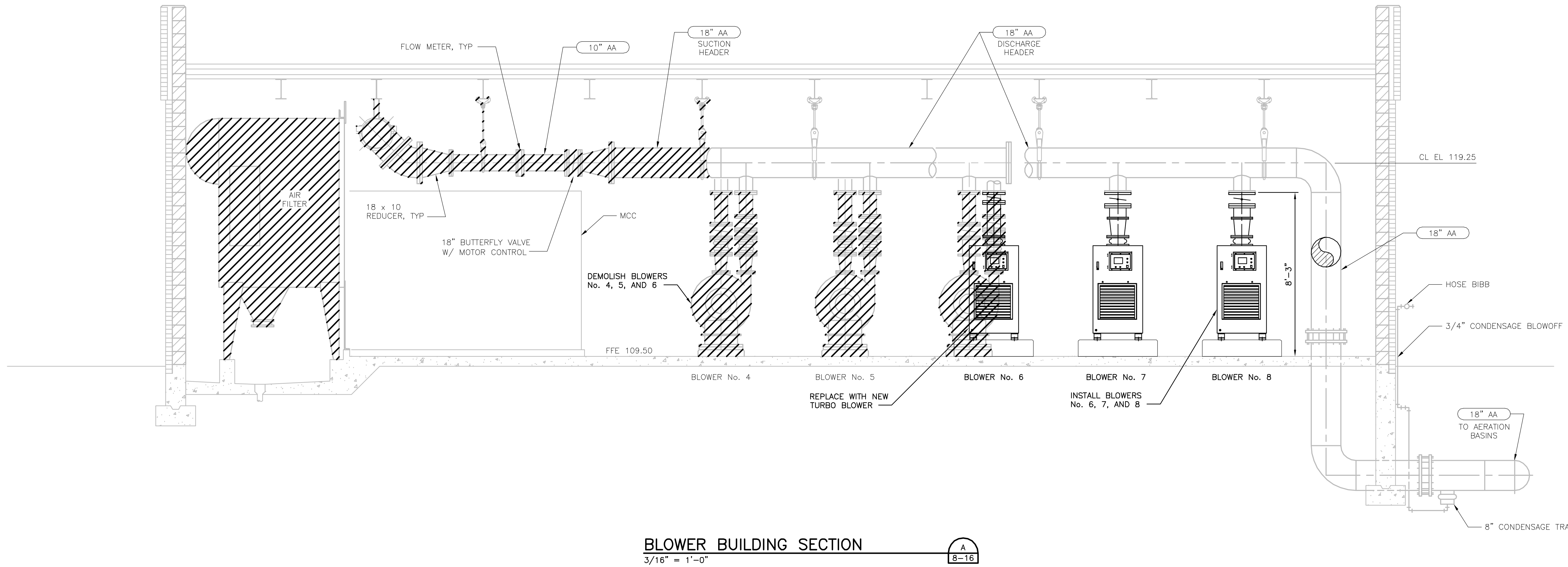
PINOLE/HERCULES WPCP PROJECT

EXISTING BLOWER BUILDING MODIFICATIONS PLAN

Figure 8–16



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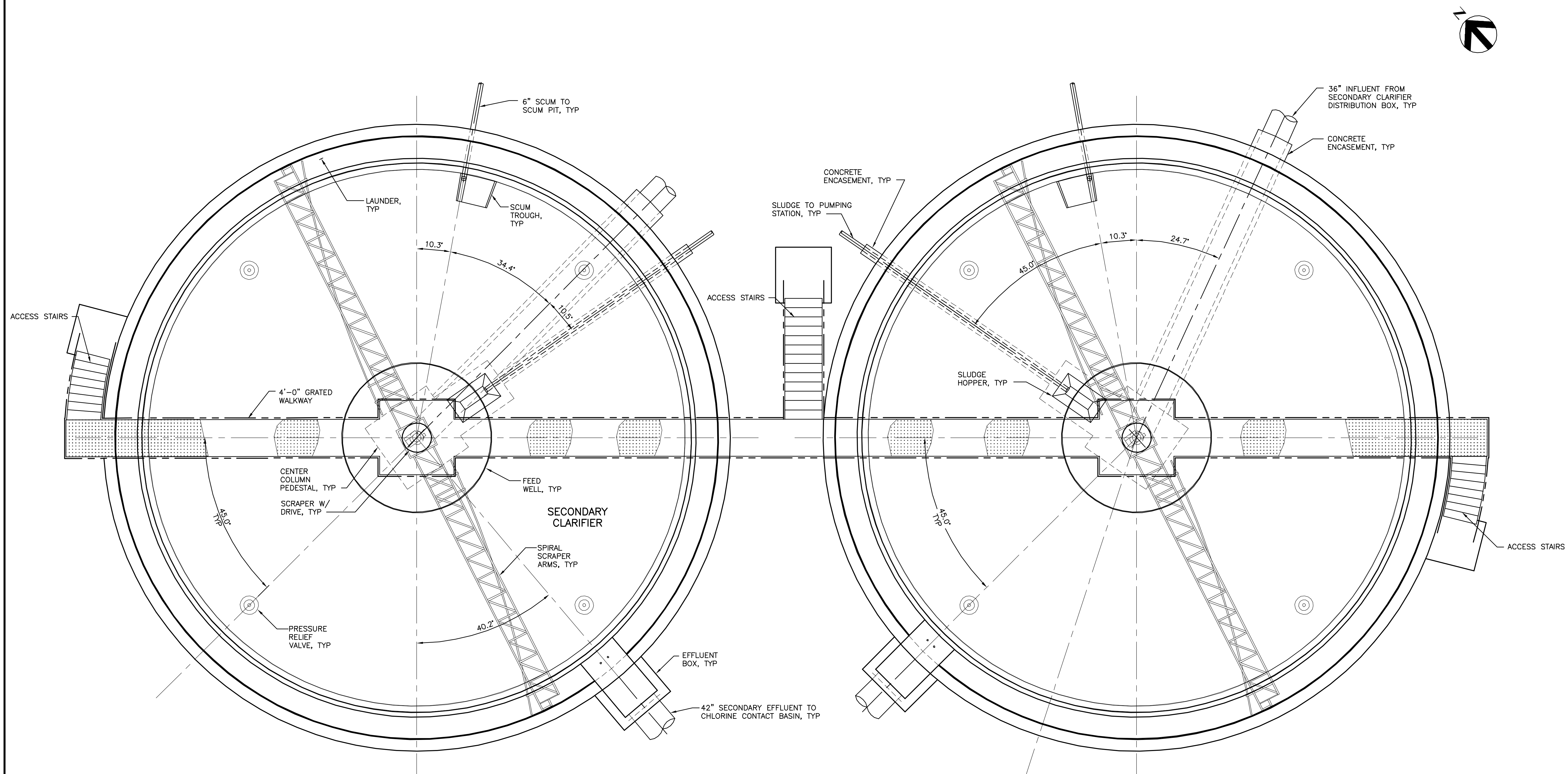
PINOLE/HERCULES WPCP PROJECT

EXISTING BLOWER BUILDING MODIFICATIONS SECTION

Figure 8-17



PLAN
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PINOLE/HERCULES WPCP PROJECT

SECONDARY CLARIFIERS #1 AND #2 PLAN

0 1" 2"

HDR

Figure 8-18

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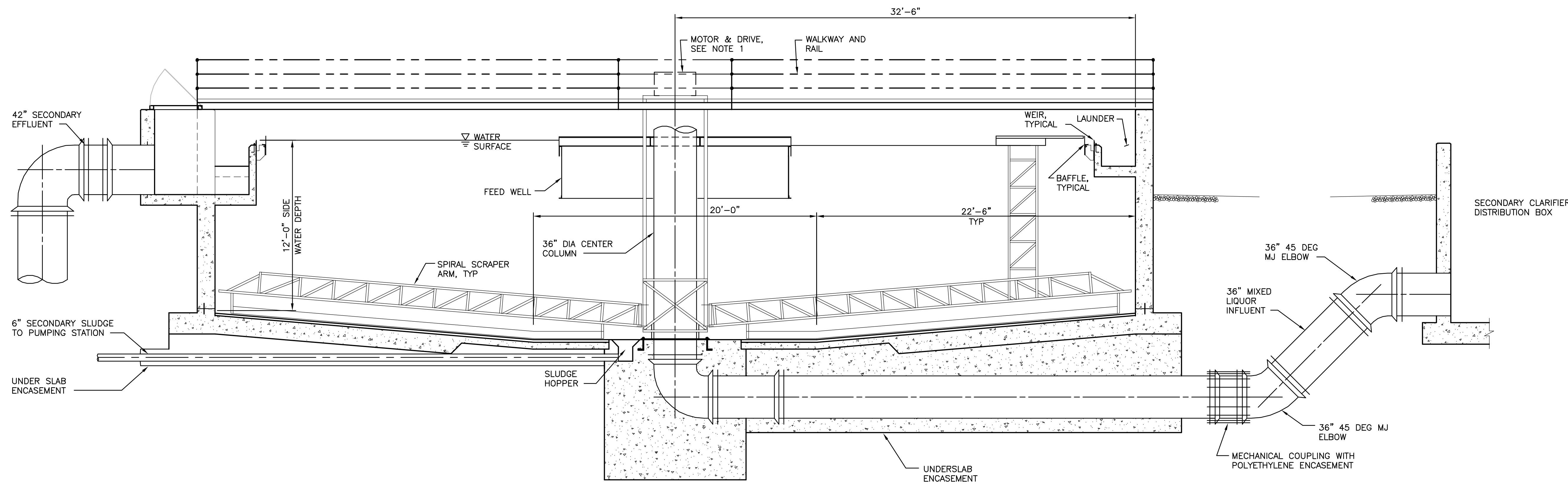
NOTES:

1. MOTOR AND DRIVE TO BE LOCATED ABOVE WALKWAY.
2. PIPING ROTATED FROM TRUE POSITION, SEE PLAN FOR ORIENTATION.



SECTION
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PINOLE/HERCULES WPCP PROJECT

SECONDARY CLARIFIER SECTION

0 1" 2"

HDR

Figure 8-19

Cost Estimate

The project costs for the Carbonaceous Mode and Nitrification Mode are summarized in Table 8-10. The construction costs include the following: construction of PC 3, improvements to PC 1 and PC 2 (weir resetting and sludge pump replacement), relocation of the digester gas flare, aeration basin improvements, installation of new aeration blowers, construction of new secondary clarifiers and installation of new RAS and WAS pumps. Demolition of PC 3, SC 1, and SC 2 are included as well as demolition of equipment that will be replaced such as the existing RAS/WAS pumps and the existing blowers.

The two modes of operation impact the construction and annual operating costs of disinfection. A comparison of the net present worth of the disinfection options was developed and is discussed in detail in TM 12. Table 8-11 summarizes the net present value over 20 years of chlorine disinfection and UV disinfection under Carbonaceous and Nitrification Modes.

Table 8-10. Construction Cost Comparison of Carbonaceous and Nitrification Modes

CSI Division	Carbonaceous Mode	Nitrification Mode
1 – General Requirements	$1,296,000	$1,497,000
2 – Site Work	$2,237,000	$2,566,000
3 – Concrete	$2,545,000	$3,136,000
4 – Masonry	$ -	$ -
5 – Metals	$187,000	$214,000
6 – Wood and Plastic	$ -	$25,000
7- Thermal and Moisture Protection	$105,000	$105,000
8 – Doors and Windows	$ -	$ -
9 – Finishes	$75,000	$75,000
10 – Specialties	$32,000	$32,000
11 – Equipment	$2,552,000	$3,059,000
13 – Instrumentation	$600,000	$600,000
14 – Conveyance	$ -	$ -
15 – Mechanical	$1,039,000	$1,122,000
16 – Electrical	$570,000	$570,000
Subtotal Construction Cost	$11,238,000	$13,001,000
Construction Contingency (20%)	$1,988,000	$2,301,000
Total Construction Cost	**$13,226,000**	**$15,302,000**
Engineering and Administration (25%)	$3,307,000	$3,826,000
Total Project Cost	**$16,533,000**	**$19,128,000**

1. Costs include construction of PC 3, improvements to PC 1 and PC 2, retrofit and expansion of aeration basins, new blowers, new secondary clarifiers and associated RAS/WAS pumping.
2. 20% construction contingency on Divisions 2 through Division 16.
3. All costs are presented in 2012 dollars

Table 8-11.Net Present Value Evaluation

Disinfection Type	Carbonaceous Mode	Nitrification Mode	Delta (Carbonaceous – Nitrification)
UV Disinfection	$ 32,300,000	$ 24,500,000	$ 7,800,000
Chlorine Disinfection	$ 24,800,000	$ 23,200,000	$ 1,600,000

1. Net present value includes construction cost plus contingency of the alternative and annual O&M costs for secondary treatment and disinfection. Net present value was calculated over a 20 year period using a 6 percent interest rate.

Evaluation

The advantages and disadvantages associated with Carbonaceous Mode and Nitrification Mode are provided in Table 8-12. The primary disadvantage of Carbonaceous Mode is that the secondary effluent quality is lower, which impacts disinfection annual and construction costs. To improve secondary effluent quality, provision for an anaerobic selector is included. However, operating with an anaerobic selector can result in biological phosphorous removal, which can ultimately change the chemistry in the anaerobic digesters and create a potential for magnesium ammonium phosphate (struvite) formation in the anaerobic digesters and downstream equipment. Struvite is a hard crystal precipitant that is difficult to remove from equipment and pipeline surfaces, and creates significant O&M issues. Wastewater treatment plants with anaerobic digestion, such as the Dublin San Ramon Services District Wastewater Treatment Facility, have observed struvite formation in solids handling equipment after operating their secondary system with an anaerobic selector. The primary advantage of Carbonaceous Mode is that it has a lower construction cost.

Nitrification Mode has a higher construction cost and marginally higher operating cost due to larger aeration blowers and internal mixed liquor recycle pumps. It does offer several advantages that include the following:

- Higher quality secondary effluent, which reduces disinfection annual and construction costs.
- Reduction in potential for struvite formation in the anaerobic digesters and downstream solids equipment.
- Improved sludge settleability which will reduce the need for polymer addition at the secondary clarifiers.
- Prepares the WPCP for potential future regulations which reduces future capital expenditures.

Table 8-12. Evaluation of Carbonaceous and Nitrification Modes

Description	Advantages	Disadvantages
Carbonaceous Mode	• Lower MLSS which reduces secondary clarifier surface area • Lower air demand • Smaller aeration basin footprint • Lower construction cost	• High potential for struvite formation in solids handling facilities • Future improvements will be needed if regulations require ammonia/ nitrogen removal • Less stable process that is more susceptible to effluent quality variations and upsets • Poor sludge settleability – lower secondary effluent quality • Higher WAS production (larger solids handling equipment required) • Higher present worth
Nitrification Mode	• Accommodates future regulations • More stable process • Improved sludge settleability – improved secondary effluent quality • Lower present worth • Reduces potential for struvite formation in solids facilities • Lower WAS production	• Larger basin footprint • Higher construction cost • Higher air demand • Operates at higher MLSS which increases secondary clarifier area needed

Based on the evaluation presented above, constructing Nitrification Mode now is recommended. Nitrification Mode does have a higher construction cost than Carbonaceous Mode; however, it has a lower present worth due to lower annual disinfection costs. Additionally, Nitrification Mode is a more stable process that is less susceptible to upsets and can produce a higher quality effluent.

Conclusions

Alternative 2 was selected as the preferred option and was developed to provide secondary treatment for PWWF up to 20 mgd. Two activated sludge operational modes were considered: Carbonaceous Mode and Nitrification Mode. Nitrification Mode was selected as the preferred mode for the following reasons:

- It provides flexibility to meet future regulations that may require ammonia and/or nitrogen removal.
- It produces a higher quality effluent that reduces annual disinfection costs.
- It is a more stable process with improved sludge settleability that can reduce the WPCP's reliance on polymer addition to meet permit limits.

Alternative 2 was developed with the following features to enable facilities to remain within the site property boundary and to maintain the Corporation Yard within the WPCP site:

- Extension of the existing aeration basins by 90 ft.
- Installation of new aeration blowers in the existing Blower Building.
- Continued use of SC 3, SC 4, and SC 5.
- Demolition of the existing peripheral feed clarifiers (SC 1 and SC 2) and construction of two new 65-ft diameter secondary clarifiers.
- Relocation of the existing Primary Clarifier 3 (PC 3) to the east of existing Primary Clarifiers 1 and 2 (PC 1 and PC 2).
- Reset of PC 1 and PC 2 effluent weirs and installation of three primary sludge pumps.
- Construction of a new Secondary Clarifier Distribution Box.
- Replacement of RAS and WAS pumps for SC 1 and SC 2.

The estimated project cost for Alternative 2 is $19,128,000.

Appendix A. Manufacturer Cut Sheets

Wilo-EMU TR 60-2 - Uniprop

Technical data of the Uniprop mixer TR 60-2 (60Hz)

Technical changes reserved !

