Industrial Reuse Water Treatment Plant: Stage 1 Engineering Report

Prepared for

City of Quincy, Washington

June 2017

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List of Abbreviations

2008 FS	*Industrial Non-contact Cooling Water Feasibility Study Report*
2013 Draft ER	*Working Draft Industrial Wastewater Treatment Plant Engineering Report*
Access	Access Business Group, LLC
AKART	all known, available, and reasonable treatment
Aquatech	Aquatech, Inc.
BC	Brown and Caldwell
BOD	biochemical oxygen demand
BOD_5	5-day biochemical oxygen demand
BODR	basis of design report
C	chlorine
$CaCO_3$	calcium carbonate
CBP	Columbia Basin Project
CIEPS	Clarified industrial effluent pump station
CIP	clean-in-place
City	City of Quincy
CoC	cycle(s) of concentration
COD	chemical oxygen demand
CT	contact time
CWDP	central water demineralization plant
DOH	Washington State Department of Health
DMR	discharge monitoring report
Duraflow	Duraflow®, LLC
Ecology	Washington State Department of Ecology
ER	engineering report
FS	Feasibility Study
ft^2	foot/feet squared
ft^3-d	cubic feet per day
GMF	granular media filtration
gpd	gallon(s) per day
gpm	gallon(s) per minute
HES	high-efficiency softening
HERO	high-efficiency reverse osmosis
HRT	hydraulic retention time
HSW	highly softened water
IFE	industrial filtered effluent
IRW	industrial reuse water
IRWTP	industrial reuse water treatment plant
IWTP	industrial wastewater treatment plant
IX	ion exchange
lb/d	pound(s) per day
lb/hr	pound(s) per hour
LCS	laboratory control spike
LCSD	laboratory control spike duplicate
LOS	level of service
MF	microfiltration
MG	million gallon(s)
mgd	million gallon(s) per day
mg/L	milligram(s) per liter
Microsoft	Microsoft Corporation
MPN	most probable number
MWH	Microsoft's west campus data center in Quincy
MWRF	municipal water reclamation facility
N/A	not applicable
NAICS	North American Industry Classification System
NEPA	National Environmental Policy Act
NH_3	ammonia
NH_3-N	ammonia-nitrogen
NM	not measured
NO_2-N	nitrate-nitrogen
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
OTR	oxygen transfer rate
Outfall Plan	*City of Quincy Industrial Wastewater New Outfall Development Plan*
P	phosphorus
PE	Primary effluent
PFD	process flow diagram
P&ID	process and instrumentation diagram
PMAC	*Plan to Maintain Adequate Capacity*
PO_4-P	phosphate
psig	pounds per square inch gauge
Q1W	Quincy 1Water Utility
Q1W Plan	Quincy 1Water Plan
RCW	Revised Code of Washington
RFB	reuse filter building

RO	reverse osmosis
RW	reclaimed water
SBR	sequencing batch reactor
scfm	standard cubic foot/feet per minute
SDI	silt density index
SEPA	State Environmental Policy Act
SIC	Standard Industry Classification
SiO_2	silica
SPCC	spill prevention, control, and countermeasure
SWPPP	stormwater pollution prevention plan
T	disinfection time
TDS	total dissolved solids
TH	total hardness
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
UF	ultrafiltration
USBR	U.S. Bureau of Reclamation
WAC	Washington Administrative Code
WCTI	Water Conservation Technologies, Inc.
WRIA	water resources inventory area
WSB	water softening building

Section 1

Introduction

This engineering report (ER) describes the Stage 1 implementation of an industrial reuse water (IRW) source to replace groundwater as a feed into the City of Quincy's (City's) existing central water demineralization plant (CWDP). A portion of the biologically treated secondary effluent from the City's industrial wastewater treatment plant (IWTP) will be intercepted and fed into a new industrial effluent filtration plant (IEFP). IRW will replace the City's groundwater supply as the primary source for the CWDP. The IEFP improves the quality for feed into the CWDP, which will be initially used to supply cooling water to industries. Whether IRW or groundwater, the CWDP has the primary function of reducing total dissolved solids (TDS) in cooling water and wastewater flows, primarily to and from data centers, respectively. Together, the IEFP and CWDP form the IRWTP. For an interim period, data centers are planned to continue discharging to the City's sanitary sewer system and the municipal water reclamation facility (MWRF) and its groundwater percolation beds.

Thus the basis of this Stage 1 ER is the production of a IRW to supply industrial cooling systems while addressing groundwater antidegradation and general performance and capacity at the MWRF. The ER basis is not related to the existing IWTP National Pollution Discharge Elimination System (NPDES) permit. IRWTP redundancy is addressed by the use of groundwater as a backup water supply.

As shown in Figure 1-1, the IRWTP collects water diverted from upstream of the final treatment processes at the IWTP. Following reuse treatment, part of or most of the TDS will be removed from the stream. It will then be used by Microsoft Corporation (Microsoft), and it will be used to blend with MWRF effluent to create a combined stream with lower TDS than the MWRF currently produces. This report describes the operations for cooling water TDS control, but also develops the framework and terminology for expansion of the system as part of the Quincy 1Water Utility (Q1W).

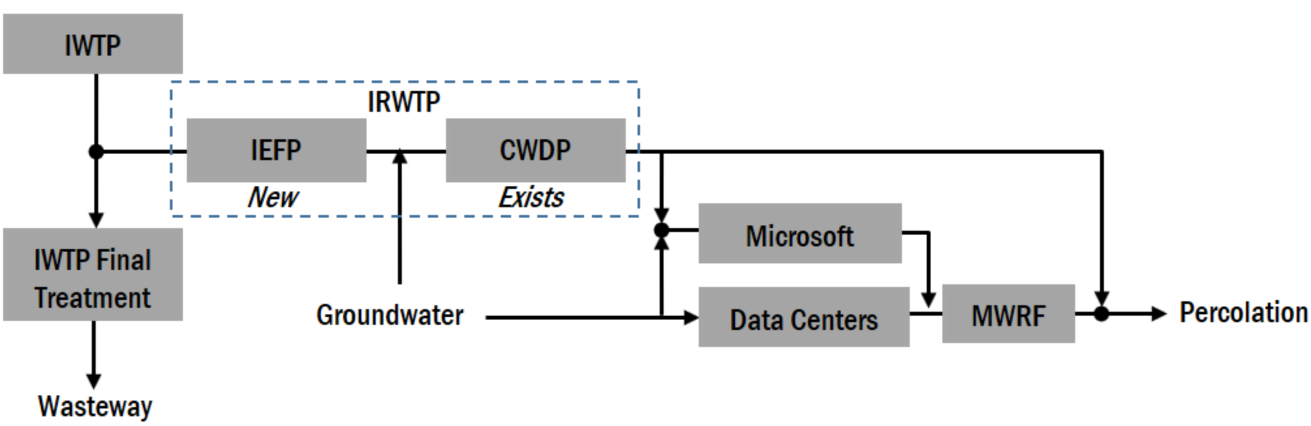

Figure 1-1. City IRW fundamental flow diagram

1.1 Background

The City is experiencing industrial and data center growth, which is creating new wastewater treatment needs and increasing the demand on its water supply. In response to these needs and in support of related regulatory changes, the City developed the Quincy 1Water Plan (Q1W Plan) from which the Q1W will be implemented. The major new components of the Q1W will service primarily private industries. The largely non-residential aspects of the Q1W are not governed by comprehensive or facility planning processes. The Q1W Plan was conceived during monthly planning meetings involving the City, the Washington Department of Ecology (Ecology) and the U. S. Bureau of Reclamation (USBR). Its purpose is to describe a unique utility and it is not an officially sanctioned document per Washington State regulations. It is being used primarily as a development guide for the City and interested stakeholders. Other City planning documents will likely rely on the content of the Q1W Plan until such time as a formal comprehensive planning document takes its place.

This ER is for a Stage 1 implementation of reuse treatment as fundamentally presented in Figure 1-1, above. Collectively, reuse treatment and TDS control form an industrial reuse water treatment plant (IRWTP) as defined in the Q1W Plan. The Stage 1 IRWTP will be implemented for primary service to data center cooling systems, which have significant water demands as a portion of the City's current demand, and generate wastewater—known as blow down—which is considered incompatible for long-term discharge into the City's sanitary sewer system and MWRF. This is because the MWRF, which produces Washington Class A reclaimed water (RW), discharges to percolation beds that require that TDS loadings be limited based on TDS antidegradation control in the aquifer below the beds. The MWRF does not provide the type of treatment required to remove the high TDS content that comes from cooling systems. In addition, data center wastewaters cannot be permitted for discharge into the IWTP because it is currently discharging under an agricultural exemption for discharge to an irrigation ditch.

These constraints were acknowledged in the *Industrial Non-contact Cooling Water Feasibility Study* (2008 FS), which identified TDS reduction via demineralization water treatment technologies as a solution (BC 2008). Water softening is also a key technology. As long as the City has adequate groundwater supply, the technologies can be applied to the treatment of the City's groundwater. In fact, the City has already installed or is installing these technologies for initial use for data center cooling water supply from the City's groundwater. The technologies allow cooling systems to either operate with very high TDS and very low flow rate discharge of brine to the evaporation ponds, or to operate with moderate discharge flow rates and TDS levels that can be compatible with the MWRF and percolation beds. The technologies themselves generate residual brine streams that are discharged to evaporation ponds, from which highly concentrated brine is hauled, solidified, and landfilled, or recovered for beneficial use. Demineralization, water softening, and evaporation ponds are already solving some of the problems identified in the 2008 FS. However, the City's groundwater supply is limited and IWTP effluent was identified as a new water source in the 2008 FS.

The IWTP treats wastewater generated by food-processing facilities located in Quincy (see Figure 1-2, below). The IWTP does not have demineralization technologies available. The IWTP is permitted to discharge under Ecology NPDES Waste Discharge Permit WA-002106-7 to an irrigation drainage ditch, or wasteway. Wasteway operation and use is also regulated by the USBR. Because USBR requires that discharges to the wasteway eventually be eliminated during the next 2 to 10 years, and because the City is seeking a new water source for industry, the City is developing the IRWTP to also allow the diversion of all flow out of the wasteway under a future, Stage 2 operation.

The Stage 1 IRWTP will treat IWTP effluent to produce IRW for feed into the existing CWDP followed by distribution to local users. Stage 1 of the IRWTP capacity will be almost entirely dedicated to Microsoft's cooling water demands at its two Quincy data center campuses. The IRWTP capacity will be expanded during the period in which wasteway discharge is being phased out. Early Stage 1 operations will also allow months of IRWTP tuning and optimization prior to Stage 2 full-scale operation. Once Stage 2 is complete and IWTP discharge to the wasteway is eliminated, the agriculture exemption limitations for use of the IWTP will be lifted, and all industrial discharge, including data center blow down, that is currently going to the MWRF can be rerouted to the IWTP—recovering MWRF capacity for use by residential and commercial customers.