Pinole Anoxic Zone Mixer Selection.
Basin size = 21' x 40' x 14.8'swd

WILO EMU GmbH
Heimgartenstraße 1-3
D-95030 Hof/Saale

Telefon +49 9281 974-0
Fax +49 9281 96528
E-Mail: info@wiloemu.de
Internet: www.wiloemu.com

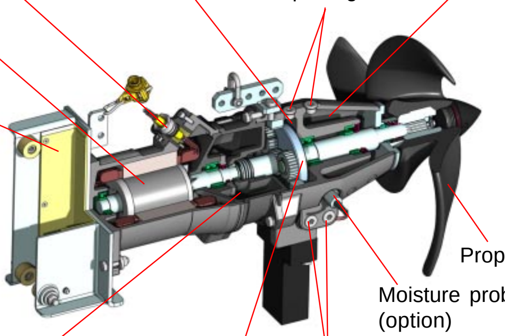
Electrical-Motor

Manufacturer: WILO EMU GmbH, Hof (Saale)
Type: submersible motor according to DIN/VDE 0530 (IEC 34) T17...R(Ex), T17...V(Ex)
Voltage: max. 660V possible
Frequency: max. 60Hz possible (higher frequencies on request)
Protection type: IP 68 (IEC 34)
Ex-proof: FM

Motor data at 460V 60Hz:

Type:	**4/8V**	**4/8R**	**4/12R**	**4/16R**
Rated power (kW):	3,3	4,2	5,5	7,5
Max. power input (kW):	4,6	5,4	7,1	9,4
Rated speed (rpm):	1680	1690	1680	1680
Efficiency (%):	72,0	79,0	78,0	80,0
Power factor (cos φ):	0,86	0,84	0,86	0,87
Rated current 3 ~ 460V (A):	6,7	8,0	10,3	13,6
Starting current, direct 3 ~ 460V (A):	30,0	33,0	45,0	65,0
Starting torque (Nm):	42,0	42,0	67,0	98,0
Moment of inertia (kg/m²):	0,0073	0,0073	0,0108	0,0134
Current supply cable, direct 230V	7x1,5	7x1,5	7x2,5	4x4/ 2x1,5
Current supply cable, direct 460V	7x1,5	7x1,5	7x1,5	7x1,5

Insulation class: F (155°C)
Max. temperature of the liquid: 40°C
(higher temperature of the liquid on request)
Max. installation depth: 12,5 m
(higher installation depth on request)
Max. starts per hour: 15
Materials: casing 0.6025 (A 48-83)
shafts 1.4021 (AISI 420)
Bearings: 1 grooved ball bearing
1 double row inclined ball bearing
Filling sealing chamber (white oil): 1,1 L (IEC 296 Cl. 2)



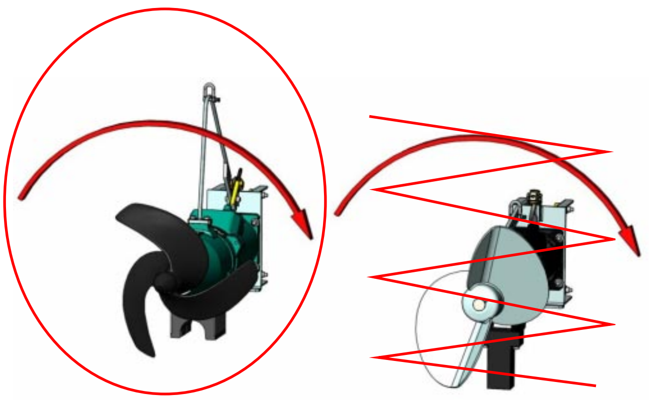
Essential construction elements of a Uniprop submersible mixer

Planetary Gearbox

Modulus: m 2,0 according to DIN 780/P10 (ISO 54)
Machining of teeth: sun and planetary wheels hardened and ground, pounded annular gear
Type of bearings: 3 needle roller bearings (planetary)
1 double row inclined ball bearing and
1 grooved ball bearing (output shaft)
Life L_{h10}: >100 000 service hours according to ISO 281
Lubrication: oil bath lubrication CLP-gearbox oil
Viscosity: ISO VG 220
Fillings: prechamber 1,2 L
gearbox chamber 0,5 L
Materials: housing 0.6025 (A 48-83)
shafts 1.4462 (S 31803(AISI))
sun wheel 1.7131 (SAE 5115)
planetary wheel 1.7131 (SAE 5115)
hollow gear 1.5216
Transmissions: i = 3,000 to 6,571

Propeller

Manufacturer: WILO EMU GmbH, Hof (Saale)
Type: 3-blade propeller** / 2-blade propeller
Material: polyurethane**
Options: welded propeller made of St 37 (1.0037 / A 283) and 1.4571 (AISI 316 Ti)
Blade profil: backwards bent therefore clogging free
Propeller diameter (mm): 600
Speeds: 169 to 570 rpm (460V 60Hz) depending on gear transmission and the number of poles



Sealing

Liquid - prechamber:	mechanical shaft seal SiC / SiC
Prechamber - gearbox:	radial shaft sealing ring Viton
Gearbox - sealing chamber:	mechanical shaft seal SiC / SiC
Sealing chamber - motor:	radial shaft sealing ring Viton

Wilo-EMU RZP 80-2

WILO EMU GmbH
Heimgartenstraße 1-3
D-95030 Hof/Saale

Telefon +49 9281 974-0
Fax +49 9281 96528
E-Mail: info@wiloemu.de
Internet: www.wiloemu.com

Technical data of the recirculation pump RZP 80-2 (60Hz)

Technical changes reserved !

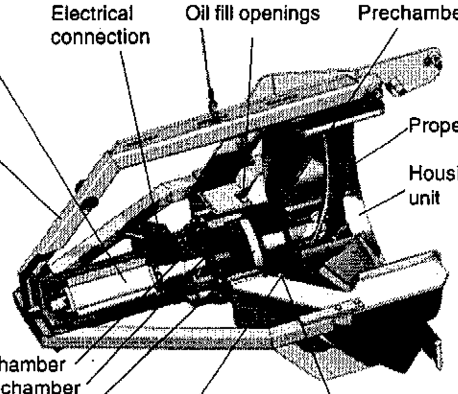
Electrical-Motor

Manufacturer: WILO EMU GmbH, Hof (Saale)
Type: submersible motor according to DIN/VDE 0530 (IEC 34) T20...R(Ex)
Voltage: max. 660V possible
Frequency: max. 60Hz possible (higher frequencies on request)
Protection type: IP 68 (IEC 34)
Ex-proof: II 2 G EEx d II B T4

Motor data at 400V 50Hz:

Type:	4/22R	4/27R	4/30R	6/22R
Rated power (kW):	15,0	18,5	22,5	10,5
Max. power input (kW):	18,3	22,0	26,5	13,0
Rated speed (rpm):	1740	1740	1740	1120
Efficiency (%):	82,0	85,0	86,0	81,0
Power factor (cos φ):	0,85	0,84	0,84	0,82
Rated current 3 ~ 460V (A):	27,5	33,0	39,5	19,9
Starting current, direct 3 ~ 460V (A)	140	170	200	90,0
Starting torque (Nm):	164	202	235	175
Moment of inertia (kg/m²):	0,0438	0,0532	0,0598	0,0587
Current supply cable, direct	4x4/ 2x1,5	4x4/ 2x1,5	4x6/ 2x1,5	4x2,5/ 2x1,5
Current supply cable, star-delta	7x2,5/ 2x1,5	2x4x2,5/ 2x1,5	2x4x2,5/ 2x1,5	7x2,5/ 2x1,5

Insulation class: F (155°C)
Max. temperature of the liquid: 40°C
(higher temperature of the liquid on request)
Max. installation depth: 12,5m
(higher installation depth on request)
Max. starts per hour: 15
Materials: casing 0.6025 (A 48-83)
shafts 1.4021 (AISI 420)
Bearings: 1 grooved ball bearing
1 double row inclined ball bearing
Filling sealing chamber (white oil): 2,0 L (IEC 296 Cl. 2)



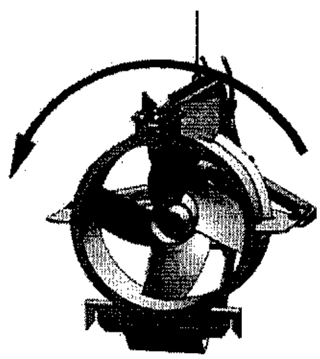
Essential construction elements of a Recirculation pump

Planetary Gearbox

Modulus: m 3,0 according to DIN 780/P10 (ISO 54)
Machining of teeth: sun and planetary wheels hardened and ground, pounded annular gear
Type of bearings: 3x2 needle roller bearings (planetary)
2 conical roller bearings (output shaft)
Life L_{h10}: >100 000 service hours according to ISO 281
Lubrication: oil bath lubrication CLP-gearbox oil
Viscosity: ISO VG 220
Fillings: prechamber 2,0 L
gearbox chamber 1,1 L
Materials: housing 0.6025 (A 48-83)
shafts 1.4462 (S 31803(AISI))
sun wheel 1.7131 (SAE 5115)
planetary wheel 1.7131 (SAE 5115)
hollow gear 1.5216
Transmission: i = 4,33 to 7,0

Propeller

Manufacturer: WILO EMU GmbH, Hof (Saale)
Type: 4-blade propeller
Material: welded propeller made of St 37 (1.0037/A283) and 1.4571 (AISI 316 Ti)
Blade profile: backwards bent therefore clogging free
Propeller diameter (mm): 785
Speed: 210 to 400rpm (460V 60Hz) depending on gearbox transmission and the number of poles



Sealing

Liquid - prechamber:	mechanical shaft seal SiC/SiC
Prechamber - gearbox:	radial shaft sealing ring Viton
Gearbox - sealing chamber:	mechanical shaft seal SiC /SiC
Sealing chamber - motor:	radial shaft sealing ring Viton

Curves for recirculation pump
REZIJET RZP 80-2.34-4/22 S17-4

WILO

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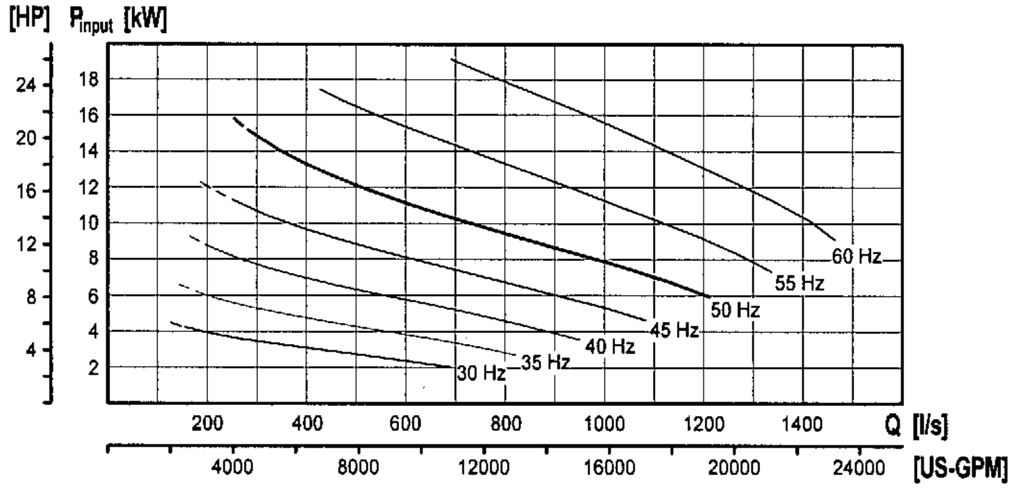
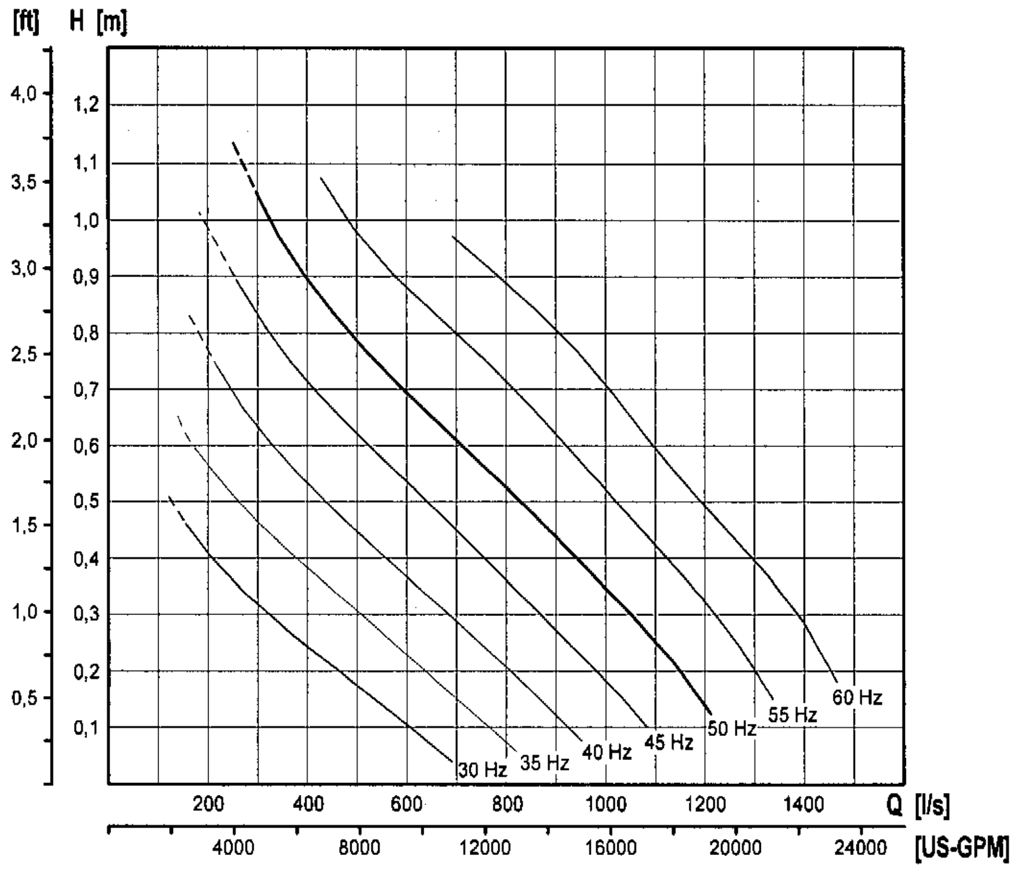
www.wiloemu.de E-Mail: info@wiloemu.de

Motor type:	T 20-4/22R			
Motor data:	Rated output [kW]	15		
	Power input [kW]	18,3		
	Rated speed [rpm]	1740	Number of poles	4
	Rated current [A]	27,5	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 17°		Number of blades	4
	Diameter [mm]	785	Free ball passage [mm]	190





Technical modifications reserved ± 10% Toleranz

Date: 11.6.08 Wi KI0229us.prt

Curves for recirculation pump
REZIJET RZP 80-2.25-4/22 S27-4

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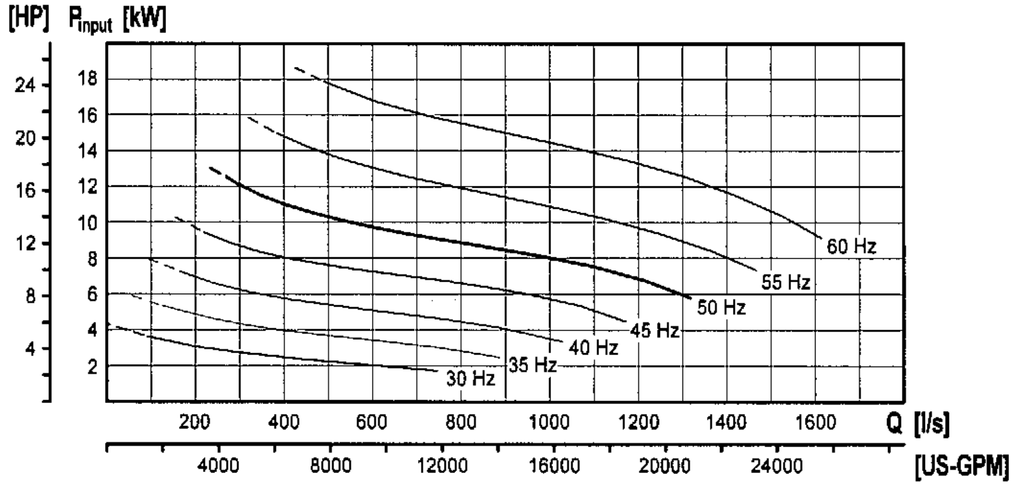
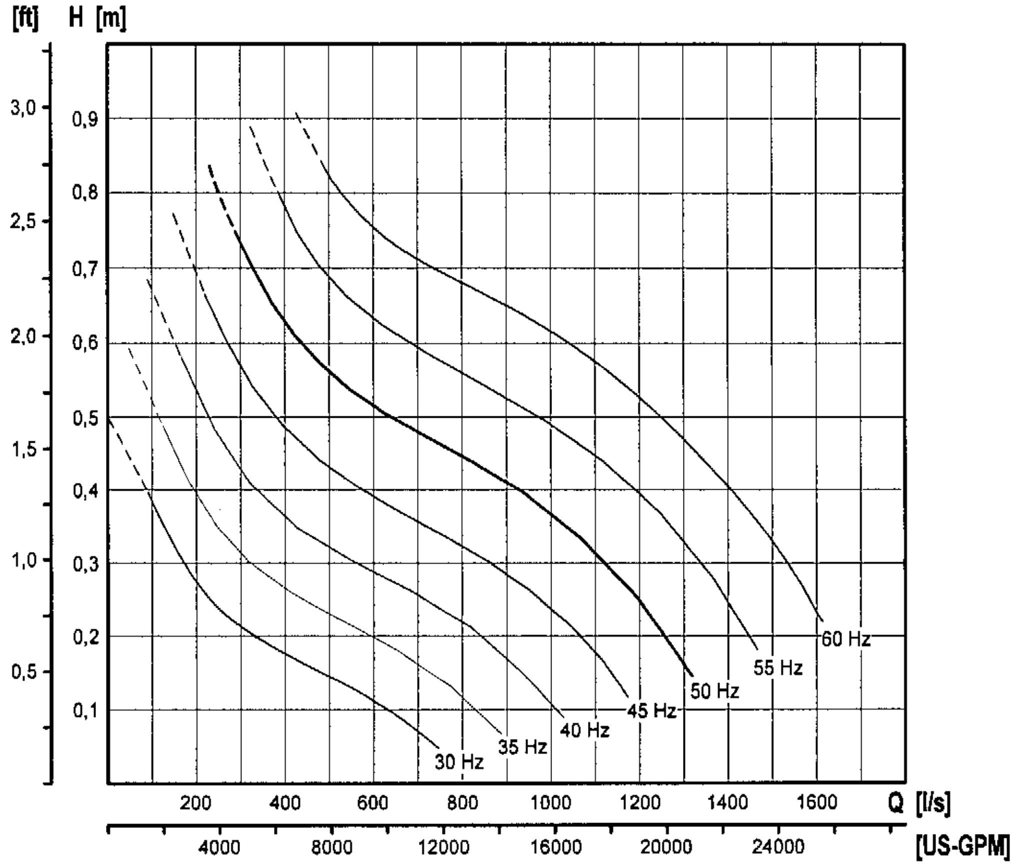
www.wiloemu.de E-Mail: info@wiloemu.de

Motor type:	T 20-4/22R			
Motor data:	Rated output [kW]	15		
	Power input [kW]	18,3		
	Rated speed [rpm]	1740	Number of poles	4
	Rated current [A]	27,5	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 27°	Number of blades	4	
	Diameter [mm] 785	Free ball passage [mm]	205	





Technical modifications reserved

± 10% Toleranz

Date: 11.6.08 Wi

KI0230us.prt

Curves for recirculation pump
REZIJET RZP 80-2.34-4/27 S20-4

WILO

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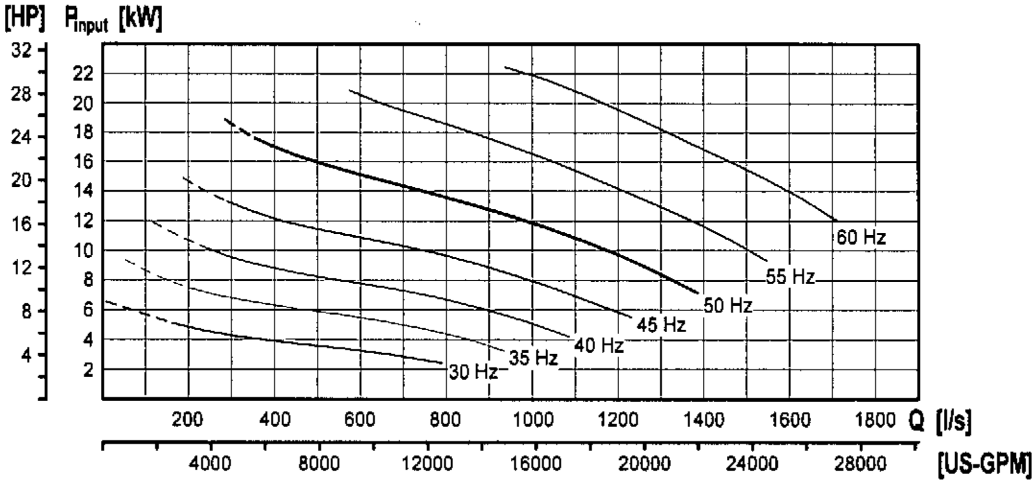
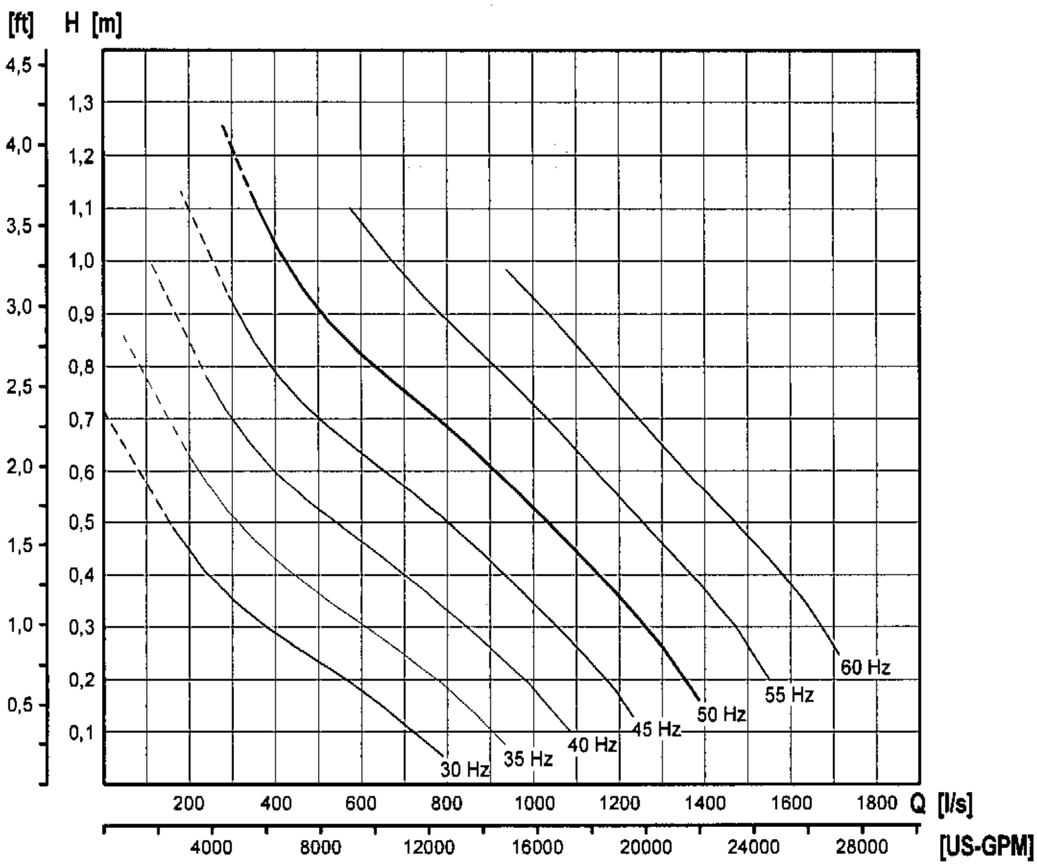
Telefon +49 9281 974-0 Fax +49 9281 96528
www.wiloemu.de E-Mail: info@wiloemu.de

Motor type:	T 20-4/27R			
Motor data:	Rated output [kW]	18,5		
	Power input [kW]	22		
	Rated speed [rpm]	1740	Number of poles	4
	Rated current [A]	33	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	4		Number of blades	4
	Diameter [mm] 785		Free ball passage [mm]	205





Technical modifications reserved ± 10% Toleranz

Date: 11.6.08 Wi KI0231us.prt

Curves for recirculation pump
REZIJET RZP 80-2.40-4/30 S17-4

WILO

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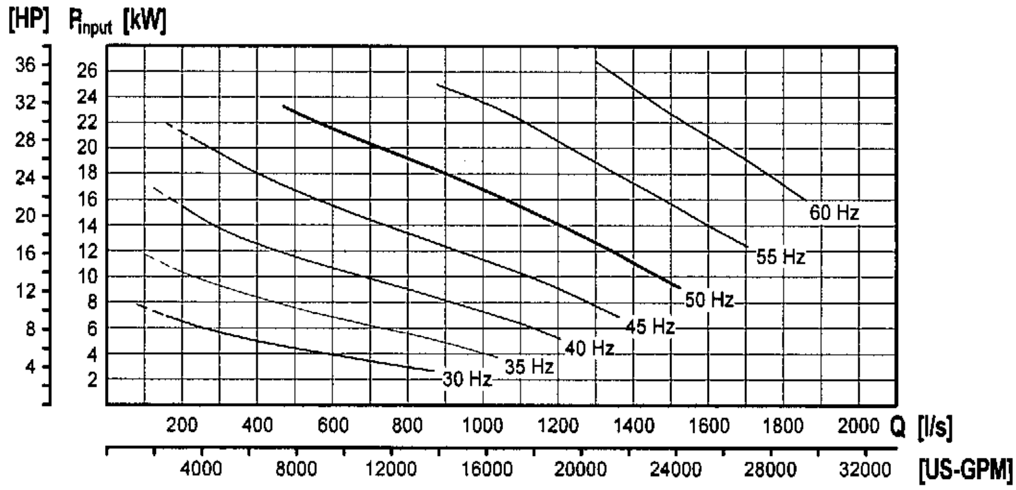
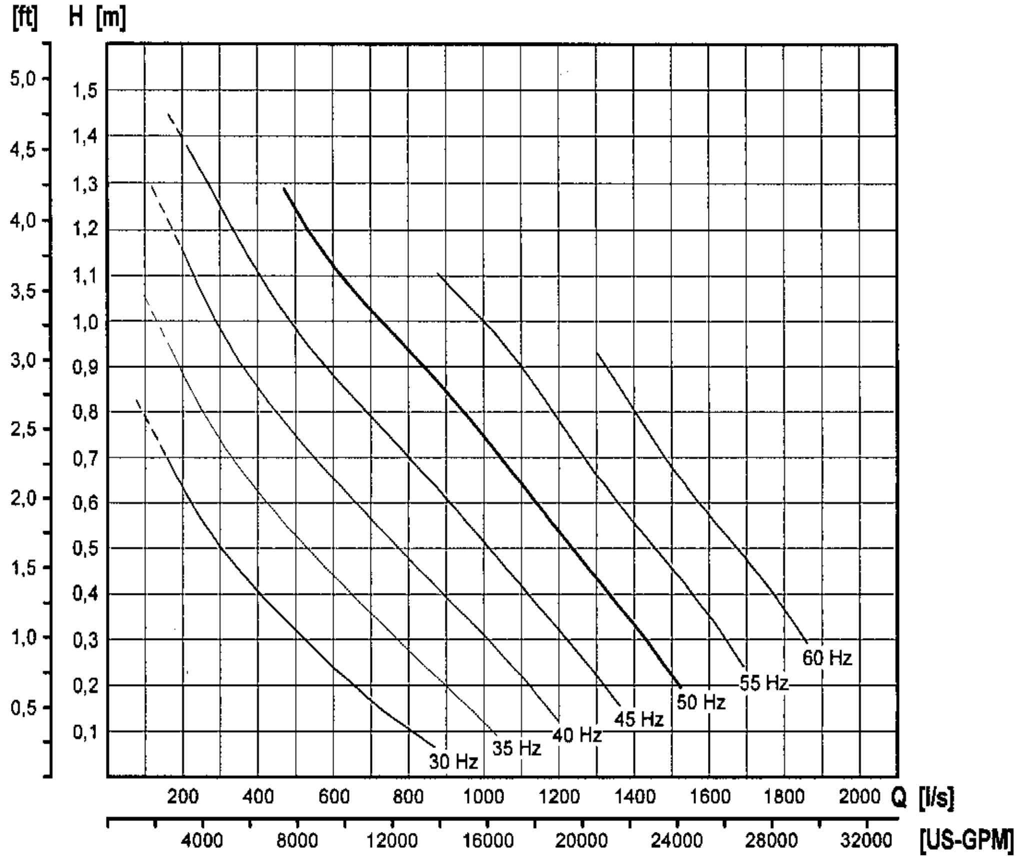
www.wiloemu.de E-Mail: info@wiloemu.de

Motor type:	T 20-4/30R			
Motor data:	Rated output [kW]	22,5		
	Power input [kW]	26,5		
	Rated speed [rpm]	1740	Number of poles	4
	Rated current [A]	39,5	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 17°		Number of blades	4
	Diameter [mm] 785		Free ball passage [mm]	190





Technical modifications reserved

± 10% Toleranz

Date: 11.6.08 Wi

KI0232us.prt

Curves for recirculation pump
REZIJET RZP 80-2.37-4/30 S20-4

WILO

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Telefon +49 9281 974-0 Fax +49 9281 96528
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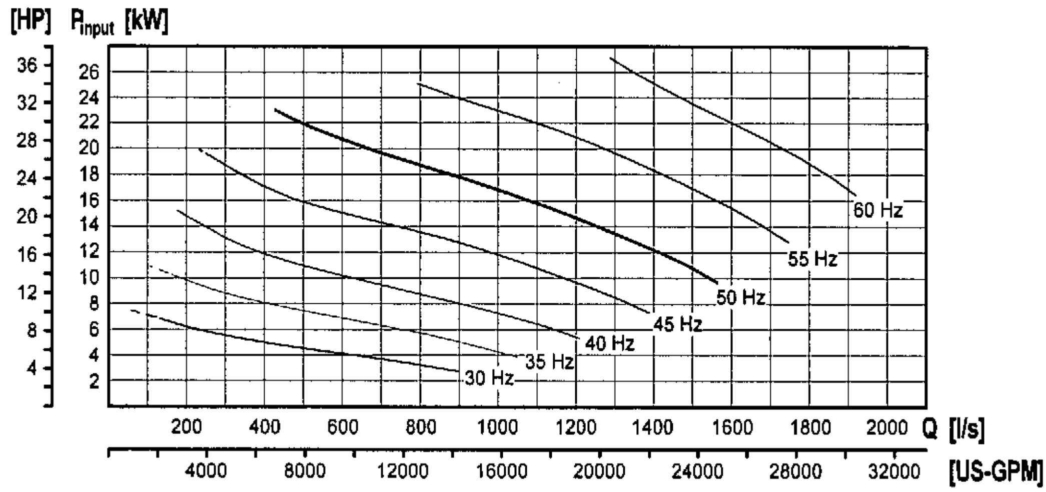
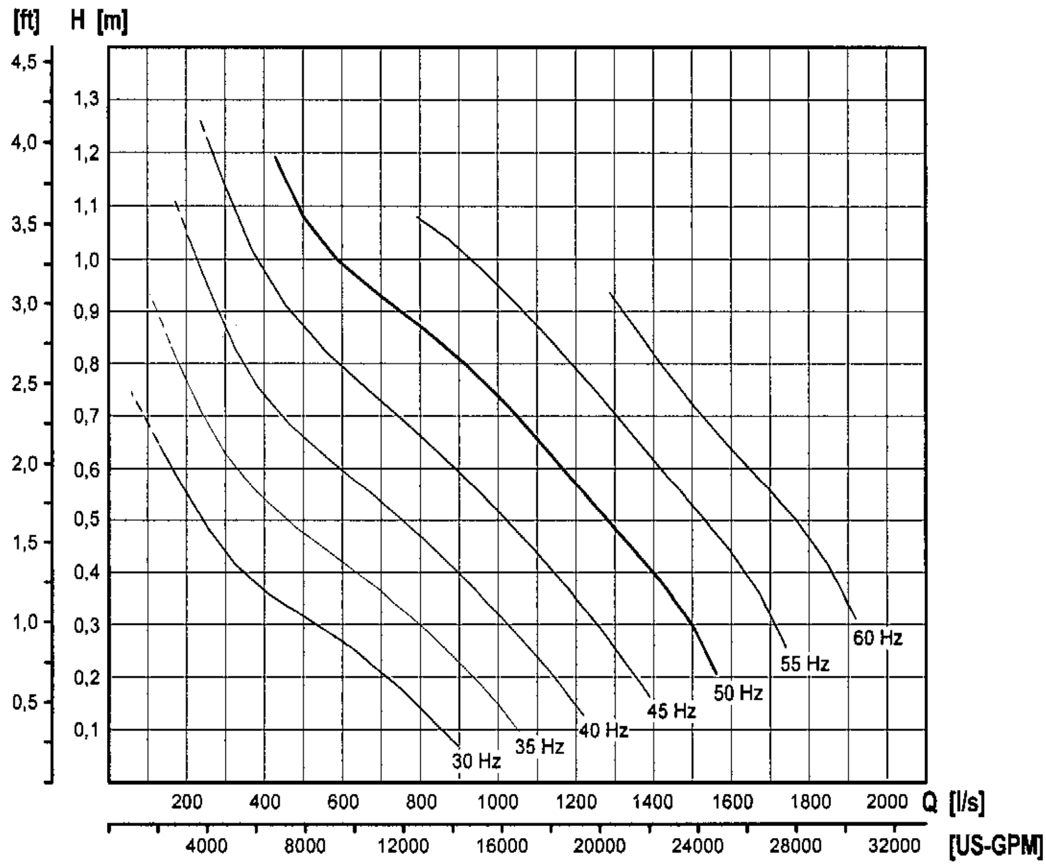
Motor type:	T 20-4/30R			
Motor data:	Rated output [kW]	22,5		
	Power input [kW]	26,5		
	Rated speed [rpm]	1740	Number of poles	4
	Rated current [A]	39,5	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 20°	Number of blades	4	
	Diameter [mm] 785	Free ball passage [mm]	195	