In early 2012, Ecology renewed the IWTP NPDES permit. The renewed permit included a condition that the City prepare and submit an ER describing changes to the City's systems that are required to terminate the discharge of wastewater from the IWTP to the USBR wasteway. That ER will be for the future Stage 2 system and will contain all applicable requirements listed in Washington Administrative Code (WAC) Section 173-240-130 for industrial facilities. This Stage 1 ER is part of stepwise due diligence activities required by the USBR to indicate that Stage 2 performance will eventually be achieved.

In preparation for a September 2015 exit from the wasteway, the City submitted the *Working Draft – Industrial Wastewater Treatment Plant Engineering Report* (2013 Draft ER) in November 2013, which covered the construction of an IRWTP large enough for use of full IWTP effluent flow via industrial reuse, groundwater recharge, and crop irrigation (City 2013). Subsequently, the City and USBR, in coordination with Ecology, allowed an extension of the exit date well beyond the original deadline. The extension allows more time for capital planning of the projects and to develop enough water use to receive full IWTP secondary effluent flow. There is currently not enough demand for all IWTP effluent because two main uses, groundwater recharge and crop production, are not in place. Thus, the IRWTP will be constructed in stages that are appropriate for growing demands. As noted in Section 11, more IRWTP capacity will be brought online as IRW demands increase.

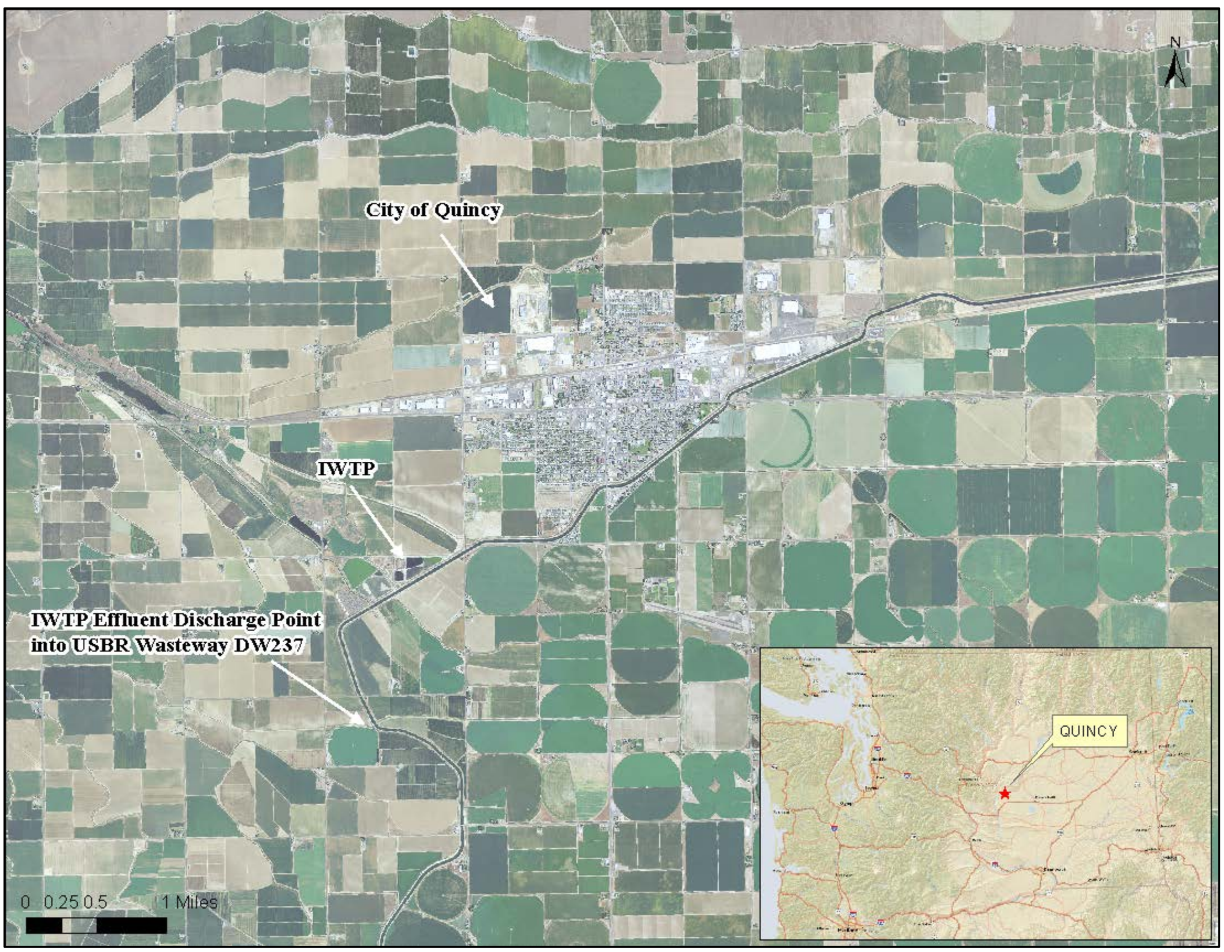

Figure 1-2. Vicinity map

1.2 Objectives of Reuse

The following are drivers for implementation of the reuse system:

- Meeting industrial water demands by augmenting the City's available groundwater supply with IRW for applications such as cooling where reuse water is suitable
- Implementing the reuse system in a manner consistent with the treatment of industrial effluent needed for other future uses
- Producing a low TDS water supply that will allow data centers to continue to discharge to the MWRF, mitigating the discharge impact on the MWRF percolation system
- Eventually eliminating IWTP effluent discharge from the wasteway
- Freeing up the IWTP for use by diverse industry, not restricted by wasteway use, thereby recovering capacity at the MWRF when industrial discharge is removed from the MWRF

The data center high TDS issue could be resolved separately from the IWTP discharge termination issue by using groundwater for cooling, and a dedicated utility and treatment system for non-contact cooling water. It was recognized in early planning of the data center solution that the technologies that are needed to treat IWTP effluent to allow wasteway exit are essentially the same as those needed for TDS control in the groundwater supply to cooling systems.

Water softeners, reverse osmosis and brine ponds (i.e., the CWDP) have been put in service already to support cooling water supply. The remaining treatment upgrades will allow IWTP effluent to replace groundwater as feed water to those technologies. The result is a holistic, regional solution that addresses not only the wasteway discharge issue, but also water supply and groundwater TDS issues. These project drivers have been incorporated into the level of service (LOS) goals for the system described below.

In addition to the requirement to submit an ER, the IWTP NPDES permit includes a condition requiring the City to prepare and submit a plan for ceasing discharge to the USBR wasteway. A report titled *City of Quincy Industrial Wastewater New Outfall Development Plan* (Outfall Plan) was submitted to Ecology on December 31, 2012, to satisfy this requirement (BC 2012). The Outfall Plan has been heavily revised and then superseded by the holistic *Quincy 1Water Utility Plan* document, which is periodically updated to acknowledge plan revisions.

1.2.1 Prior Planning

The 2012 Outfall Plan, the 2013 Draft ER, and the Q1W Plan have reported on analyses of alternatives for removal of the IWTP discharge from the wasteway within the context of Quincy's overall water cycle, and have considered the relationship between IWTP influent and discharge and the City's other water utilities, including municipal wastewater, reclaimed and reuse water, and groundwater. The plans and reports described beneficial uses including industrial reuse, agricultural reuse (i.e., irrigation), and shallow groundwater recharge through percolation beds, drywells, and direct aquifer injection to replace the wasteway discharge. Past work indicated that the necessary level of treatment could be achieved by augmenting the existing IWTP biological treatment system with granular media filtration (GMF) or membrane ultrafiltration (UF) and a sidestream demineralization system consisting of high-efficiency ion exchange (IX) based high-efficiency softening (HES) and reverse osmosis (RO). The softening step may occur with a combination of lime softening and resin softening. Both conventional RO and high-efficiency RO (HERO) have been considered. Because of patent and licensing limitations, HERO was eliminated.

None of the prior planning documents, all of which were submitted to Ecology, have been formally reviewed. However, Ecology is at least familiar with the evolution of the IRWTP and the treatment unit processes. This Stage 1 ER remains consistent with the past technology selections.

This ER refines and further develops determinations in past documents and does not repeat past decision-making analyses, except as noted. Past plans are summarized and included by reference in this document where the discussion or conclusions that are presented are relevant to this ER. New analyses and discussion in the ER will focus on water quality and quantity, unit process capacity, infrastructure, operation and management, and regulatory issues directly related to the IRWTP.

1.2.2 Engineering Report Basis

A principal ER objective is defined in WAC 173-240-130(1), which states: "The engineering report for an industrial wastewater facility must be sufficiently complete so that plans and specifications can be developed from it without substantial changes." However, this ER describes the operation of a reuse water treatment system (the IRWTP) as a source of water to primarily the Microsoft cooling towers, and of demineralized water to control TDS at the MWRF percolation system.

Although it is acknowledged above that this operation is planned as an interim step in addressing the IWTP wasteway issue, for the purposes of this Stage 1 ER, the IRWTP is not considered a component or unit process of the IWTP. Essentially, Stage 1 IWTP operation is not dependent upon the IRWTP. IRWTP operation assumes that the IWTP produces a manageably consistent secondary effluent water quality to supply the IRWTP. City groundwater is considered a back up to the supply if the reuse water quality is momentarily unacceptable or otherwise unavailable for IRWTP feed.

The sequence of treatment processes for reuse water to be supplied to data centers and the MWRF percolation beds includes lime softening combined with coagulation and sedimentation, followed by UF. These form the IEFP. Sidestream treatment with HES and RO (the CWDP) provide demineralization. Based on using Washington State Class A RW treatment requirements as a standard, the stream is considered to be IRW after UF treatment and matches the Class A requirements for use in cooling towers and groundwater percolation. The UF system will discharge into a 200,000-gallon clearwell.

In addition to the need for coagulation and filtration, the high total hardness (TH), silica, and TDS concentrations of either the reuse water or groundwater, and the high phosphorus (P) concentration in the reuse water require:

- Softening and silica and P removal to control the scale in the cooling systems
- TDS removal in reuse water that is conveyed directly to the MWRF percolation beds to meet groundwater antidegradation requirements
- TDS removal in the cooling feed to limit TDS in blow down that is sent to the percolation beds

Lime softening will remove essentially all of the P, most of the TH and silica, and a portion of the TDS. Further reduction or polishing of these constituents will be provided for by HES (for TH) and RO (for silica and TDS). If reuse water is not available, groundwater will be fed into the UF clearwell and then to HES and RO to achieve the same level control as with reuse water. Because aquifer antidegradation at the MWRF percolation beds already needs to be addressed and the reuse water will not be available for approximately 1 year, groundwater will be used in the interim to feed the clearwell. Thus, from the clearwell and downstream, the pre-Stage 1 and Stage 1 operations are for the benefit of the MWRF as it pertains to antidegradation and non-contact cooling water flow limits. The use of demineralized water for antidegradation was described in the *Plan to Maintain Adequate Capacity* (PMAC), as was the continued discharge of data centers until such time as other blow down discharge options are developed (BC 2011a).