Technical modifications reserved ± 10% Toleranz

Date: 11.6.08 Wi KI0233us.prt

Curves for recirculation pump
REZIJET RZP 80-2.29-4/30 S27-4

WILO

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Telefon +49 9281 974-0 Fax +49 9281 96528
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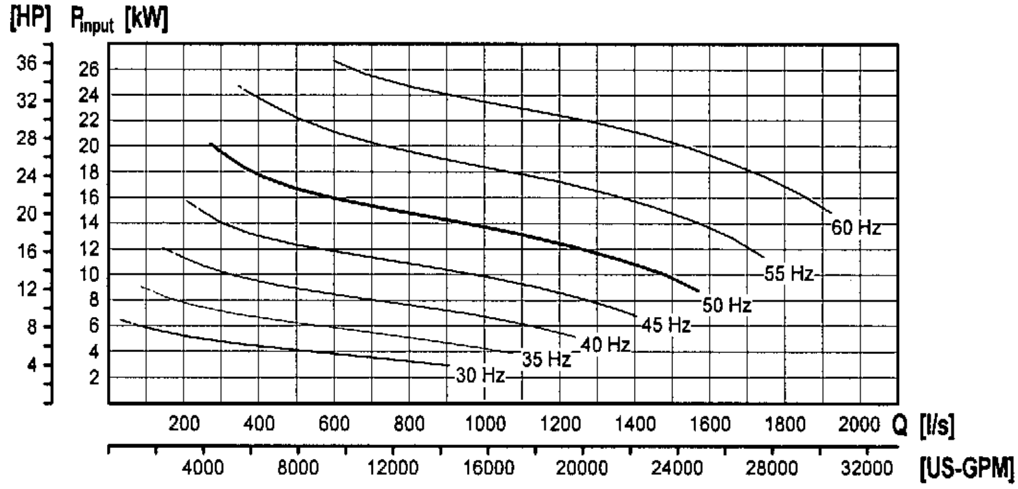
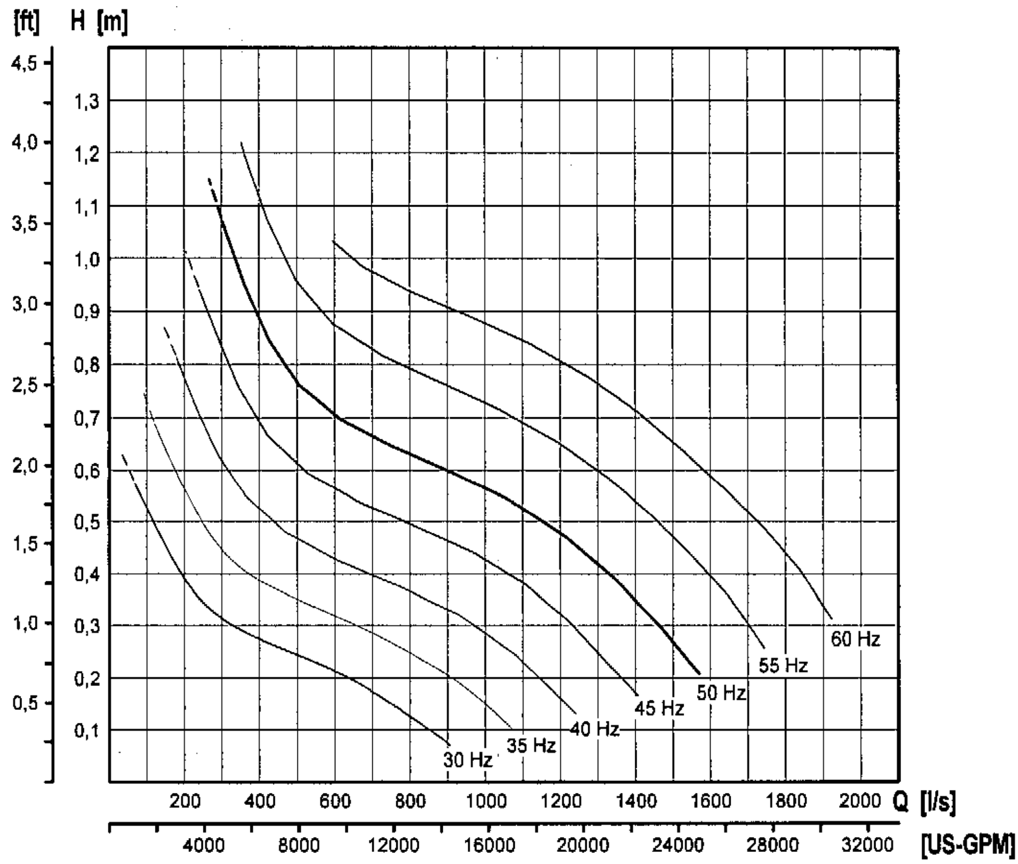
Motor type:	T 20-4/30R			
Motor data:	Rated output [kW]	22,5		
	Power input [kW]	26,5		
	Rated speed [rpm]	1740	Number of poles	4
	Rated current [A]	39,5	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 27°		Number of blades	4
	Diameter [mm] 785		Free ball passage [mm]	205





Technical modifications reserved ± 10% Toleranz

Date: 11.6.08 Wi KI0234us.prt

Curves for recirculation pump
REZIJET RZP 80-2.28-6/22 S17-4

WILO

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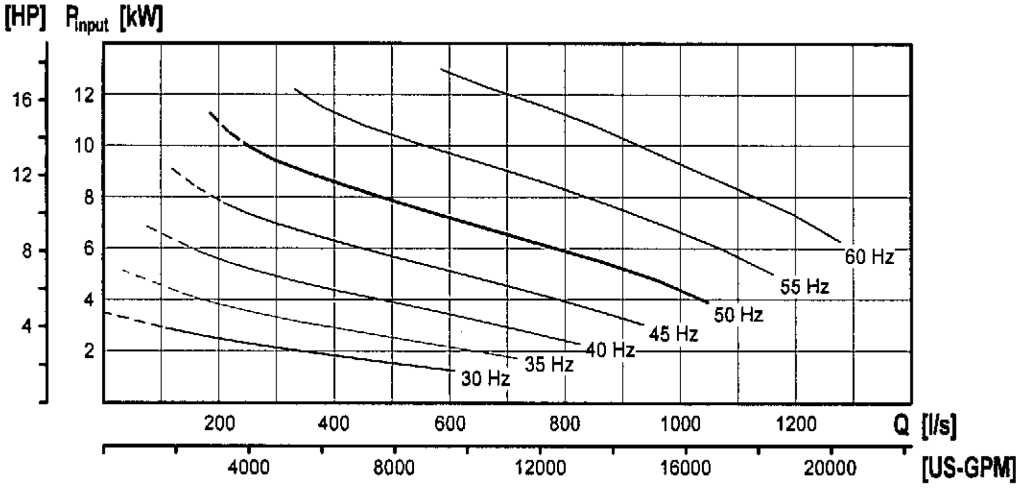
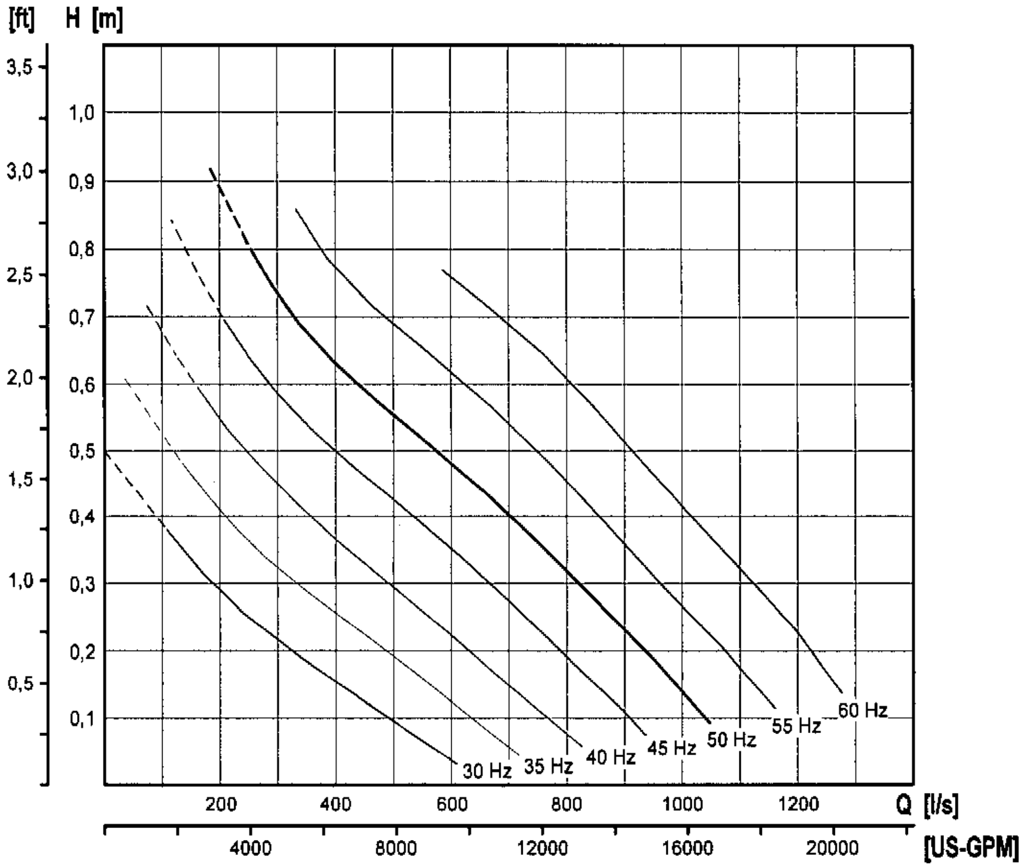
Motor type:	T 20-6/22R			
Motor data:	Rated output [kW]	10,5		
	Power input [kW]	13		
	Rated speed [rpm]	1120	Number of poles	6
	Rated current [A]	19,9	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 17°		Number of blades	4
	Diameter [mm] 785		Free ball passage [mm]	190





 ± 10% Toleranz

Curves for recirculation pump
REZIJET RZP 80-2.21-6/22 S27-4

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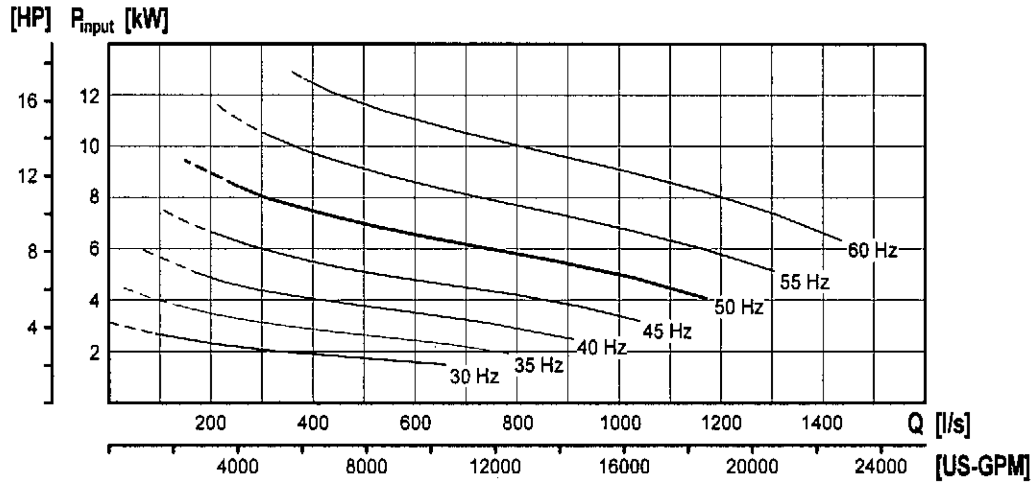
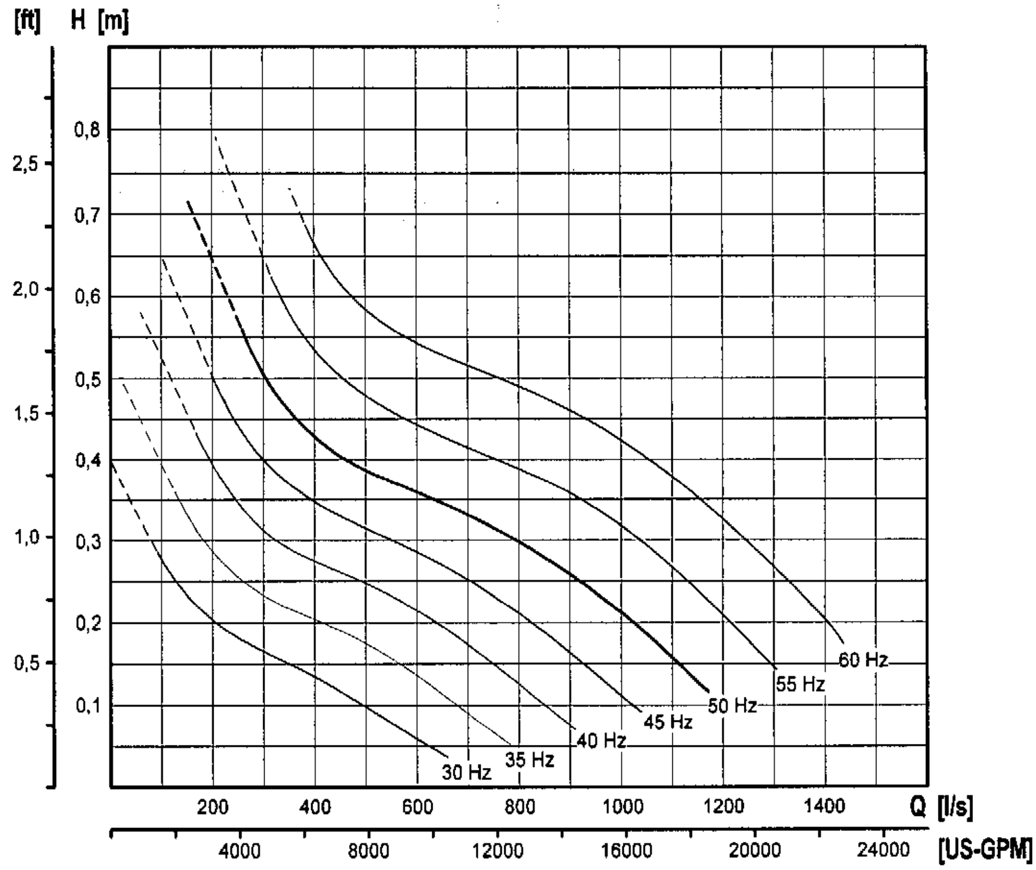
Motor type:	T 20-6/22R			
Motor data:	Rated output [kW]	10,5		
	Power input [kW]	13		
	Rated speed [rpm]	1120	Number of poles	6
	Rated current [A]	19,9	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 27°		Number of blades	4
	Diameter [mm]	785	Free ball passage [mm]	205





Technical modifications reserved ± 10% Toleranz

Date: 11.6.08 Wi KI0236us.prt

Abmessungen für Rezirkulationspumpe RZP 80-2

Dimensions of Recirculation pump RZP 80-2

Dimensions de la pompe de récirculation RZP 80-2

WILO

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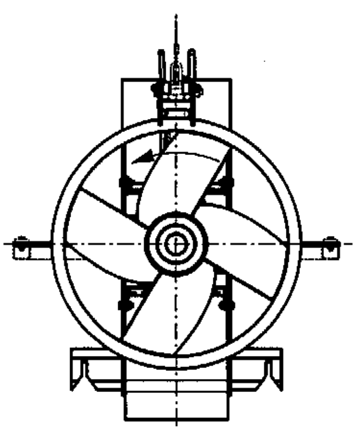
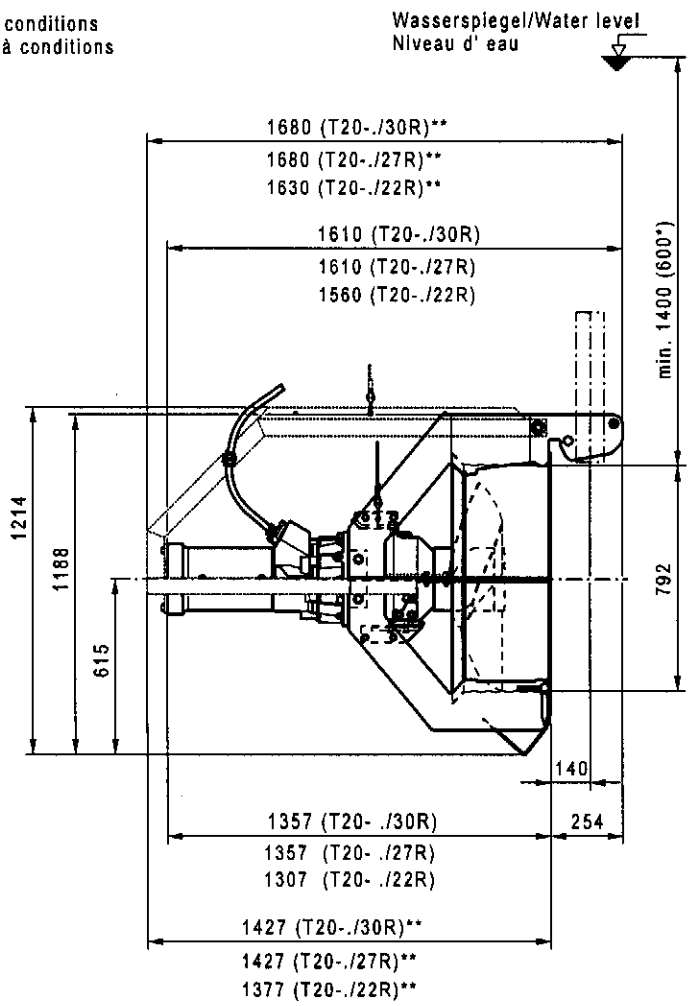
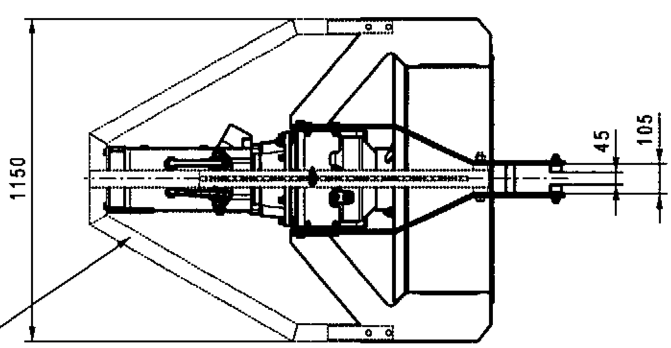
*) bei geringer Motorleistung und sehr guten Fließbedingungen
at low rating and very good flow conditions
à puissance du moteur basse et à conditions de fluage favorables