The partially demineralized IRW that is delivered directly to the percolation beds for TDS antidegradation is primarily a service to high-TDS data center dischargers into the MWRF. In this sense, Stage 1 IRWTP operation is partly governed by the MWRF state waste discharge permit, as well as the City's Industrial Pretreatment Program. In addition, the Stage 1 IRWTP operation will be governed by the production of Class

A RW, as a regulatory basis, out of the UF system, possibly requiring reuse permits for feed to the cooling towers.

Ecology publication 05-10-014, *State Requirements for Submission of Engineering Reports and Plans for Industrial Wastewater Treatment Facilities*, further defines a "substantial change" as a change in the treatment process, design criteria and unit process sizing, project location, environmental impact of the project, or an increase in the total project cost (including design, construction, operation, and maintenance costs). If, after some period of operation, the IRWTP is considered as a means to increase IWTP capacity, the City may consider an IWTP permit modification at that time. For now, the Stage 1 IRWTP is not considered a part of the IWTP—it is a standalone system and does not cause "substantial change," or any change to the IWTP or its ability to meet the permit.

While this ER follows the framework set forth by WAC for industrial wastewater facilities, it does so due to a lack of other guidance related to this specific scenario. This ER acknowledges the following water reuse distinctions:

- **RW:** Reuse water originating from sanitary wastewater sources and receiving biological, coagulation, filtration, and disinfection treatment with uses specifically defined by the Revised Code of Washington (RCW) under four classes: Class A, B, C, D.
- **IRW:** Reuse water originating from industrial wastewater sources. Source industry types and treatment requirements are not defined, and classes are not assigned. This ER assumes that the lack of these definitions means that reuse allowances are on a case-by-case basis.
- **Water recycling:** Private industry may, within its footprint, use its waters and wastewater consistent with its internal water quality requirements. For example, an industry with an NPDES permit may scalp some of its effluent for housekeeping.

For the purposes of this ER and recognizing that the IWTP uses activated sludge biological treatment—which is essentially universally used for sanitary wastewater—the requirements for Class A RW are applied in the absence of definitive requirements. This approach does not assume that the concerns for use of reclaimed sanitary wastewater, such as exposure to human pathogens, apply in any way.

In summary, the basis of this Stage 1 ER is the production of a reuse water supply for industrial cooling systems while addressing groundwater antidegradation and general performance and capacity at the MWRF. The ER basis is not related to the IWTP permit, and IRWTP system redundancy is addressed by the use of groundwater as a backup water supply.

In addition to the requirements noted above, WAC 173-240-130 requires a range of specific information to be included in the ER. This includes production information from the processes producing wastewater; wastewater quantity and quality information; all known, available, and reasonable treatment (AKART) analyses; process sizing calculations, maps, and process flow diagrams (PFDs); outfall or land application information; solids analysis; and other information.

From these requirements, the primary objectives of the ER can be established. Broadly, the ER objectives are to: (1) evaluate IRWTP treatment technologies and residuals management options, and select one or more for use in Stage 1, which will allow partial reuse of the water currently discharged to the wasteway, and (2) develop the selected alternative to a level that is sufficient to serve as a basis of design. The following specific objectives for the ER fit within these two broad goals:

- Evaluate alternatives and select a preferred alternative:
  - Establish LOS goals for the IRWTP
  - Confirm that the existing IWTP produces sufficient effluent quantity of adequate quality to supply the IRWTP
  - Evaluate IRWTP treatment technologies and residuals management options

- Perform an AKART analysis of the alternatives and select a preferred alternative
- Sufficiently develop a preferred alternative to serve as a basis of design:
  - Establish design criteria and unit process sizing
  - Determine the project location
  - Develop PFDs and schematic maps
  - Analyze environmental impacts of the project
  - Estimate project costs
  - Establish beneficial reuse requirements for Stage 1 operations

1.3 Engineering Report Content

The content of this ER is included to meet the WAC requirements for IWTPs that are stated in WAC 173-240-130. Portions of the ER that address RW are intended to meet the requirements of WAC 173-240-060. Applicable WAC requirements and the corresponding ER sections are shown in Table 1-1.

Table 1-1. ER Requirements

WAC requirement		ER section
173-240-130(2)(a)	Type of industry or business	Section 2. Water Quality and Quantity
173-240-130(2)(b)	Kind and quantity of finished product	
173-240-130(2)(c)	Quantity and quality of water used by the industry and how it is disposed, including: • Process water • Domestic wastewater • Non-contact cooling water • Water consumed or lost to evaporation	
173-240-130(2)(d)	Amount and type of chemicals used in the treatment process	Section 3. Secondary Process Capacity Assessment Section 6. Selected Alternative: Process Description
173-240-130(2)(e)	Basic design data and sizing calculations	
173-240-130(2)(f)	Discussion of the suitability of the proposed site	Section 6. Selected Alternative: Process Description
173-240-130(2)(g)	A description of the treatment process and operation, including a flow diagram	Section 3. Secondary Process Capacity Assessment Section 6. Selected Alternative: Process Description
173-240-130(2)(h)	All necessary maps and layout sketches	
173-240-130(2)(i)	Provisions for bypass, if any	N/A
173-240-130(2)(j)	Physical provision for oil and hazardous materials spill control or accidental discharge prevention, or both	Section 2. Water Quality and Quantity
173-240-130(2)(k)	Expected results from the treatment process	Section 5. Water Quality Requirements Section 6. Selected Alternative: Process Description
173-240-130(2)(l)	Receiving water description	N/A
173-240-130(2)(m)	Detailed outfall analysis	
173-240-130(2)(n)	Relationship to existing treatment facilities	Section 6. Selected Alternative: Process Description

Table 1-1. ER Requirements		
WAC requirement		ER section
173-240-130(2)(o)	Publicly owned treatment works discharge information	N/A
173-240-130(2)(p)	Land application information	N/A
173-240-130(2)(q)	A statement expressing sound engineering justification through the use of pilot plant data, results from other similar installations, and scientific evidence from literature that the effluent from the proposed facility will meet applicable permit effluent limitations or pretreatment standards, or both	Section 6Selected Alternative: Process Description
173-240-130(2)(r)	A discussion of the final method of sludge disposal	Section 7. Residuals
173-240-130(2)(s)	A statement regarding who will own, operate, and maintain the system after construction	Section 9. Ownership, Operations, and Maintenance
173-240-130(2)(t)	A statement regarding compliance with any state or local water quality management plan or any plan adopted under the Federal Water Pollution Control Act, as amended	Section 10. Regulatory Issues
173-240-130(2)(u)	Provisions for any committed future plans	Section 11. Future Provisions
173-240-130(2)(v)	A discussion of the various alternatives that were evaluated	Section 5. Alternatives Evaluation
173-240-130(2)(w)	A timetable for design and construction	Section 8. Schedule
173-240-130(2)(x)	A statement regarding compliance with SEPA and NEPA, if applicable	Section 10 Regulatory Issues
173-240-130(2)(y)	Solid waste leachate treatment system information	N/A

1.4 Level of Service

LOS for a wastewater facility refers to the standard of service that a utility delivers to its customers, and how the overall performance goals of the utility will be achieved. LOS is usually expressed as quantifiable measures or goals that can be expressed in dollar terms. A sustainable LOS is one that can be delivered long term to a utility's customers at rates that are not overly burdensome to the customer base. A defined LOS provides an objective baseline by which decisions regarding which utility modifications to implement can be made.

LOS goals for the IWTP were developed in planning documents and through informal discussions with the City and Ecology between 2008 and 2012. LOS goals were documented in the Outfall Plan, and are described below:

- **Meet or exceed standards for water quality and the environment, including groundwater TDS:** Effluent from both of the City's wastewater treatment plants (the MWRF and IWTP) will be treated to meet or exceed the standards for water quality and environmental impacts. Additionally, the City will work to reverse the trend of increasing groundwater TDS at the MWRF percolation beds. Any new groundwater recharge will be treated to a level that does not degrade groundwater quality. The nominal TDS groundwater target is 500 milligrams per liter (mg/L), and for the purposes of planning, water recharged to groundwater will be treated to a TDS concentration of 500 mg/L or less.

- **Maintain sufficient capacity for existing industrial customers, and allow for growth or expansion:** The City will, at a minimum, maintain its industrial treatment capacity at a level that is sufficient to serve its current industrial customer base, plus a safety factor and growth allowance. New users may be added provided that they fit within the growth allowance. Significant flow and load increases because of new users would require increased overall capacity.
- **Develop a system that is expandable to accommodate new industrial customers:** To maintain a stable rate structure, the City's goal is to add capacity to the IWTP on an as-needed basis. This maintains equitable rates by requiring current users to pay for only the capacity that they use, while the costs for expansion will be offset by primarily connection and user fees for new users. The current biological capacity of the IWTP significantly exceeds the current flows and loadings. An expandable system means a system that can add tertiary or advanced treatment capacity and reuse capacity in a modular staged fashion, without having to fundamentally alter the nature of beneficial reuse or unit treatment processes.
- **Provide IRW to Microsoft:** By leasing and operating the IRWTP, the City gained the use of a significant piece of infrastructure that will help meet its capacity and water quality goals. In exchange, the City is obligated to provide an average of 0.26 million gallons per day (mgd) and 700 gallons per minute (gpm) of instantaneous flow to Microsoft, with quality standards as defined in the agreements and consistent with IRWTP capacity.

LOS goals for the IRWTP will be created for each stage. Stage 1 will be designed to produce a sufficient quantity and quality of IRW to supply Microsoft with cooling tower makeup needs projected to 2022. Stage 2 will be designed to generate IRW from all of the IWTP effluent and meet the water quality demands for each user of that water.

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Section 2

Water Quality and Quantity

This section describes the industries and businesses served by the IWTP, IRWTP, and MWRF, including the industrial production and water and wastewater quantities and qualities. This section is included to satisfy the ER requirements of WAC 173-240-130(2)(a) through WAC 173-240-130(2)(c), and WAC 173-240-130(2)(j).

2.1 IWTP Industrial User Overview

The IWTP serves two food processing facilities, Lamb Weston and Quincy Foods. A third industrial user, Access Business Group, LLC/Nutrilite (Access), currently discharges to the MWRF but will soon discharge its wastewater to the IWTP instead.

The industrial users of the IWTP and the types of facilities are summarized in Table 2-1.

Table 2-1. IWTP Industrial Users

User	Type of industry or business	SIC/NAICS code
Access	Herbal supplement manufacturing	325411 (NAICS)
Lamb Weston	Frozen potato products	2037 (SIC)
Quincy Foods	Vegetables, pasta, and rice processors	2037 (SIC)

NAICS = North American Industry Classification System, SIC = Standard Industry Classification.

2.2 Industry Production

Industrial production information is compiled from permit applications and information provided by industrial users. Production information is summarized in Table 2-2.

Table 2-2. Average Industrial User Production

User	Finished product	Quantity (tons per year)
Access	Botanical concentrates	150 [a]
Lamb Weston	Potato products	350,000
Quincy Foods	Vegetables	63,050

a. *Value was taken from the Access ER (Access 2016).*

2.3 IRWTP and MWRF Industrial User Overview

The IRWTP will initially serve three data centers: Microsoft, Intuit, and Sabey. It will also serve the general MWRF customer base and elevated TDS that might come from that base. Microsoft is the only currently planned direct consumer of IRWTP reuse water. The other data centers and customer base use groundwater—either from the City or private wells. Intuit and Sabey's discharge to the MWRF are permitted under the City's industrial pretreatment program. Microsoft's two data centers are transitioning their cooling system operations and will start to discharge to the MWRF under pretreatment permits that are currently being developed. Intuit and Sabey's TDS are not limited in their permits, and the TDS effects are compensated for by demineralized water that is delivered to the MWRF effluent. These TDS effects are compensated for by a TDS surcharge applied to Intuit and Sabey's sewer rates. Microsoft's permit will have TDS limits, either on a mass loading basis or concentration basis, and it is expected that demineralized blending with MWRF effluent will also be required to mitigate Microsoft's TDS effects. Microsoft will pay for reuse water and possibly a TDS surcharge.

2.4 Industrial User Water Quality and Quantity

This section describes the existing IWTP operations as it pertains to the effects on the production of secondary effluent that will feed the IRWTP, and on the available flow rate to satisfy the IRWTP water demands. Industrial user water quality and quantity data are compiled from IWTP discharge monitoring reports (DMRs), process control reports, and information provided by industrial users.

2.4.1 Process Wastewater

The analysis of process wastewater is based on historical influent flows and loadings from Lamb Weston and Quincy Foods. The City anticipates that Access, which currently discharges to the MWRF, will at some point in the future begin discharging to the IWTP. Process discharge from Access is expected to average less than 0.10 mgd (i.e., less than 2 percent of the IWTP's rated flow of 4.89 mgd); therefore, it is neglected in this analysis.

Table 2-3 below provides a summary of the total plant influent flows, loadings, and biochemical oxygen demand (BOD) and total suspended solids (TSS) loadings and concentrations from 2011 through July 2016. Figure 2-1 below shows the monthly average IWTP flows from the two food processors between 2011 and early 2016. The total plant influent flow follows a seasonal trend. The highest flows are in June through October, and there is an annual dip in July. As shown, the monthly average flows have remained well below the current rated maximum month flow of 4.89 mgd. The data also show increased flows in 2014–16 over the 2011–16 averages.

Figure 2-2 below shows the 2010–16 monthly average flows for each facility. The flows from Quincy Foods are seasonal, because the facility processes fresh vegetables immediately after harvest. In contrast, wastewater flows from Lamb Weston remain about the same throughout the year, because that facility processes potatoes, which can be stored after harvest. Thus, Lamb Weston provides the base flow to the IWTP, and Quincy Food provides the peaks. With monthly average flows from the two food processors ranging between 1.4 and 3.2 mgd, the addition of less than 0.1 mgd flow from Access will be insignificant.

Figures 2-3 and 2-4 below show 2010–16 monthly average loadings of BOD and TSS, respectively, from each facility. As with flow, Lamb Weston provides the base loading to the IWTP, and Quincy Food provides the peaks. In terms of total influent loadings (except in October 2010) both BOD and TSS loadings have stayed below the permitted maximum month loadings of 74,000 and 66,400 pounds per day (lb/d), respectively, although there are 2 months in 2012 when BOD or TSS loadings exceeded 90 percent of the permitted amounts.

Table 2-3. Quincy IWTP Influent Flows, Loadings, and Concentrations							
Parameter	2011	2012	2013	2014	2015	2016 [a]	Average
Total plant influent flow, mgd							
Annual average	2.01	2.05	2.09	2.18	2.33	2.28	2.16
Maximum month	2.83	2.83	3.08	3.08	3.19	2.99	3.00
Peak day	3.53	3.62	4.11	3.85	3.84	3.99	3.82
Total plant influent BOD loading, lb/d							
Annual average	34,234	38,496	44,724	38,384	42,267	45,483	40,598
Maximum month	52,224	66,823	78,269	71,775	73,001	59,536	66,938
Peak day	81,016	94,123	97,953	92,400	107,606	87,263	93,393
Total plant influent TSS loading, lb/d							
Annual average	31,090	34,892	34,013	37,785	35,692	77,252	41,787
Maximum month	51,046	61,172	53,207	72,165	49,406	91,671	63,111
Peak day	115,015	187,426	82,416	151,861	77,268	176,380	131,728
BOD concentration, mg/L							
Annual average	1,886	2,143	2,423	1,954	1,820	2,252	2,079
During maximum month flow (October)	1,809	1,812	2,567	2,498	2,593	-	2,256
During maximum month load (September)	2,192	1,920	2,803	1,997	1,810	-	2,144
TSS concentration, mg/L b							
Annual average	1,647	1,854	1,816	2,059	1,521	3,803	2,117
During maximum month flow (September)	2,101	2,484	1,614	2,782	2,436	-	2,283
During maximum month load (September)	2,101	2,484	1,614	2,782	2,436	-	2,283

a. *Through July 2016.*

b. *The maximum month flow and load occurred during the month of the September.*

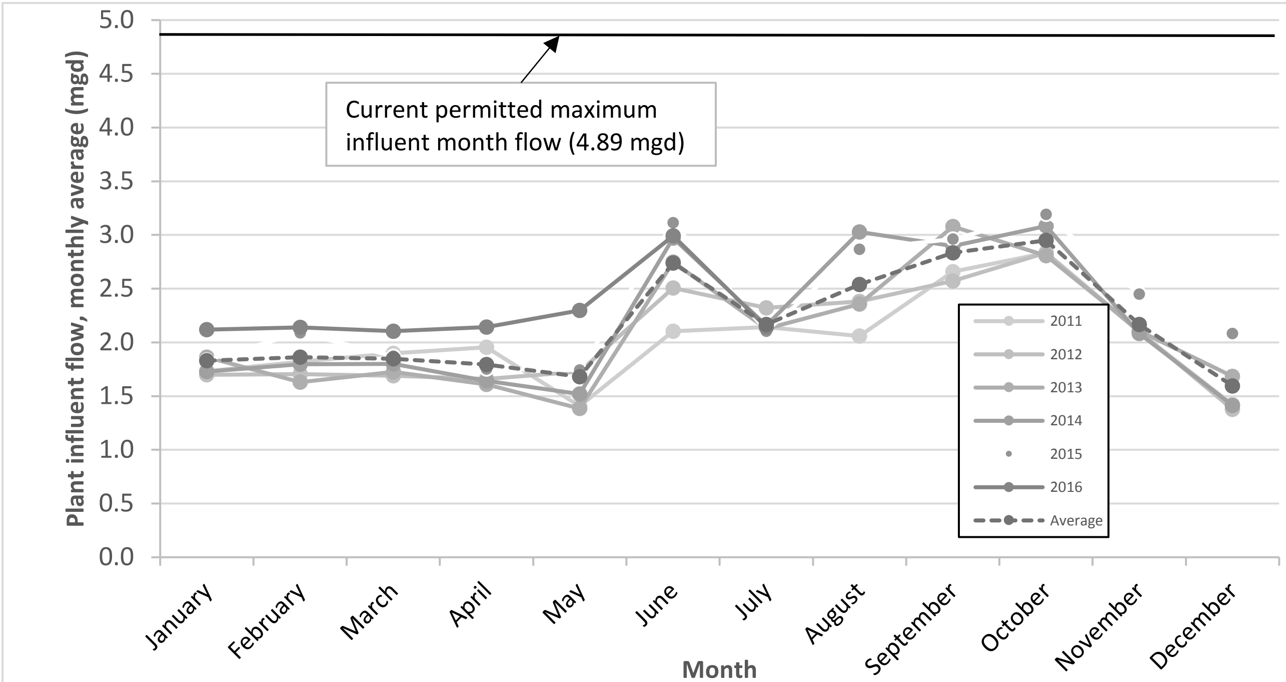

Figure 2-1. IWTP influent flows over time

Lines are progressively darker with time. The curves are nearly the same, indicating little year-over-year increase, but the darkest line (January–July 2016) is the highest.

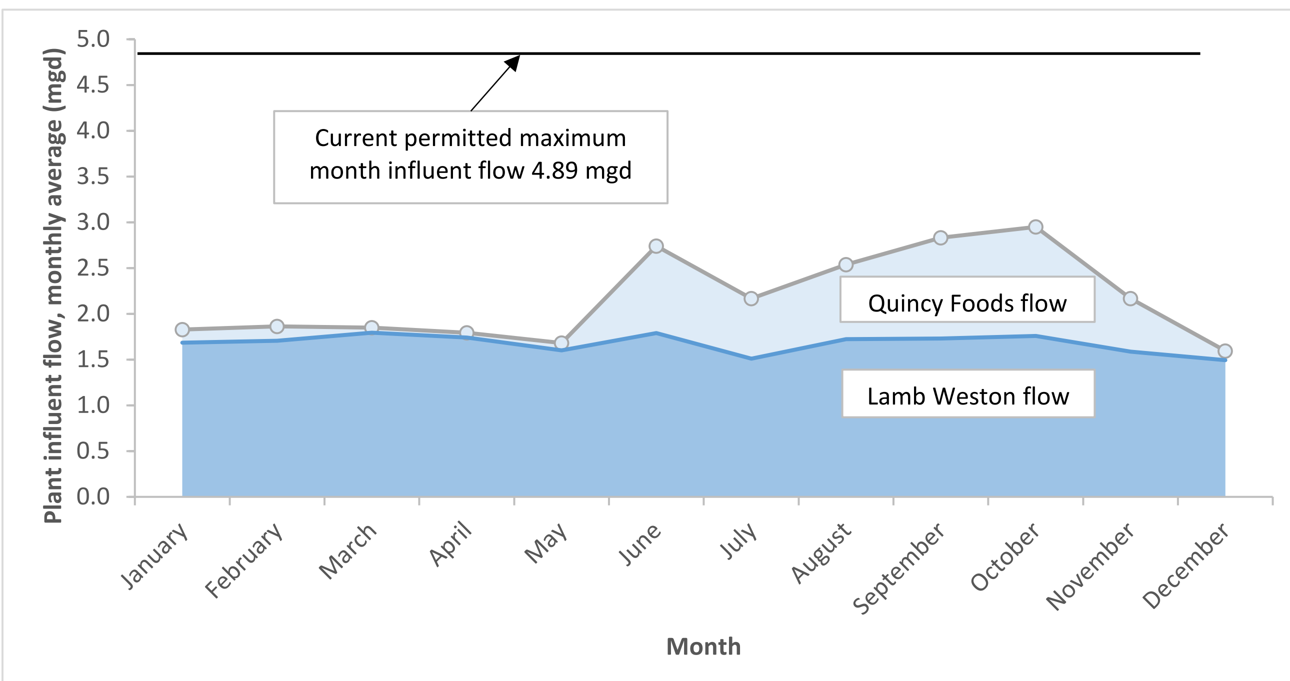

Figure 2-2. Sources of IWTP influent flow

Data shown are 2011–16 averages, except August–December, which are 2011–15 averages.
Lamb Weston provides a uniform base flow, and Quincy Food provides peak flows.