**)Option





Schweißpropeller aus Stahl
welded propeller made of steel
hélice soudée en acier



bei ungünstigen Zuströmbedingungen**
with unfavorable flow in direction to the RZP**
avec courant dé favorable en direction de la RZP**

Maßstab: 1:25 Technische Änderungen vorbehalten - Technical changes reserved - Modifications techniques réservées

Datum: 5.5.08 Wi Mb033.prt

Anschlußmaße für Rezirkulationspumpen
RZP 80-2

Connection dimensions of Recirculation pump **RZP 80-2**

Dimensions de raccordement de la pompe de récirculation **RZP 80-2**

WILO

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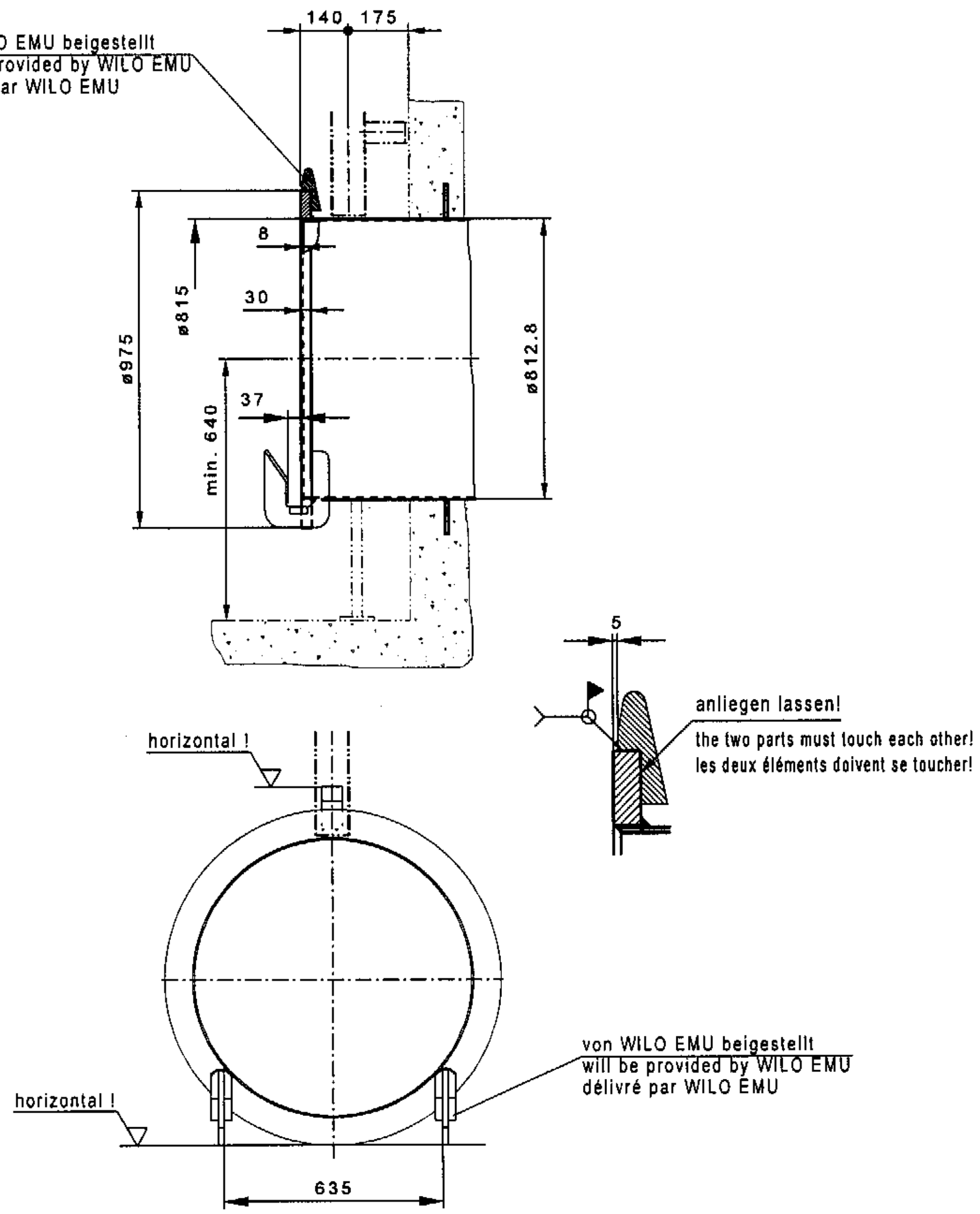


Druckrohr mit Stahlring
Discharge pipe with steel ring
Tube de refoulement avec anneau en acier

Maßstab: 1:20 Technische Änderungen vorbehalten - Technical changes reserved - Modifications techniques réservées

Datum: 19.10.07 Wi

Mb034.prt

Planungshilfe **Absenkvorrichtung**
Selection aid **Lowering device** **AVR 100**
Aide de sélection **Dispositif de descente**

WILO

Typ:
Type: **RZP80-2**
Type:

Maßstab:
Scale: **1:25**
Echelle:

Technische Änderungen vorbehalten !
Technical changes reserved !
Changements techniques réservés !

Nr./No.: **Plh143**
Stand: 6.5.08 Wi

Typ	øA	D	F_G	D**	F_G**
RZP 80-2.../22	800	640	455 kg	610	415 kg
RZP 80-2.../27	800	640	470 kg	610	430 kg
RZP 80-2.../30	800	640	475 kg	610	435 kg

Auftragsbezogene Maße
Dimensions acc. to order
Dimensions selon commande

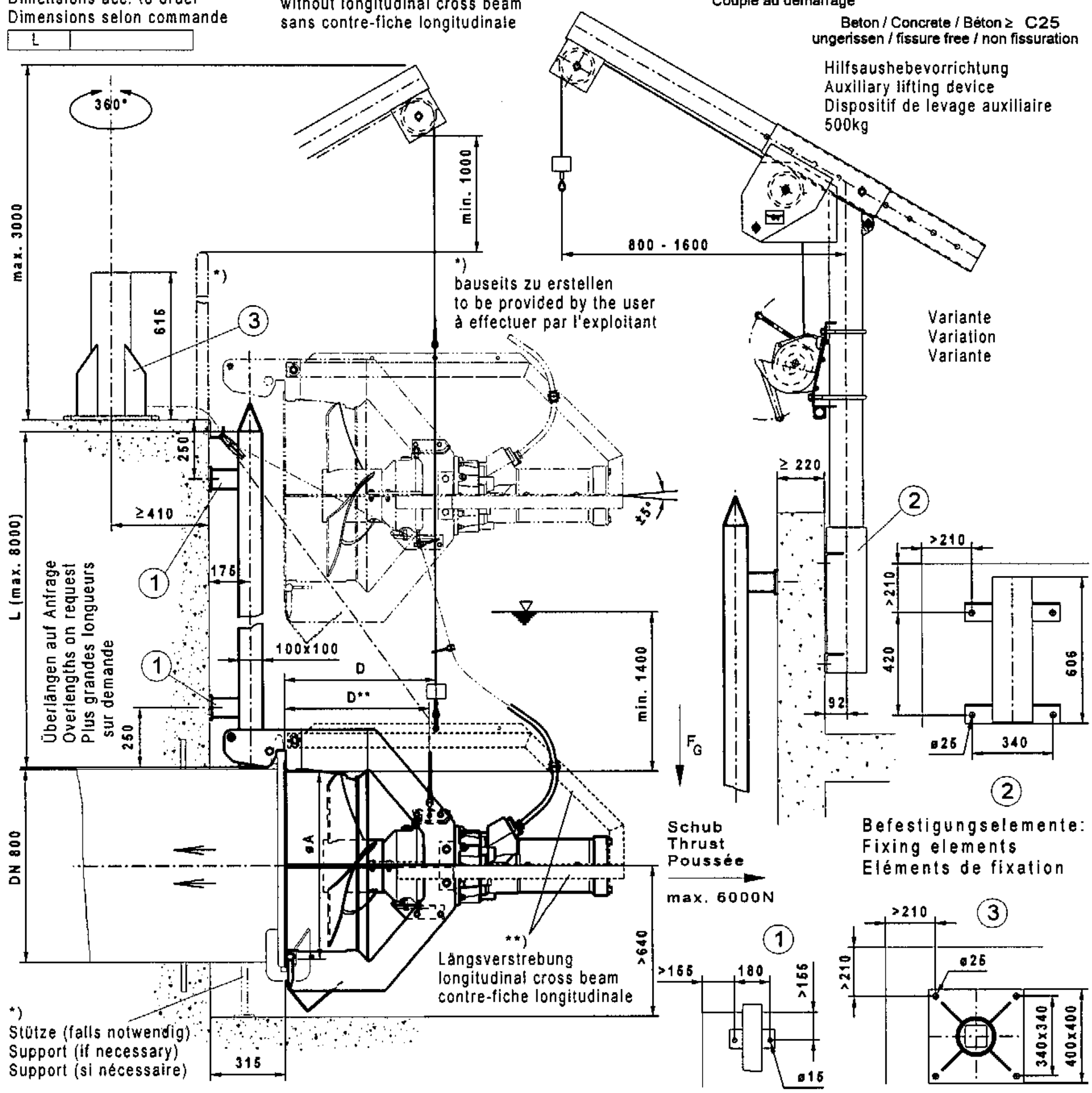
L	

**) ohne Längsverstrebung
without longitudinal cross beam
sans contre-fiche longitudinale

Sämtliche Anschlüsse gedübelt mittels HVA-Verbundanker
All connections doweled by means of composite anchor HVA
Tous les raccords par goujonnage d'ancre de raccordement HVA

	M20	M12
Bohrloch / Perforation / Perforation	Ø24x170	Ø14x110
Anzugmoment / Tightening torque / Couple au démarrage	150 Nm	40 Nm

Beton / Concrete / Béton ≥ C25
ungerissen / fissure free / non fissuration



Lieferumfang: Absenkvorrichtung bis einschließlich Befestigungselemente, Rezirkulationspumpe mit 10m Kabel (Überlängen auf Anfrage)
Notwendige Änderungen am Bauwerk (z.B. steckbare Geländer, Abdeckungen, Brücken, Podeste) sowie die Stromzuführung sind bauseits zu erstellen
Für den ordnungsgemäßen Betrieb und die Einhaltung aller Unfallverhütungs-, Sicherheits- und Hygienevorschriften ist der Betreiber verantwortlich.
Freier Zugang sowie sichere Bedienung und Montage sind zu ermöglichen.

Range of delivery: Lowering device including fixing elements. Rezirculation pump with 10 m cable (overlengths on request)
Necessary modifications of the structure (for example plug-in railings, covers, bridges, platforms) as well as the power supply will have to be provided by the user. The user is responsible for due operation and compliance with all accident prevention and safety regulations and rules of hygiene.
Free access as well as safe operation and installation will have to be made possible.

Particularités : Dispositif de descente et éléments de fixation inclus. Pompe de recirc. fournie avec 10 m de câble (autres dimensions sur demande). Des modifications nécessaires du bâtiment (par ex. des garde fous encastrables, des scellements, des ponts, des paliers)et l'arrivée du courant doit être réalisée par l'exploitant. Ce dernier est responsable de l'entretien, de la maintenance, du respect des normes de sécurité, d'hygiène et de prévention des accidents. Un libre accès, une utilisation et un montage en toute sécurité doivent être rendus possibles.

WILO EMU GmbH, Heimgartenstraße 1-3, D-95030 Hof, Telefon +49 9281 974-0, Telefax: +49 9281 96528, www.wiloemu.de

Planungshilfe **Absenkvorrichtung**
Selection aid **Lowering device** **AVRD 100**
Aide de sélection **Dispositif de descente**

WILO

Typ:
Type: **RZP80-2**
Type:

Maßstab:
Scale: **1:35**
Echelle:

Technische Änderungen vorbehalten !
Technical changes reserved !
Changements techniques réservés !

Nr./No.: **Plh144**
Stand: 6.5.08 Wi

Typ	øA	D	F_G	D**	F_G**
RZP 80-2.../22	800	640	455 kg	610	415 kg
RZP 80-2.../27	800	640	470 kg	610	430 kg
RZP 80-2.../30	800	640	475 kg	610	435 kg

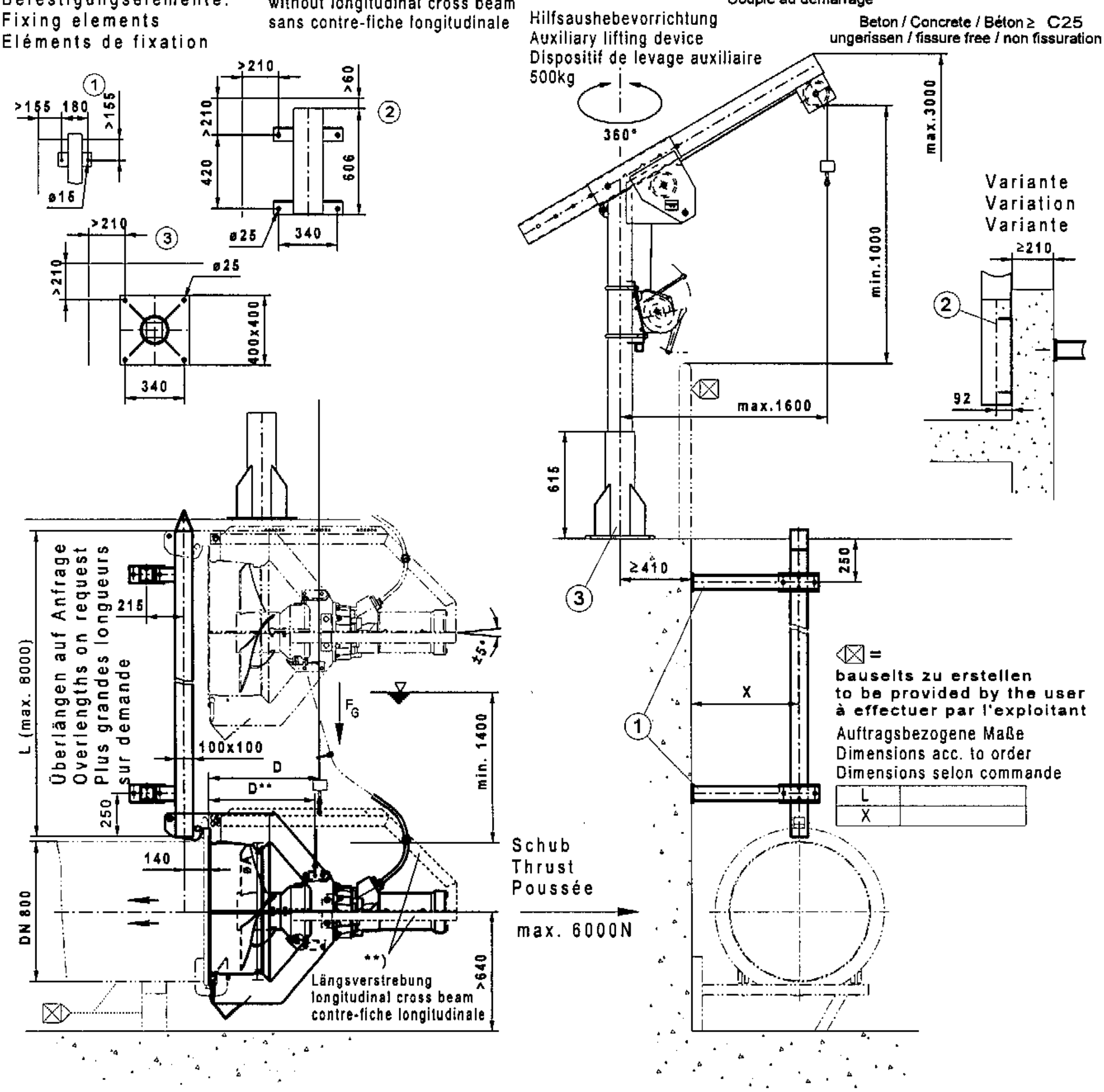
**) ohne Längsverstrebung
without longitudinal cross beam
sans contre-fiche longitudinale

Sämtliche Anschlüsse gedübelt mittels HVA-Verbundanker
All connections doweled by means of composite anchor HVA
Tous les raccords par goujonnage d'ancre de raccordement HVA

	M16	M12
Bohrloch / Perforation / Perforation	Ø18x125	Ø14x110
Anzugmoment / Tightening torque / Couple au démarrage	80 Nm	40 Nm

Beton / Concrete / Béton ≥ C25
ungerissen / fissure free / non fissuration

Befestigungselemente:
Fixing elements
Eléments de fixation



Lieferumfang: Absenkvorrichtung bis einschließlich Befestigungselemente, Rührwerk mit 10m Kabel (Überlängen auf Anfrage).
Notwendige Änderungen am Bauwerk (z.B. steckbare Geländer, Abdeckungen, Brücken, Podeste) sowie die Stromzuführung sind bauseits zu erstellen.
Für den ordnungsgemäßen Betrieb und die Einhaltung aller Unfallverhütungs-, Sicherheits- und Hygienevorschriften ist der Betreiber verantwortlich.
Freier Zugang sowie sichere Bedienung und Montage sind zu ermöglichen.