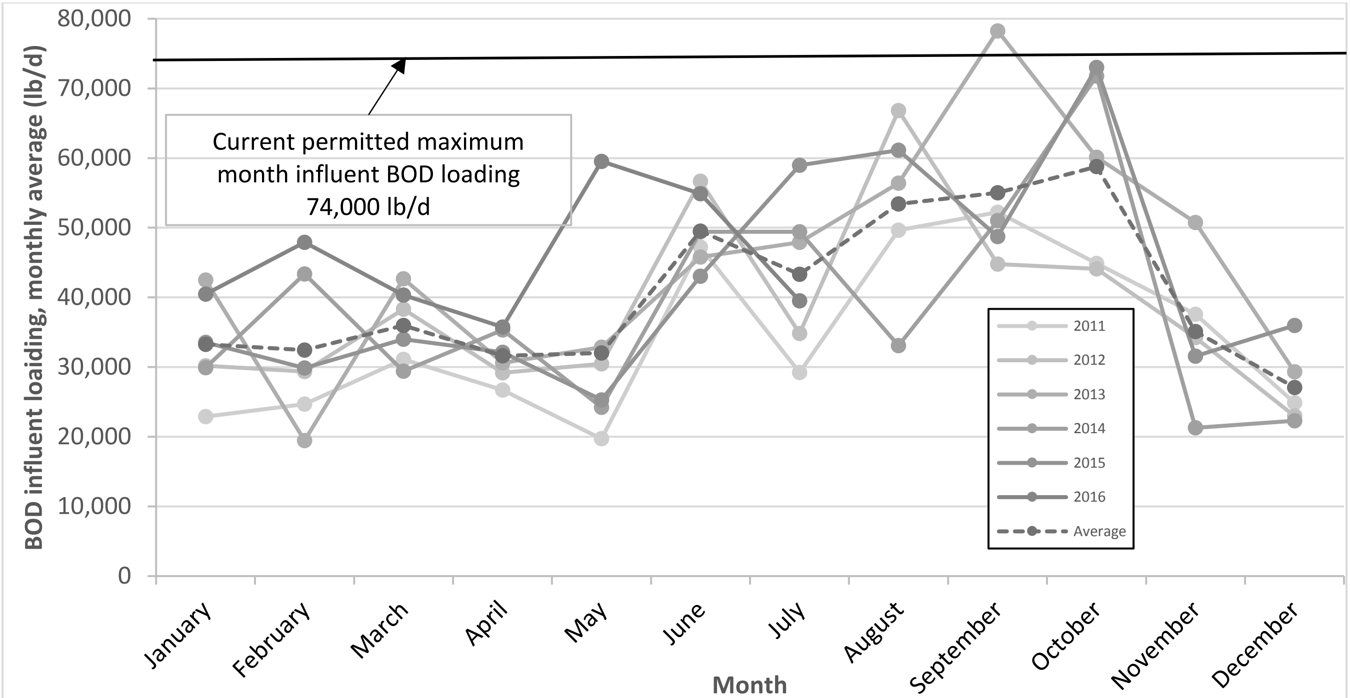

Figure 2-3. IWTP influent BOD loading over time

Lines are progressively darker with time. Note that the darkest line (January–July 2016) is the highest.

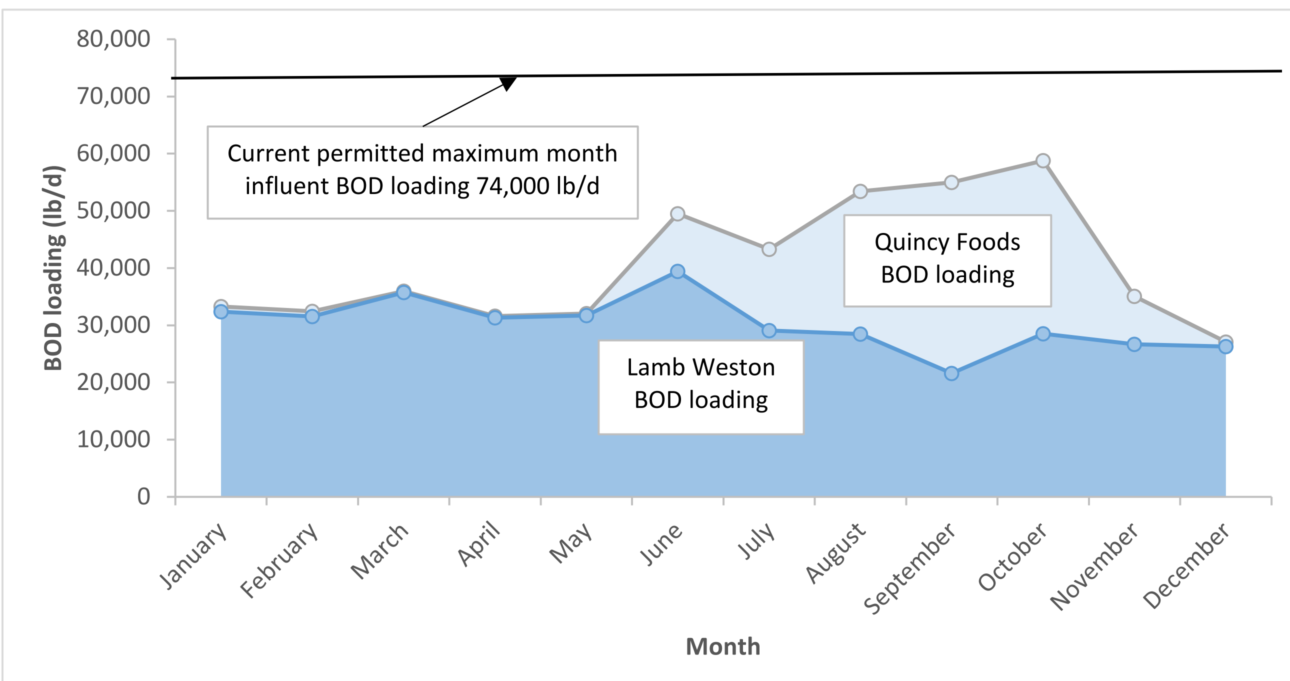

Figure 2-4. Sources of IWTP influent BOD loading

Data shown are 2011–16 averages, except August–December, which are 2011–15 averages.

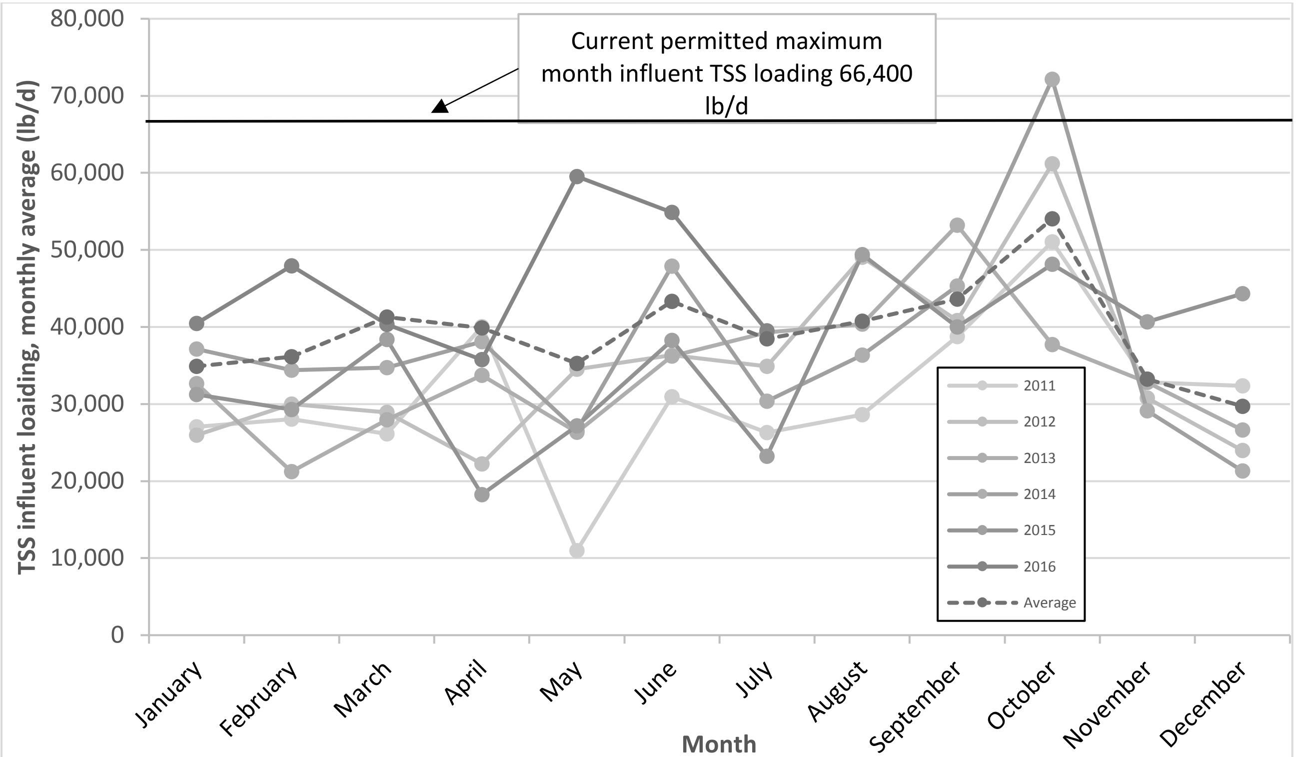

Figure 2-5. IWTP influent TSS loading over time

Lines are progressively darker with time. Note that the darkest line (January–July 2016) is the highest.