Range of delivery: Lowering device including fixing elements. Mixer with 10 m cable (overlengths on request).
Necessary modifications of the structure (for example plug-in railings, covers, bridges, platforms) as well as the power supply will have to be provided by the user. The user is responsible for due operation and compliance with all accident prevention and safety regulations and rules of hygiene.
Free access as well as safe operation and installation will have to be made possible.

Particularités : Dispositif de descente et éléments de fixation inclus. Circulateur fourni avec 10 m de câble (autres dimensions sur demande). Des modifications du bâtiment sont nécessaires (par ex. des garde-fous encastrables, des scellements, des ponts, des paliers) et l'arrivée du courant doit être réalisée par l'exploitant. Ce dernier est responsable de l'entretien, de la maintenance, du respect des normes de sécurité, d'hygiène et de prévention des accidents. Un libre accès, une utilisation et un montage en toute sécurité doivent être rendus possibles.

Planungshilfe **Absenkvorrichtung**
Selection aid **Lowering device** **AVRZ 100**
Aide de sélection **Dispositif de descente**

WILO

Typ:
Type: **RZP80-2**
Type:

Maßstab:
Scale: **1:30**
Echelle:

Technische Änderungen vorbehalten !
Technical changes reserved !
Changements techniques réservés !

Nr./No.: **Plh145**
Stand: 8.5.08 Wi

Typ	øA	D	F_G	D**	F_G**
RZP 80-2.../22	800	640	455 kg	610	415 kg
RZP 80-2.../27	800	640	470 kg	610	430 kg
RZP 80-2.../30	800	640	475 kg	610	435 kg

Auftragsbezogene Maße
Dimensions acc. to order
Dimensions selon commande

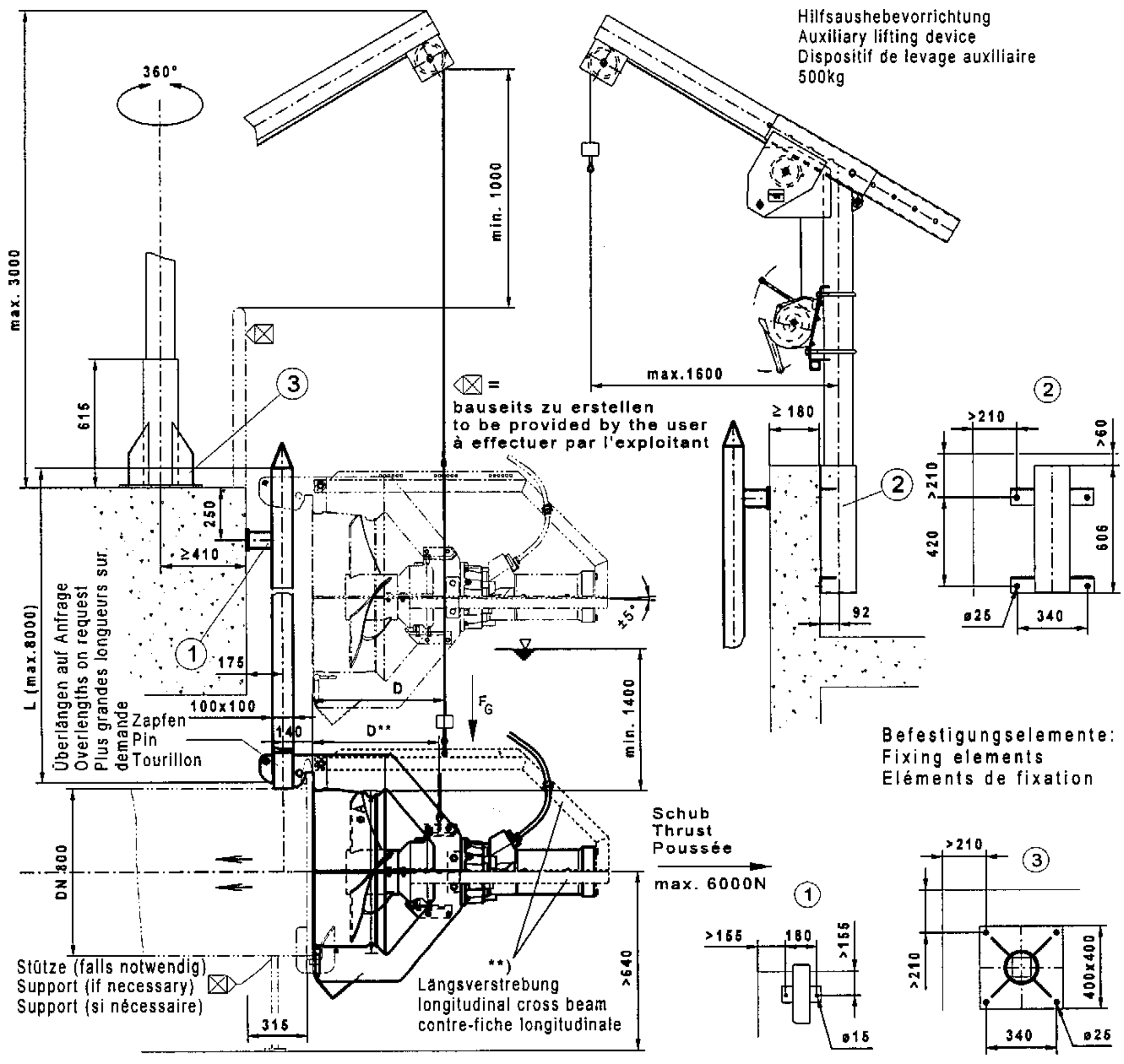
L	

**) ohne Längsverstrebung
without longitudinal cross beam
sans contre-fiche longitudinale

Sämtliche Anschlüsse gedübelt mittels HVA-Verbundanker
All connections doweled by means of composite anchor HVA
Tous les raccords par goujonnage d'ancre de raccordement HVA

	M16	M12
Bohrloch / Perforation / Perforation	Ø18x125	Ø14x110
Anzugmoment / Tightening torque / Couple au démarrage	80 Nm	40 Nm

Beton / Concrete / Béton ≥ C25
ungerissen / fissure free / non fissuration



Lieferumfang: Absenkvorrichtung bis einschließlich Befestigungselemente, Rührwerk mit 10m Kabel (Überlängen auf Anfrage).
Notwendige Änderungen am Bauwerk (z.B. steckbare Geländer, Abdeckungen, Brücken, Podeste) sowie die Stromzuführung sind bauseits zu erstellen.
Für den ordnungsgemäßen Betrieb und die Einhaltung aller Unfallverhütungs-, Sicherheits- und Hygienevorschriften ist der Betreiber verantwortlich.
Freier Zugang sowie sichere Bedienung und Montage sind zu ermöglichen.

Range of delivery: Lowering device including fixing elements. Mixer with 10 m cable (overlengths on request).
Necessary modifications of the structure (for example plug-in railings, covers, bridges, platforms) as well as the power supply will have to be provided by the user. The user is responsible for due operation and compliance with all accident prevention and safety regulations and rules of hygiene.
Free access as well as safe operation and instalation will have to be made possible.

Particularités : Dispositif de descente et éléments de fixation inclus. Circulateur fourni avec 10 m de câble (autres dimensions sur demande). Des modifications du bâtiment sont nécessaires (par ex. des garde-fous encastrables, des scellements, des ponts, des paliers) et l'arrivée du courant doit être réalisée par l'exploitant. Ce dernier est responsable de l'entretien, de la maintenance, du respect des normes de sécurité, d'hygiène et de prévention des accidents. Un libre accès, une utilisation et un montage en toute sécurité doivent être rendus possibles.

WILO EMU GmbH, Helmgartenstraße 1-3, D-95030 Hof, Telefon +49 9281 974-0, Telefax: +49 9281 96528, www.wiloemu.de

Planungshilfe
Selection aid
Aide de sélection

Absenkvorrichtung
Lowering device
Dispositif de descente

AVRZD 100

WILO

Typ:
Type: **RZP 80-2**
Type:

Maßstab:
Scale: **1:35**
Echelle:

Technische Änderungen vorbehalten !
Technical changes reserved !
Changements techniques réservés !

Nr./No.: **Plh146**
Stand: 8.5.08 Wi

Typ	øA	D	F_G	D**	F_G**
RZP 80-1.../22	800	640	455 kg	610	415 kg
RZP 80-1.../27	800	640	470 kg	610	430 kg
RZP 80-1.../30	800	640	475 kg	610	435 kg

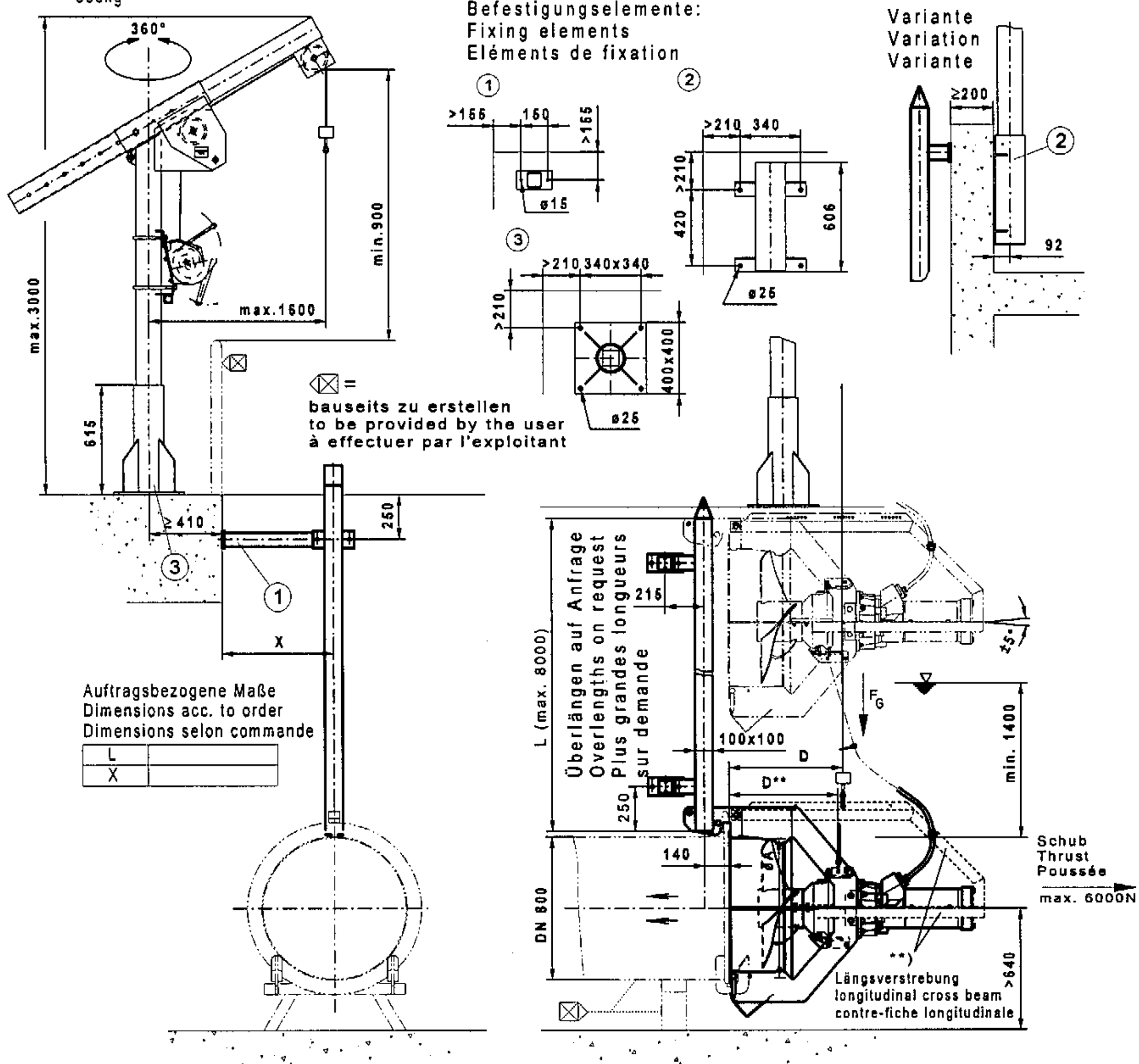
**) ohne Längsverstrebung
without longitudinal cross beam
sans contre-fiche longitudinale

Sämtliche Anschlüsse gedübelt mittels HVA-Verbundanker
All connections doweled by means of composite anchor HVA
Tous les raccords par goujonnage d'ancre de raccordement HVA

	M16	M12
Bohrloch / Perforation / Perforation	Ø18x125	Ø14x110
Anzugmoment / Tightening torque / Couple au démarrage	80 Nm	40 Nm

Beton / Concrete / Béton ≥ C25
ungerissen / fissure free / non fissuration

Hilfsaushebevorrichtung
Auxiliary lifting device
Dispositif de levage auxiliaire
500kg



Lieferumfang: Absenkvorrichtung bis einschließlich Befestigungselemente, Rührwerk mit 10m Kabel (Überlängen auf Anfrage).
Notwendige Änderungen am Bauwerk (z.B. steckbare Geländer, Abdeckungen, Brücken, Podeste) sowie die Stromzuführung sind bauseits zu erstellen.
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Free access as well as safe operation and installation will have to be made possible.

Particularités : Dispositif de descente et éléments de fixation inclus. Circulateur fourni avec 10 m de câble (autres dimensions sur demande). Des modifications du bâtiment sont nécessaires (par ex. des garde-fous encastrables, des scellements, des ponts, des paliers) et l'arrivée du courant doit être réalisée par l'exploitant. Ce dernier est responsable de l'entretien, de la maintenance, du respect des normes de sécurité, d'hygiène et de prévention des accidents. Un libre accès, une utilisation et un montage en toute sécurité doivent être rendus possibles.