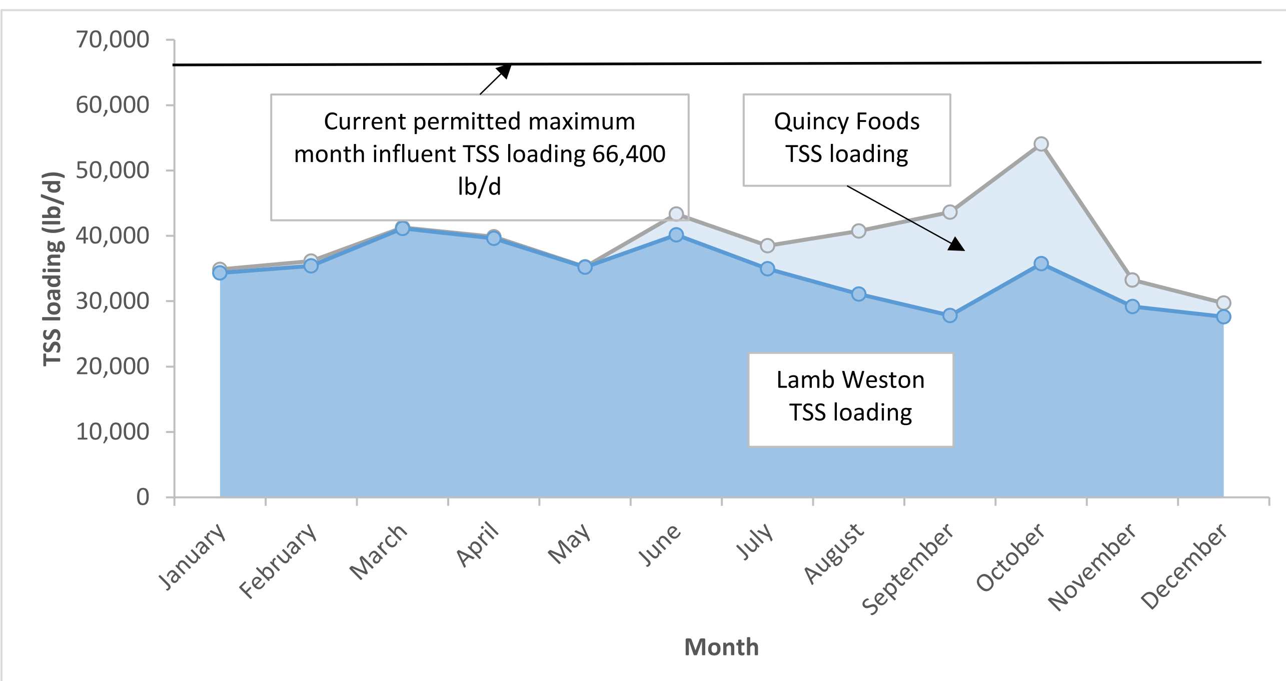

Figure 2-6. TSS loading to the IWTP

Data shown are 2011–16 averages, except August–December, which are 2011–15 averages.

2.4.2 Domestic Wastewater

Domestic wastewater from Access, Lamb Weston, and Quincy Foods is discharged to the MWRF and is not discussed within this ER.

2.4.3 Non-contact Cooling Water

Lamb Weston and Quincy Foods operate cooling systems that utilize non-contact cooling water. Access does not use non-contact cooling water.

Non-contact cooling water discharge volumes, which are estimated based on information provided by industrial users, are shown in Table 2-4.

Table 2-4. Non-contact Cooling Water

User	Average non-contact cooling water flow (gpd)
Access	0
Lamb Weston	141,000
Quincy Foods	168,000 [a]

a. Non-contact cooling water flow was not reported; it is estimated from the reported evaporation quantity and assumption of 3 CoC.

2.4.4 Evaporation and Water Losses

Evaporation is estimated based on information provided by industrial users. Quincy Foods does not operate processes that result in losses to evaporation. The cooling systems for Quincy Foods are operated by the adjacent Columbia Colstor facility. Evaporation losses are shown in Table 2-5.

Table 2-5. Evaporation from Industrial Users

User	Average evaporation (gpd)
Access	600
ConAgra Foods	106,000
Quincy Foods	110,000 [a]

a. Evaporative cooling systems are operated by the adjacent Columbia Colstor facility. Average evaporation from Columbia Colstor is estimated to be 21,000 gallons per day (gpd) based on reported blowdown flow and 3 CoC. Evaporation is assumed to be 2/3 of makeup flow rate.

ITWP effluent characteristics related to antidegradation and industrial reuse are listed in Table 2-6, below.

Table 2-6. IWTP SBR Effluent Composition				
Parameter	Units	Effluent composition		
		January 2008 [a]	December 2013 [b]	January 2016 [c]
pH	-	7.90	NM	NM
Total alkalinity	mg/L as $CaCO_3$	569	483	NM
TDS	mg/L	1,337	NM	NM
TSS	mg/L	37	NM	NM
Electrical conductivity	µS/cm	2,150	NM	NM
Ammonia	mg/L as N	0.47	NM	NM
Calcium	mg/L	44.70	65.00	54.90
Magnesium	mg/L	25.20	35.20	27.80
P (total)	mg/L	2.72	29.30	29.00
Potassium	mg/L	296	NM	262
Silica	mg/L as SiO_2	25.7	56.3	50.2
Sodium	mg/L	235.0	NM	169.5
Chloride	mg/L	281	NM	NM
Fluoride	mg/L	0.31	NM	0.22
Nitrate	mg/L	1.32	NM	61.20
Sulfate	mg/L	82.9	NM	55.3

NM = not measured.

a. *Average of seven samples collected 01/23/08–01/31/08.*

b. *Average of seven samples collected 12/19/2013.*

c. *Average of seven samples collected 01/20/2016.*

Note: January 2016 sodium results had a qualifier noting that the laboratory control spike (LCS) or laboratory control spike duplicate (LCSD) was outside of acceptance limits

For the purposes of this report, the TDS bases are:

- MWRF effluent TDS: 600 mg/L
- MWRF end-of-pipe antidegradation TDS: 500 mg/L
- IWTP sequencing batch reactor (SBR) effluent TDS: 1,400 mg/L
- Industrial reuse to groundwater (end of pipe): 500 mg/L

Industrial users will only be those that do not require a food-grade water source or other source for which human exposure is an issue. It is expected that industrial users will be primarily concerned with alkalinity, P, TH, and silica as they affect scale potential, pH control, and other factors. Control of these constituents has been addressed in the development of the IRWTP Stage 1 facilities.

Discharge to the MWRF percolation ponds is regulated on TDS and nitrate. As demonstrated in Section 3 below, nitrogen is controlled through the biological treatment processes. The SBRs provide denitrification, which produces an effluent that meets groundwater recharge limits. Also, RO in the IRWTP will further reduce the concentration of nitrate in water sent to the percolation ponds.

2.5 Spill Control and Bypass Provisions

Provisions for spill control for Lamb Weston, Quincy Foods, and Access are detailed in the stormwater pollution prevention plans (SWPPPs) and spill prevention, control, and countermeasure (SPCC) plans for those facilities. SWPPPs and SPCC plans are included as Appendix A.

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Section 3

Secondary Process Capacity Assessment

The biological treatment processes at the IWTP include a 24.3-million-gallon (MG) covered anaerobic lagoon and two SBRs. The former was converted from an existing solids storage lagoon in 2011. With the addition of the anaerobic lagoon—which replaced treatment by the primary clarifiers while also providing sludge treatment—the overall biological treatment performance and capacity have been changed. An evaluation was conducted in 2013 to determine the hydraulic and organic loading capacity of the biological processes, which will allow the City to determine the spare capacity that is currently available for new food processors. The assessment takes into consideration effluent quality that is compatible with the future downstream tertiary processes to produce RW. This section summarizes the results of the 2013 assessment. Flows have not changed significantly in the past 5 years (see Figure 3-1); however, BOD loading (Figure 2-3) and TSS loading (Figure 2-5) have increased somewhat, but the conclusions from the 2013 assessment have not changed. Details of the procedures and assumptions are given in a draft technical memorandum included in Appendix B. This section is included to satisfy the ER requirements of WAC 173-240-130(2)(d), (e), (g), and (h).

3.1 Anaerobic Lagoon Evaluation

The anaerobic lagoon was installed to serve in place of the former primary clarifiers to reduce the volume of solids for disposal and generate biogas for reuse. Biogas is currently not being reused—it is destroyed in a flare—but solids are being removed.

The anaerobic lagoon is a variation of the low-rate anaerobic treatment systems designed for treatment of food processing wastewaters, which have been in service throughout the world since the mid-1970s. Typical design criteria for this type of system include organic loading rates of 60 to 180 lb chemical oxygen demand (COD) per 1,000 cubic feet per day (ft^3-d) and a minimum hydraulic retention time (HRT) of 7 days. The minimum HRT criterion was developed to avoid washout of methanogenic bacteria, which may take about 8 or 9 days to form a stable population. For the anaerobic lagoon at the IWTP, assuming a minimum HRT of 7 days during the warmer months to maintain methanogenesis in the lagoon, the corresponding influent flow rate is about 3.5 mgd. Because biogas recovered from the lagoon is currently flared and not reused, complete digestion (i.e., methanogenesis) is not critical, so that the HRT design criterion is not considered a stringent requirement in assessing overall capacity of the biological treatment system, and the anaerobic lagoon could be fed more than 3.5 mgd. The system can currently handle up to 5 mgd, which is the lagoon effluent pump station capacity (3,475 gpm). In the future, when the biogas is beneficially reused, lagoon HRT could be manipulated to increase biogas production. However, increased biogas production would likely not be a preferred mode of operation if it limited IWTP secondary process treatment capacity.

Lagoon performance was evaluated based on sampling data collected in January, February, August, and September 2012 and March 2013. These sampling data are summarized in Table 3-1, below. The limited sampling data indicate a large variability in the lagoon effluent concentrations. Even between the data collected in January/February 2012 and those collected in March 2013, both of which were during the low production periods when there was little flow from Quincy Foods, there are significant differences in the concentrations of some of the constituents including COD, BOD, and TSS. The values for percent changes shown in the table indicate a significant reduction in COD and BOD in the lagoon. TSS reduction was more variable, averaging at 89 percent during the August/September period but only 43 percent during the March period. The data for both periods indicated considerable increases in ammonia and orthophosphate, as expected in an anaerobic digestion process. Large alkalinity increases were also measured.

Table 3-1. Summary of Anaerobic Lagoon Sampling and Performance

Parameter	January–February 2012	August–September 2012	March 2013
Lagoon Effluent Concentrations (mg/L) [a]			
COD	432 (356 to 503)	403 (281 to 480)	843
BOD	208 (164 to 260)	95 (80 to 108)	124
TSS	53 (40 to 68)	148 (90 to 181)	880
TKN	157 (149 to 162)	90 (72 to 101)	183
NH_3-N	96 (15 to 156)	82 (64 to 94)	137
NO_3-N + NO_2-N	-	≤ 0.1	≤ 0.1
TP	48 (42 to 54)	29 (24 to 31)	41
PO_4-P	39 (34 to 48)	27 (25 to 31)	39
Alkalinity	1,117 (1,070 to 1,170)	778 (714 to 818)	1080
Changes Across Lagoon [b]			
COD	-	- 91% (-87% to -97%)	-83%
BOD	-	-97% (-96% to -97%)	-94%
TSS	-	-89% (-84% to -96%)	-43%
TKN	-	-26% (-10% to -37%)	+60%
NH_3-N	-	+ 205% (+154% to +266%)	+759%
NO_3-N + NO_2-N	-	-76% (-36% to -96%)	-
TP	-	+41% (+21% to +55%)	+96%
PO_4-P	-	+105% (+26% to +129%)	+254%
Alkalinity	-	-	+558%

a. *Average concentrations (and ranges) shown for each sampling period. Only the average concentrations are shown for the March 2013 period because only two samples were collected.*

b. *Calculated percent changes between raw influent and lagoon effluent samples. A negative percentage indicates reduction and a positive percentage indicates increase.*

NO_2-N = nitrate-nitrogen, PO_4-P = phosphate, TP = total phosphorus.

3.2 Sequencing Batch Reactor Evaluation

There are two SBR basins at the IWTP. Each basin is operated in batch mode, with the influent flow directed alternately between SBR 1 and SBR 2. Each treatment cycle consists of the following steps or phases, with the current operating times in each phase:

1. Anoxic fill (mixers on, air off) (70 minutes)
2. React fill (mixers off, air on) (170 minutes)
3. React (mixers off, air on) (no feed) (70 minutes)
4. Settle (mixers off, air off) (no feed) (60 minutes)
5. Decant (mixers off, air off) (no feed) (110 minutes)
6. Idle (mixers off, air off) (no feed) (none)

Currently, the total cycle time is 480 minutes, and each SBR is operated for up to three cycles per day. Sludge wasting takes place at the end of the decant phase. The constant-speed waste sludge pumps transfer the sludge to the anaerobic lagoon for further treatment. The sludge can also be pumped to lagoon 3.

3.2.1 Sequencing Batch Reactor Operation

A portion of the flow from the primary plant is bypassed around the anaerobic lagoon, blended with lagoon effluent, and routed to the SBRs. The fraction of bypassed flow is not measured, but plant staff have estimated that it is about 30 to 40 percent of the influent flow. Because the lagoon removes a significant amount of organics but generates ammonia as a result of the anaerobic process, the COD-to-total-Kjeldahl-nitrogen (TKN) ratio decreases from the raw influent to the lagoon effluent, and there is less carbon available for denitrification. Bypassing flow around the lagoon increases the amount of carbon available for denitrification. It also allows adequate biomass growth for proper operation of the two SBR units, which is particularly critical during the parts of the year when COD loading is lowest. For calibration of the process simulator using the August/September 2012 sampling data (Appendix B), a bypass value of 23 percent was found to provide a good match of the measured and predicted values, and for the calibration using the March 2013 data, a bypass value of 20 percent was assumed.

Hydraulic capacity of the SBRs is constrained mainly by the decanter capacity. Each SBR is equipped with two decanters, each with a capacity of 4,500 gpm. This corresponds to a maximum decanting flow of 9,000 gpm per SBR. The influent flow limit on a continuous basis depends on the length of the decanting phase and number of cycles per day. For the current operation of three cycles per day per SBR and a decanting period of 110 minutes, the maximum influent flow is 5.94 mgd.

Organic and nitrogen loading capacities of the SBRs are mainly limited by aeration capacity. The aeration system consists of disc-type membrane diffusers in the basins that are fed by three multistage centrifugal blowers. The aeration blower capacity, based on the total capacity of two blowers (the third blower is used only as a backup) is 18,400 standard cubic feet per minute (scfm). The original design maximum month oxygen requirement was 70,714 lb/d, which corresponds to 17,400 scfm. It was assumed that the additional airflow available from the blowers allows the blowers to meet aeration requirements beyond the maximum month value. Therefore, for this analysis, the blower capacity was assumed to correspond to a field oxygen transfer rate (OTR) of 70,714 lb/d or 2,946 pounds per hour (lb/hr) on a maximum month basis after accounting for the diffuser efficiency, diffuser depth, alpha (i.e., the ratio of process to clean water OTR), and mixed liquor temperature. This is the maximum OTR during the period in each cycle when the SBR is aerated. The blowers provide air to only one SBR at a time.

3.2.2 Observed Sequencing Batch Reactor Performance

Figure 3-1 below shows the monthly average plant effluent BOD, TSS, and ammonia-nitrogen (NH_3-N) concentrations from 2010–16. The data indicate that while effluent BOD concentrations remained below 30 mg/L (except in December 2010, when it was 32 mg/L), effluent TSS concentrations fluctuated greatly and often exceeded 30 mg/L. NH_3-N concentrations remained below 2 mg/L, indicating near full nitrification in the SBRs, except in July and August 2011 when the NH_3-N increased to above 10 mg/L. The reason for this spike in NH_3-N concentration is not known.

Sampling data collected in August/September 2012 and March 2013 indicate a large variability in the effluent nitrate concentrations, with concentrations below 10 mg/L in the former period and concentrations above 60 mg/L in the latter period. Effluent alkalinity varied from about 300 to 500 mg/L as calcium carbonate ($CaCO_3$).

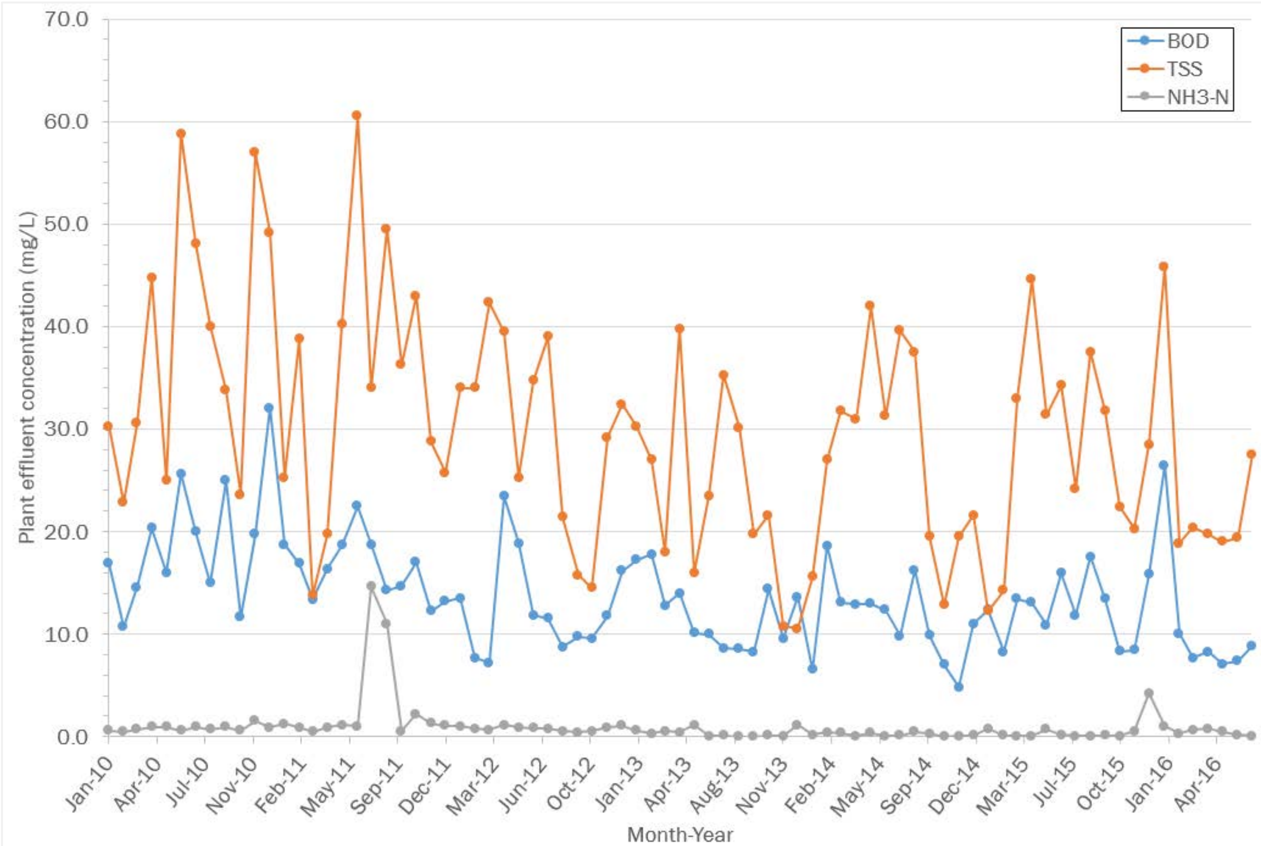

Figure 3-1. IWTP monthly average plant effluent concentration from 2010–12

3.3 Overall Biological Capacity Assessment

This section describes the assessment of the overall capacity of the existing biological processes, including both the anaerobic lagoon and the SBRs. The following five scenarios were evaluated:

1. Current rated flow and loadings with and without raw wastewater bypassed around the anaerobic lagoon
2. Current rated flow and higher loadings (per existing influent characteristics)
3. Current rated flow and maximum loadings for existing blower capacity
4. Maximum flow and loadings at three cycles per day per SBR
5. Maximum flow and loadings at four cycles per day per SBR

The wastewater characteristics and other assumptions used in the analysis are given in Appendix B. In all cases, it was assumed that the SBR effluent must achieve a monthly average effluent limit of 30 mg/L for both BOD and TSS and less than 10 mg/L for nitrogen. Turbidity and TDS requirements would be met by treatment in IRWTP facilities downstream of the SBRs. Because at least a portion of the plant effluent will be used for groundwater recharge at the MWRF percolation ponds, total nitrogen (TN) removal will be required, typically down to a TN concentration below 10 mg/L. The IRWTP RO system will remove nitrate, so the biological system does not need to achieve an effluent TN concentration below that level. It was assumed that if at least three quarters of the plant effluent will be treated in the RO process, which would remove almost all of the nitrates in that stream, then the maximum allowable nitrate level in the secondary effluent would be about 40 mg/L. A minimum alkalinity limit of 400 mg/L was assumed, which corresponds to the estimated alkalinity level for optimal operation of the potential lime-softening systems downstream of the SBR system.