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Zubehör - Accessories - Accessoires

Rezijet RZP 80-2

AVR 100 - AVRD 100 - AVRZ 100 - AVRZD 100

Kunde / Customer / Client	Projekt / Project / Projet	Angebot - Quotation - Offre
		Auftrag - Order - Commande
		Nr. - No.:

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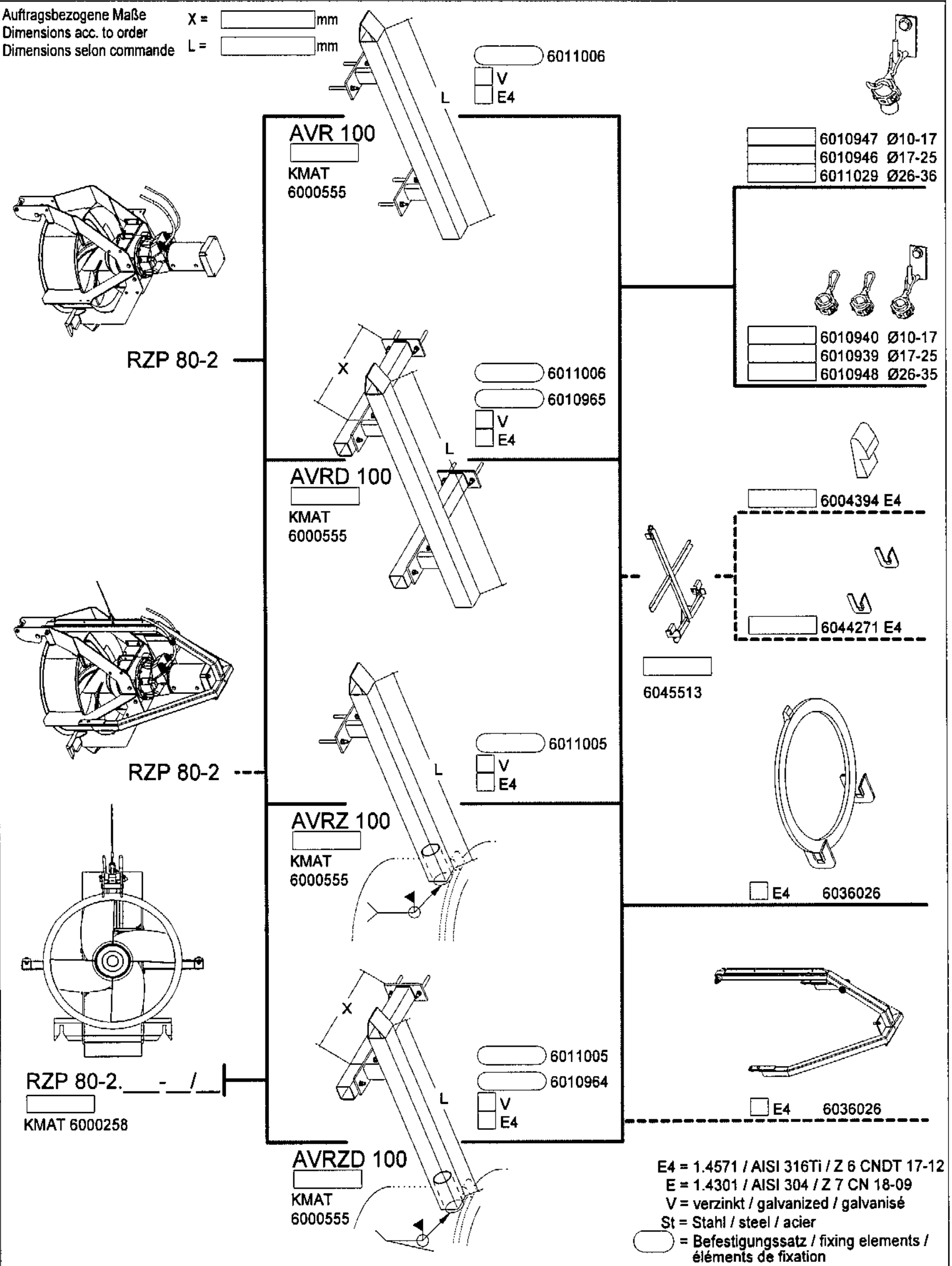
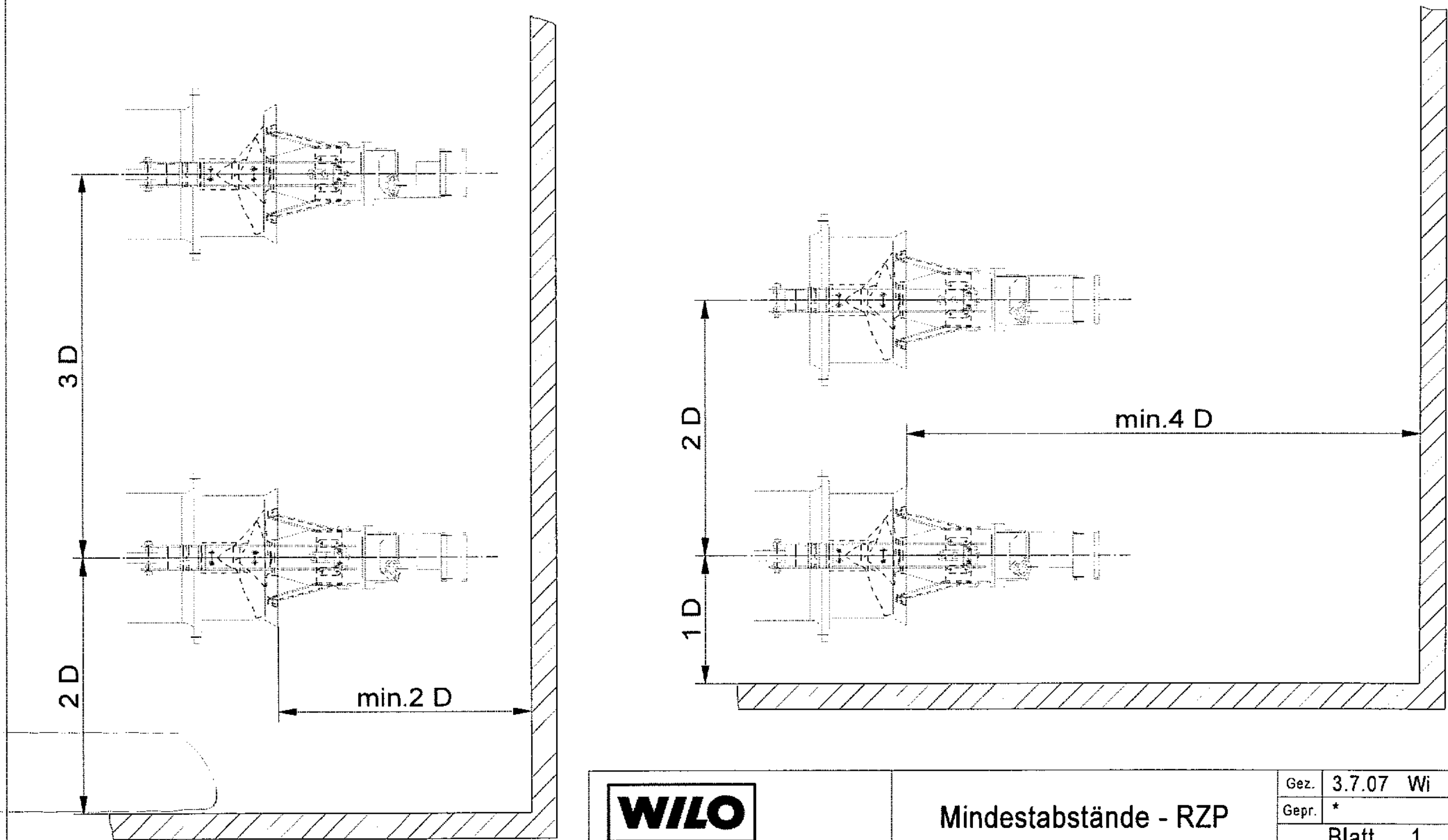
www.wiloemu.com E-Mail: info@wiloemu.de

Auftragsbezogene Maße
Dimensions acc. to order
Dimensions selon commande

X = mm
L = mm



E4 = 1.4571 / AISI 316Ti / Z 6 CNDT 17-12
E = 1.4301 / AISI 304 / Z 7 CN 18-09
V = verzinkt / galvanized / galvanisé
St = Stahl / steel / acier
( ) = Befestigungssatz / fixing elements / éléments de fixation



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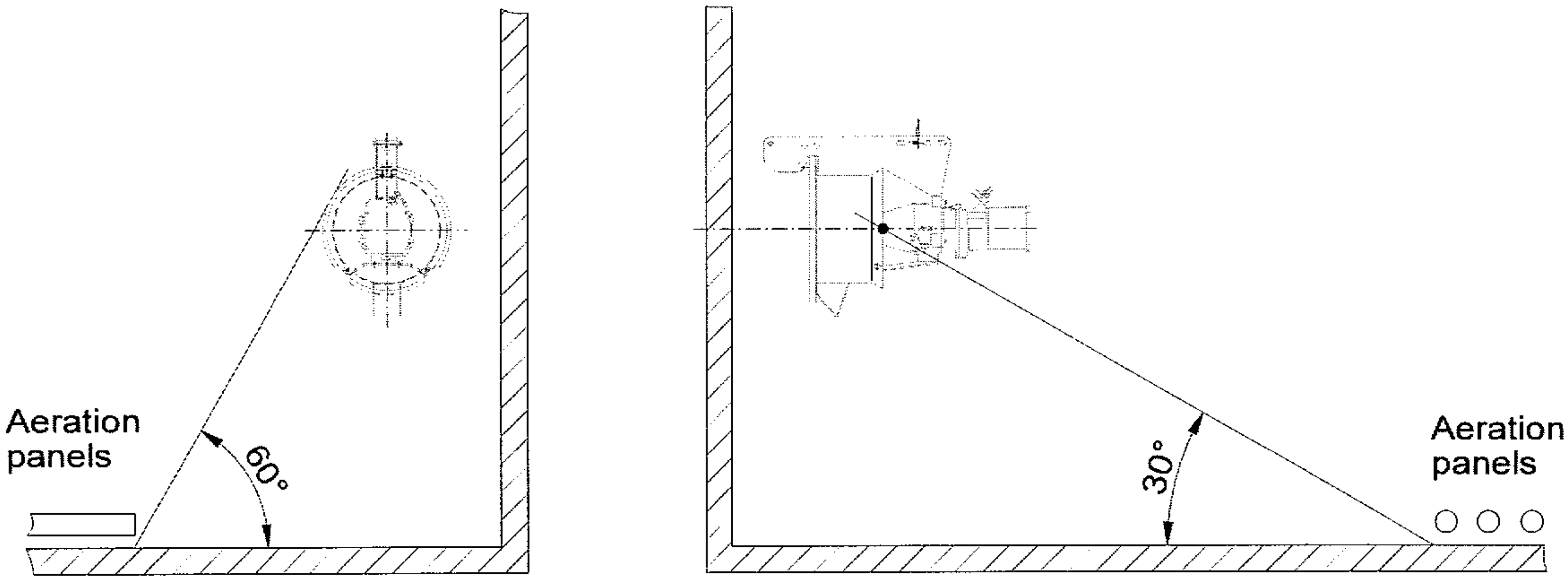
Mindestabstände - RZP
Minimum distances - RZP

Gez.	3.7.07 Wi
Gepr.	*
Blatt	1
*	



WILO	Distance to aeration panels	Gez.	17.7.07 Wi
Heimgartenstraße 1-3 D-95030 Hof/Saale Telefon +49 9281 974-0 Fax +49 9281 96528 www.wiloemu.com E-Mail: info@wiloemu.de	RZP-pumps	Gepr.	*
		Blatt 1	
		*	

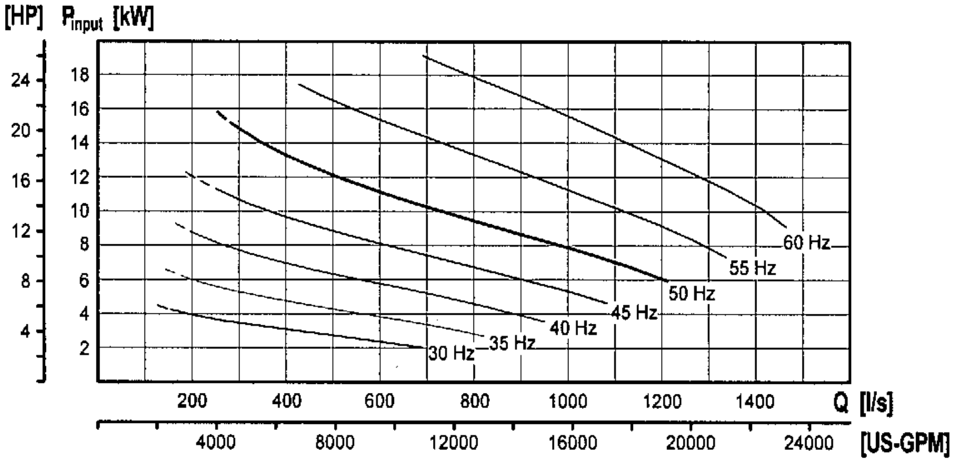
Pinole Recirculation Preliminary Selection.
02/13/13-ra

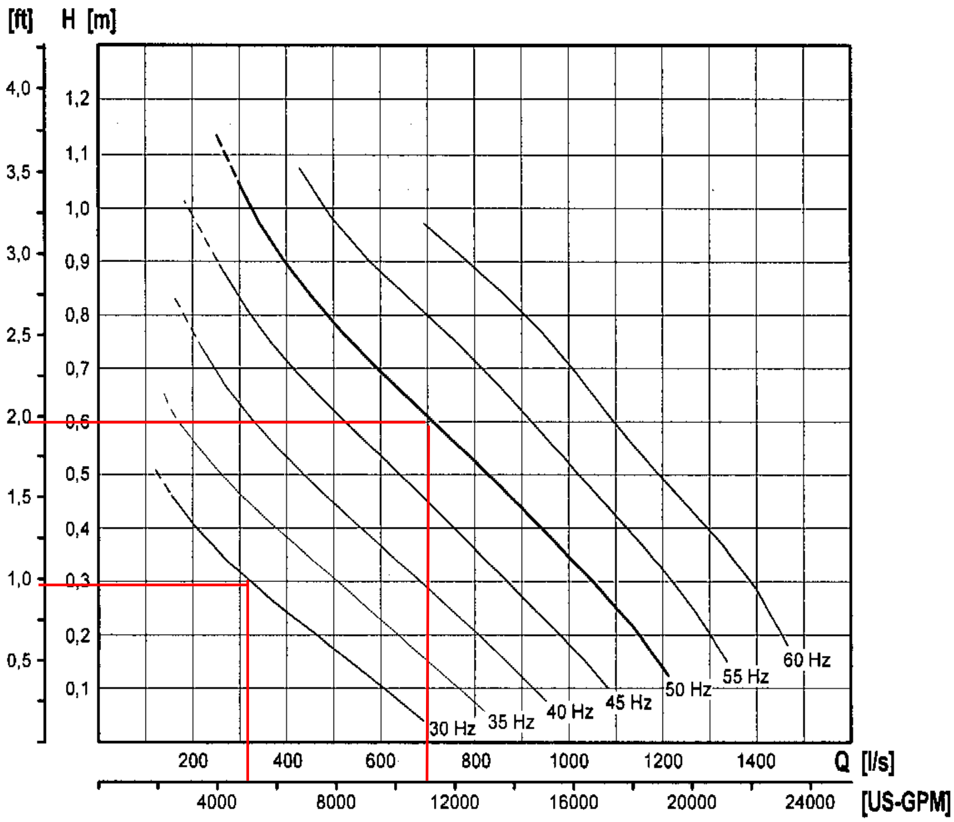
Curves for recirculation pump
REZIJET RZP 80-2.34-4/22 S17-4

WILO

Heimgartenstraße 1-3 D-95030 Hof/Saale
Telefon +49 9281 974-0 Fax +49 9281 96528
www.wiloemu.de E-Mail: info@wiloemu.de

Motor type:	T 20-4/22R			
Motor data:	Rated output [kW]	15		
	Power input [kW]	18,3		
	Rated speed [rpm]	1740	Number of poles	4
	Rated current [A]	27,5	Frequency [Hz]	60
	Maximum starts [/h]	15	Rated voltage [V]	460
Propeller type:	welded steel 17°		Number of blades	4
	Diameter [mm]	785	Free ball passage [mm]	190





Technical modifications reserved ± 10% Toleranz

Date: 11.6.08 Wi KI0229us.prt

Rev 1.3

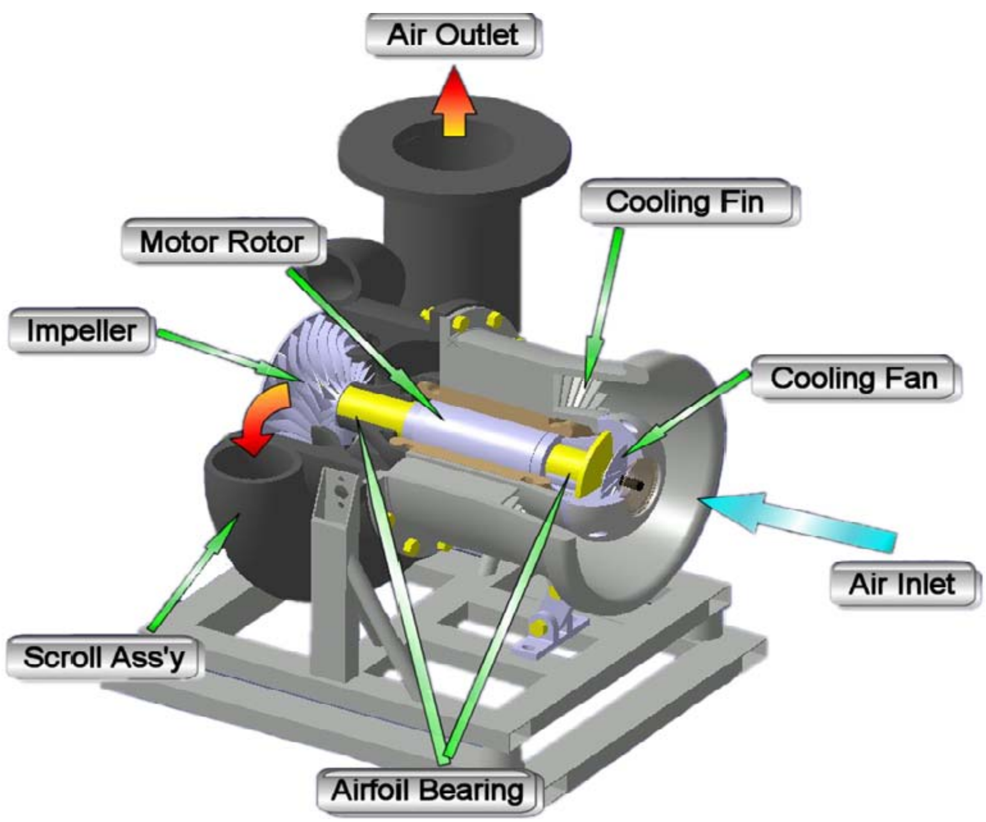
APG-Neuros Turbo Blower Scope of Supply Proposal

Pinole

HDR Engineering

Prepared By APGN Inc. *dba* APG-Neuros

Date
February 12, 2013
Proposal Reference # 789-010413-MC



APG-Neuros Turbo Blower Core

APGN Inc.
1270 Michele-Bohec, Blainville, QC, J7C-5S4
Tel: 450-939-0799 Fax: 450 939 2115
www.apg-neuros.com

Pinole - APG- Neuros Turbo Blower - Performance Data

Design Conditions

Application	Aeration	
Blower Installation Location	Indoor	
Working Fluid	Air	
Elevation	NA	Feet
Inlet Pressure	14.7	PSIA
Inlet Temperature	68	Deg. F
Relative Humidity	36	%

Design Conditions

Maximum Design System Flow Rate	4000	SCFM
Average Design System Flow Rate	3000	
Minimum Design System Flow Rate	2500	SCFM
Discharge Pressure	10	PSIG
Flow Rate per Blower	3000	SCFM
Number of Blowers - Duty	2	Units
Number of Blowers - Stand-By	1	Units

Available Blower Performance

Model	**NX200-C070**	
Rate Motor Output Power	200	HP
Maximum Air Flow @ Duty Discharge Pressure per Blower	4045	SCFM
Minimum Air Flow @ Duty Discharge Pressure per Blower	2021	SCFM
Turndown from Maximum Flow	50.0%	%
Shaft Power @ Design Conditions per Blower	**136.8**	**bhp**
Wire-to-Air Power @ Design Condition per Blower	**114.3**	**kW**
Discharge Temperature @ Design Condition	175	Deg. F
Maximum Discharge Pressure	13.5	PSIG
Rise-to-Surge	3.5	PSIG

Notes

Maximum Noise Level @ 3 feet	80	dBA
Dimensions per Blower, L / W / H	83/39/65	Inches
Weight per Unit	2693	lbs.
Heat Rejection inside Blower Room	0	kW
Cooling Requirements	0	kW
Input Voltage/Phase/Frequency	480/3/60	V/Phase/Hz
Full Load Amperage	221	Amps
Blower Inlet Air Entry type	Louvered	
Inlet Flange Size (Optional, if louvered inlet does not apply)	16	Inches
Discharge Flange Size	12	Inches

Note:
Performance data is measured at core inlet with a Tolerance of ± 5 % on flow values and ± 2 dBa on noise level

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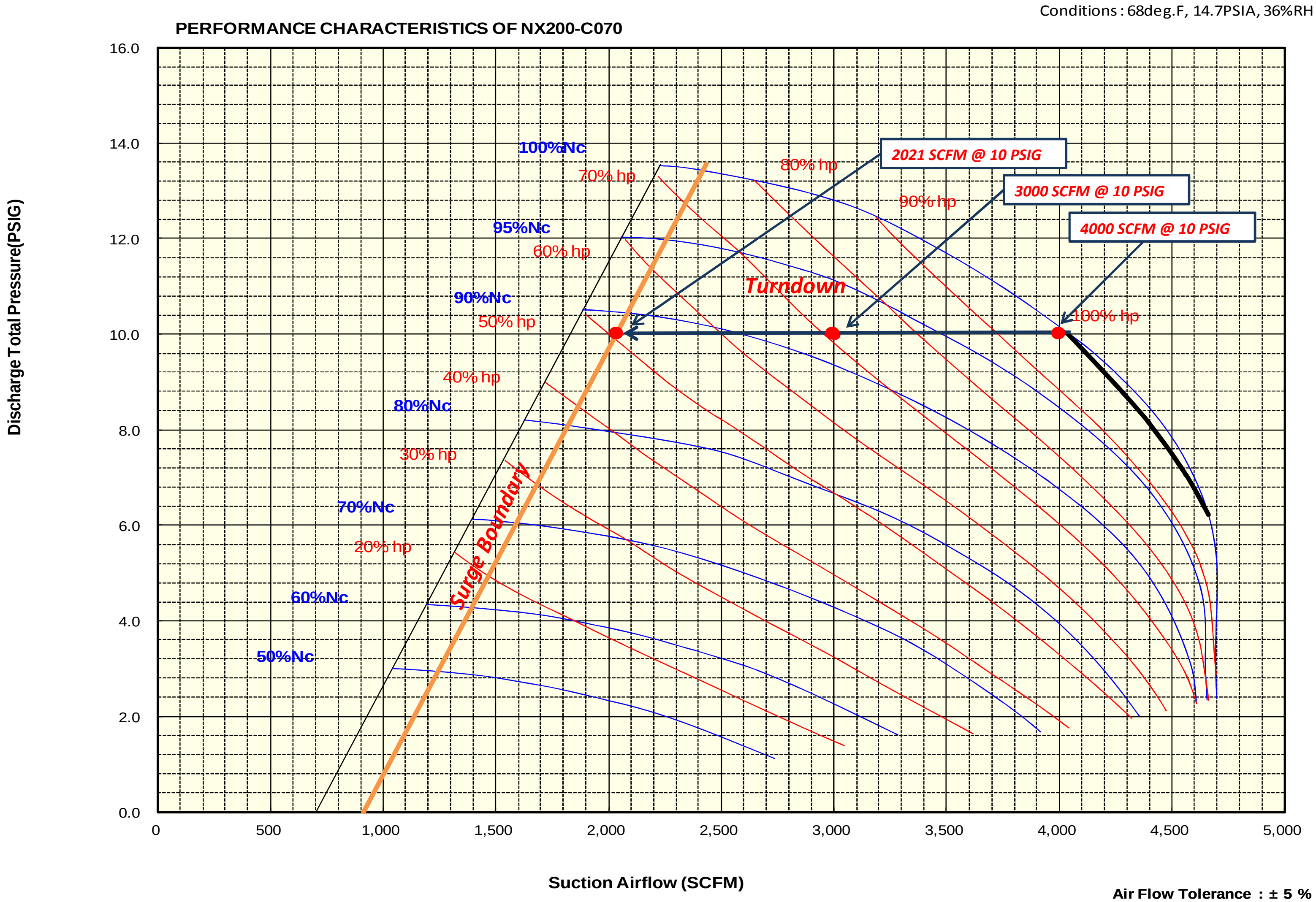
Pinole - APG - Neuros Turbo Blower - Performance Curves

NXMap Ver 4.94c



Air Flow Tolerance : ± 5 %

APGN proprietary Information

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APG - Neuros Turbo Blower - Blower Components

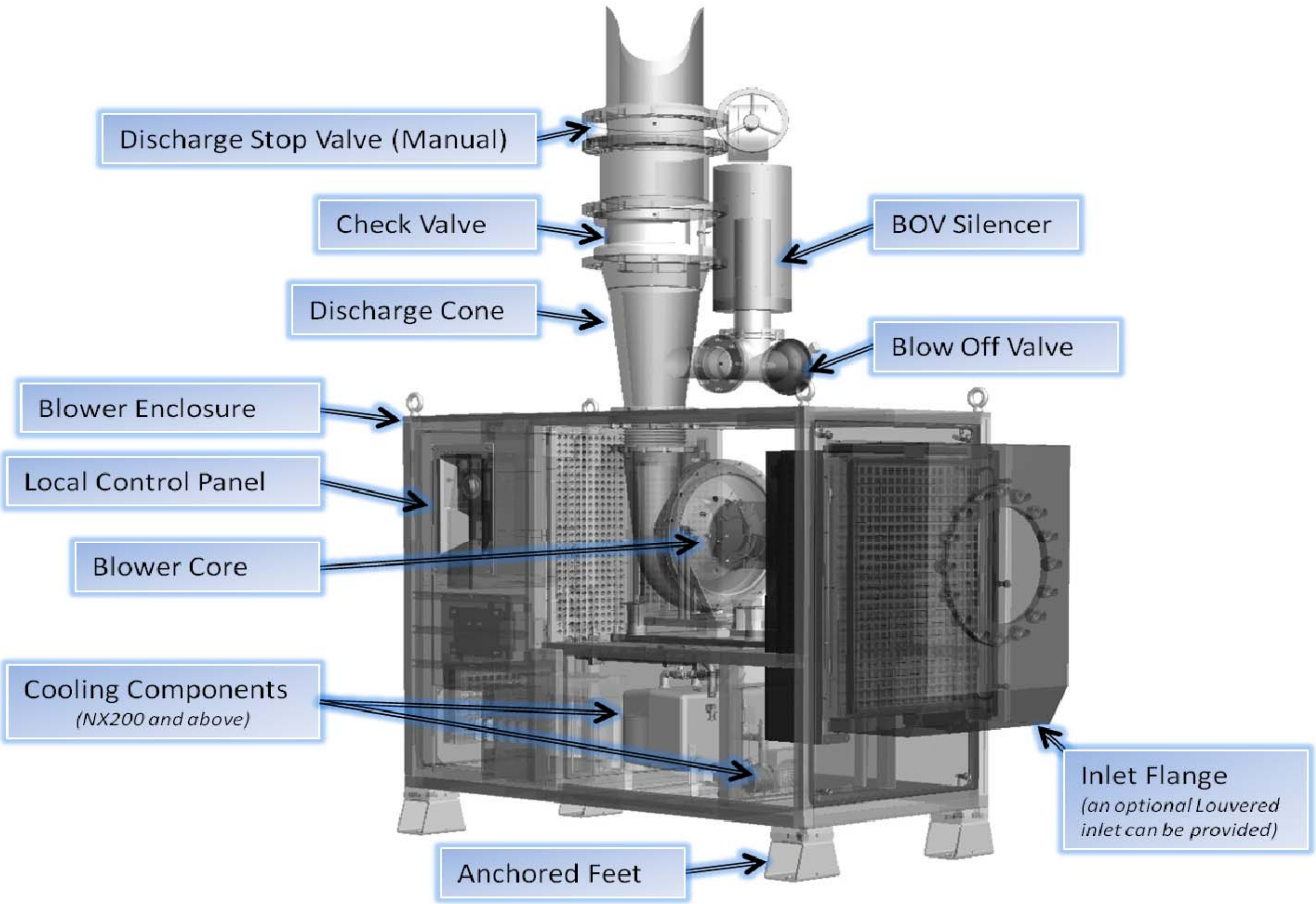

**Image is not project specific*.

APGN's proprietary Information

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Pinole - APG - Neuros Turbo Blower - Scope of Supply

APG-Neuros Inc., agrees to sell to the Buyer, the equipment designated as Included in the scope of supply below, subject to the Seller's General Terms and Conditions of Sales available upon request and special conditions outlined herein in this proposal.

1. Standard Turbo Blower Equipment *(Included)*

1.1 Blower Package

1. Blower Core with Permanent Magnet Synchronous Motor, Air Bearing and Forged Impeller
2. High Performance Variable Speed Drive / Inverter
3. Local Control Panel for Control and Monitoring, **A-B MicroLogix Case 2 PLC based**
4. Remote Control capability via Ethernet, LAN or Hard wiring
5. Built in Standard Sound Enclosure with Louver Intake
6. Temperature Sensors for motor, bearing, inlet and discharge air flow
7. Pressure Sensors for discharge conditions
8. Pressure Sensor and alert for air filter condition
9. Built in Flow Calculation
10. Built in Speed Measurement
11. Internal Expansion Joint
12. Internal vibration and dynamic effect Absorption Mounts
13. Line Input Reactor to maintain high power factor
14. Sinewave (Sinus) Filter
15. Built in Air Filter to within ten micron filtration

1.2 Standard Ship Loose Accessories

1. One (1) US Valve Wafer Style Discharge Check Valve **
2. One (1) DK T.M.I Discharge Butterfly Valve **
3. One (1) Maxi Joint EPDM Discharge Duct Expansion Joint **
4. One (1) Discharge Cone**
5. One (1) Blow-off Valve to blow off air flow during start / shutdown
6. One (1) Blow-off Silencer

***Sizes as indicated on the performance data sheet.*

2. Equipment Adders

A - Master Control Panel to operate multi-blowers *(Not Included unless specified in Price sheet)*

1. Complete standalone computer system, built with its own state of the art technology microprocessor in a self contained enclosure.
2. MCP operates based on input and output signals to control on line blowers and other flow equipment based on command point

B - Harmonic Filters *(Not Included unless specified in Price sheet)*

1. Meets IEEE 519 standards for <8% THD or 5%THD
2. Can be Included inside the blower enclosure or as a stand alone unit
3. Upgrade to install Harmonic Filters inside the blower enclosure

Model	Price Adder (per unit)
NX200	$4,000

C - Vibration Sensor *(Not Included unless specified in Price sheet)*

1. Vibration sensor comes with transmitter and display screen

Model	Price Adder (per unit)
NX200	$2,750

D - Enclosure Options *(Not Included unless specified in Price sheet)*

1. Upgrade to a complete 316 Stainless Steel Enclosure

Model	Price Adder (per unit)
NX200	$5,500

E - Uninterruptable Power Supply (UPS) *(Not Included unless specified in Price sheet)*

1. Provide a 10 minute UPS internal to the blower enclosure
2. The UPS is connected to the Blower PLC only.

Model	Price Adder (per unit)
NX200	$2,800

4. Standard Documentation *(Included)*

A. Submittal Information: PDF Electronic File

1. Bill of Material
2. Installation Drawings
3. Electrical and Control Drawings
4. Operation and Maintenance Manual
5. Commissioning Instructions

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Pinole - APG - Neuros Turbo Blower - Scope of Supply

B. Standard Tests

1. Standard Blower Package Functional Acceptance Test ***included***

2. PTC-10 Factory Performance Test - available for additional cost upon request

3. Optional Functional tests with Plant LC - available for additional cost upon request

4. Optional Aeration System Control functional system test - available for additional cost upon request

For any Factory witnessed testing or additional tests, please contact APG-Neuros for a price quote.

5. Spare parts (on site)

A. One set of spares

1. One (1) set of Air Filter Elements

6. Quality Assurance and Control and Product certification

A. Neuros Quality Assurance program is ISO 9001 certified on the basis of Neuros Co. Ltd.

B. Neuros Turbo Blower is UL / CSA certified

C. Turbo Blower UL 1450 or UL508A certification is supplied as an option.

D. Turbo Blower is CE certification is supplied as an option.

7. Start-up and Factory Testing Service:

Unless inlcuded in the Price, start-up and operator training is available at US $2,000 per day plus travel and living expenses billed at cost, plus 10%. Advance notification of 15 working days is required for scheduling.

8. Proposal Validity and Seller Terms and Conditions

A. Unless otherwise specified elsewhere in the Sales Agreements, the prices in this proposal are valid for ninety (90) days from the issue date on the cover page.

B. This proposal, unless otherwise specified herein this document, is subject to the Seller's General Terms and Conditions of Sales available upon request.

9. Payment Terms:

Payments shall be made as follows:

15% upon issuance of shop drawings

75% at delivery to Jobsite or offer to ship based on agreed upon schedule

10% upon Start-up, no later than 90 days after Delivery

All invoices are paid Net 30 Days

1.5% Interest charge per month will be added to past due accounts.

Letter of Credit listing draw of payments against above deliverables will apply for Sales outside US and Canada.

100 % of invoice amount shall be payable by bank wire transfer without deduction and to be paid Net 30 days after invoice date.

Payment shall not be dependent on the buyer being paid by any third parties or equipment acceptance by owner.

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Pinole - APG - Neuros Turbo Blower - Scope of Supply

10. Submittals or Shop Drawings:

Submittal package will be provided within 3-4 weeks after acceptance of the Purchase Order by APG-Neuros.

11. Shipment:

Shipping terms, unless otherwise stated in price details, shall be ExWorks Factory

Shipment will be made 16 weeks after acceptance of Purchase Order by APG-Neuros or 12-14 weeks after approval of Submittals, which ever occurs last.

Add Five percent (5%) escalation to Price for each partial or full quarter that shipment is extended beyond one year after order acceptance.

12. Warranty

A. Standard Warranty (INCLUDED)

Non pro-rated One (1) year from commissioning date or Eighteen (18) months from delivery, whichever occurs first.
Warranty will begin upon successful completion of start-up and certification for full-scale operation by APG-Neuros, or Eighteen (18) months after shipment, whichever occurs first. Under no circumstances will the warranty begin upon "beneficial use", completion of the project, or acceptance of the equipment as determin ed by the Engineer or End User.

B. Extended Warranty (OPTIONAL - Not Included)

Warranty extension available included in Maintenance Cost Guarantee program described in Item C below.

C. Maintenance Cost Guarantee (OPTIONAL - Not Included)

All inclusive maintenance and warranty cost coverage beyond first year is available at additional cost.

13. Technical and Spares Support

Technical service personnel as required to support start-up and technical service is available at additional cost.

14. Items Not Included:

Installation, main starters, anchor bolts, interconnecting pipe, Electrical & Control Items outside Blower Package, fittings, bolts, nuts, gaskets, wiring, valves, taxes and duties, or any other items not specifically listed above.

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Pinole - APG - Neuros Turbo Blower - Price

Budgetary Price (U.S. Dollars, 2012 Economy Year)

Tuesday, February 12, 2013

Standard Equipment Scope of Supply Price:

Application	Aeration
Blower Inlet Air Entry Type	Louvered
Total Quantity, Units	3
Model	NX200-C070
Design Condition, per Blower, SCFM	3000
Design Discharge Pressure, PSIG	10
Motor Rating, HP	200

Total Base Price $465,000

Notes

Unless otherwise specified else where in this proposal,

Shipping and Handling	**ExWork Factory**
Taxes and Duties are	**Not included**
Start Up and Training	**Not included**

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