Results of the analysis are summarized in Table 3-2.

Table 3-2. Summary of Biological Process Capacity Analysis

Raw influent wastewater				Anaerobic lagoon			SBR	SBR effluent			
Flow (mgd)	BOD (lb/d) (mg/L)	TSS (lb/d) (mg/L)	TKN (lb/d) (mg/L)	Flow to lagoon (mgd)	HRT (day)	COD load (lb/1,000 ft^3-d)	Maximum OTR (lb/hr)	BOD (mg/L)	TSS (mg/L)	NO_3-N (mg/L)	Alkalinity (mg/L)
Limits:	-	-	-	≤ 3.50	≥7.0	≤ 60	2,946	30.0	30.0	40	500
Scenario 1: Current Rated Plant Flows and Loadings											
4.89	74,000 (1,814)	66,400 (1,628)	4,700 (115)	4.89	5.0	52	1,960	1.2	9.6	70	500
4.89	74,000 (1,814)	66,400 (1,628)	4,700 (115)	3.90	6.2	45	2,506	1.6	8.7	32	500
4.89	74,000 (1,814)	66,400 (1,628)	4,700 (115)	3.50	7.0	43	2,710	1.8	8.6	14	530
Scenario 2: Current Rated Flow and High Loadings											
4.89	122,300 (3,000)	102,000 (2,500)	7,000 (170)	3.90	6.2	74	3,755	2.0	9.2	33	500
Scenario 3: Current Rated Flow and Maximum Loadings for Current Blower Capacity											
4.89	85,600 (2,100)	71,400 (1,750)	4,900 (120)	3.70	6.5	51	2,900	1.9	8.6	20	520
Scenario 4: Maximum Flow and Loadings at Three Cycles per Day per SBR											
5.94	118,900 (2,400)	99,100 (2,000)	6,800 (137)	4.80	5.1	74	3,814	1.3	9.8	30	500
Scenario 5: Maximum Flow and Loadings at Four Cycles per Day per SBR											
7.20	120,100 (2,000)	100,100 (1,667)	6,900 (114)	5.80	4.2	74	4,110	5.0	31.0	25	570
7.20	117,100 (1,950)	97,600 (1,625)	6,700 (111)	5.00	4.9	67	4,295	5.9	32.0	8	550

Scenario 1 represents the current 2013 rated flows and loadings. This scenario was simulated both with and without bypass around the anaerobic lagoon. In the first case, it was found that without any bypass, the SBRs would not provide adequate denitrification. Therefore, in the second case, a 20 percent bypass was assumed, which reduced the effluent nitrate to below the target concentration of 40 mg/L. A third case was evaluated where the flow to the lagoon was kept at 3.5 mgd to meet the 7-day HRT criterion for the lagoon. This resulted in a higher bypass flow, and thus higher organic and solids loadings to the SBRs, and the analysis showed that the SBRs would have adequate capacity to treat the additional loadings.

In scenario 2, the influent concentrations and loadings were increased to match influent concentrations during maximum month loadings as observed in plant data from 2010–12. The resultant influent loadings were about 50 to 65 percent higher than the current rated loadings. By allowing 20 percent of the flow to bypass the lagoon, the SBRs would then produce the desired effluent quality. However, in this case, the higher loadings would result in aeration requirements that exceed the existing blower capacity. Therefore, the addition of new blowers or replacement of the existing blowers with higher-capacity blowers would be required.

In scenario 3, the influent loadings were adjusted downward from scenario 2 to meet the existing blower capacity. The results showed that the biological system can accommodate about 16 percent higher BOD loadings and about 4 percent higher TKN loadings than the current rated loadings without exceeding the blower capacity. It should be noted that because the anaerobic lagoon removes a significant amount of organics (75 percent COD removal assumed in this analysis, which is considerably higher than the typical removal across a primary clarifier), it would be expected that the system could accommodate much higher BOD loadings without exceeding the existing blower capacity. However, ammonia loading to the SBR system, and to a lesser extent TKN loading, has increased substantially with the addition of the anaerobic lagoon because of the release of ammonia in the anaerobic process. Because it takes about 4.6 lb of oxygen to oxidize 1.0 lb of ammonia, the oxygen needed for nitrification in the SBRs has increased substantially from the original design. Denitrification provides recovery of oxygen equivalents, but there is still a net addition of oxygen due to the higher ammonia load, because it was assumed in this analysis that the SBRs would not provide complete denitrification. Under the current operation, however, even with the additional ammonia loading generated in the lagoon, the existing blowers have excess capacity as the current maximum month BOD loading (at about 70,000 lb/d) is almost 20 percent less than the BOD loading capacity determined for this scenario. During the time of year when Quincy Foods loading is low, BOD loading is significantly less than the capacity value and may result in an airflow requirement less than the minimum blower airflow and some air may have to be blown off.

In scenario 4, the maximum flow and loadings were determined assuming the current SBR operation of three cycles a day per SBR unit. As described above, the hydraulic capacity of the SBRs is dictated mainly by the decanter capacity. With three cycles per day per SBR and assuming the same decanting period per cycle (110 minutes), the maximum plant influent flow is 5.94 mgd. The analysis shows that at this influent flow rate, up to about 119,000 lb/d of BOD can be treated in the biological system. As in scenario 2, the blower capacity would be exceeded, thus requiring the addition of new blowers or replacement of the existing blowers with higher-capacity blowers. The hydraulic capacity of the SBRs could be increased by increasing the decanting period in each cycle, or by replacing the existing decanters with higher-capacity decanters. For the same cycle time (8 hours for this scenario), a longer decanting period would require a reduction in the react period, settle period, or both.

In scenario 5, the maximum flow and loadings were determined for the case in which each SBR was operated for four cycles per day. The cycle time would be reduced from 8 to 6 hours. This scenario was based on the following cycle:

1. Anoxic fill: 50 minutes
2. React fill: 130 minutes
3. React: 50 minutes
4. Settle: 30 minutes
5. Decant: 100 minutes

This scheme has both shorter react and settle periods. A shorter settle period is considered to be acceptable based on the results of the mixed liquor settleability tests conducted in May 2013. The test results indicate that settling is essentially complete after a 30-minute period, with the sludge volume at 30 minutes being about the same as the sludge volume at 60 minutes after settling was initiated. The simulator predicted higher effluent BOD and TSS concentrations than in the other scenarios because of the shorter settle phase. However, because the actual settling characteristics may be better than those assumed in the simulator, the actual effluent concentrations may be lower. Two cases were evaluated for this scenario: in the first case, 20 percent of the influent flow was bypassed around the lagoon, resulting in a flow of 5.8 mgd going to the lagoon, which would exceed the capacity of the existing lagoon effluent pump; in the second case, the flow to the lagoon was limited to the effluent pump capacity (5.0 mgd). The analysis shows that the system can treat up to about 120,000 lb/d of BOD in the first case and up to about 117,000 lb/d in the second case. However, in both cases, the blower capacity for aeration in the SBRs would be exceeded. The maximum flow capacity of 7.2 mgd is just less than the City's industrial wastewater pumping capacity of 7.3 mgd.

In all simulation scenarios described above, except for the third case of scenario 1, the lagoon HRT would be less than the design value of 7 days. The COD loading would be higher than the design limit of 60 lb/1,000 ft^3-d in all scenarios except scenario 1. These original design criteria were based on those for low-rate anaerobic lagoons to provide digestion of the raw and waste sludge solids and for optimal biogas generation. Because biogas from the lagoon is currently flared and not reused, the anaerobic lagoon at the IWTP currently functions more like a pretreatment system for the SBRs. When biogas utilization is implemented in the future, the lagoon HRT may need to be limited to optimize biogas production.

3.4 Summary and Recommendations

In summary, the analysis indicates that the system can accommodate higher flow and loadings than the current rated flow of 4.89 mgd and rated loadings of 74,000 lb/d of BOD, 66,400 lb/d of TSS, and 4,700 lb/d of TKN. Maximum influent flow is limited at 5.94 mgd by the SBR decanter capacity, assuming three cycles per day per SBR and a decanting period of 110 minutes per cycle. If each SBR were operated at four cycles per day with a decanting period of 100 minutes per cycle, the influent flow capacity could be increased to 7.2 mgd. The organic and TKN loadings are limited by the existing blower capacity at about 85,600 lb/d and 4,900 lb/d, respectively. The loading capacities are greatly influenced by the additional ammonia load in the lagoon effluent that is subsequently treated in the SBRs. In almost all scenarios that were simulated, the lagoon HRT is less than the design value of 7 days and the COD loading is higher than the design limit of 60 lb/1,000 ft^3-d. This is considered acceptable until utilization of the biogas captured from the lagoon is implemented, at which point the flow and loadings to the lagoon may need to be limited to optimize methane production.

Recommendations for process improvements and for increasing system capacity in the future include the following:

- Install a flow meter and a control valve in the anaerobic lagoon bypass line. This will allow monitoring and automatic adjustment of the bypass flow to achieve the desired secondary effluent quality. The adjustment could be based on on-line nitrate and alkalinity measurements of the SBR effluent.
- Perform a more detailed analysis of the blower capacity, including turndown capability to match the current aeration requirements. The analysis could also include a life-cycle evaluation of replacing the existing blowers with high-efficiency, high-speed blowers versus keeping the existing blowers.
- Perform additional settling tests to confirm the potential of reducing the time for the settle phase during an SBR cycle. By shortening the settle phase, a longer decant phase could be used to increase the SBR hydraulic capacity.
- Add new blowers or replace existing blowers with higher-capacity blowers to increase the loading capacity (if this has not been done as a result of the blower capacity analysis mentioned above). New blowers to increase aeration capacity are not expected to be needed in the near future, until the loadings increase to the levels estimated in this analysis. If the blowers are replaced sooner to provide better turndown and efficiency, future aeration requirements should be considered during equipment selection.
- Replace the existing decanters in the SBRs with higher-capacity decanters to further increase the hydraulic capacity of the SBRs (beyond 7.2 mgd).

Figure 3-2 below presents the prioritized list of improvements and operational changes for increasing the plant capacity. For simplicity, capacity in terms of flow only is shown on this figure. For example, the current maximum biological system capacity with the existing blowers is expressed as an equivalent flow of 5.6 mgd that corresponds to the 85,600 lb/d of BOD shown for scenario 3 in Table 3-2, above. The bar chart on Figure 3-2 illustrates that the anaerobic lagoon and SBRs can treat as much as 7.2 mgd on a maximum month flow basis if the total blower capacity is increased and each SBR operates at four cycles per day.

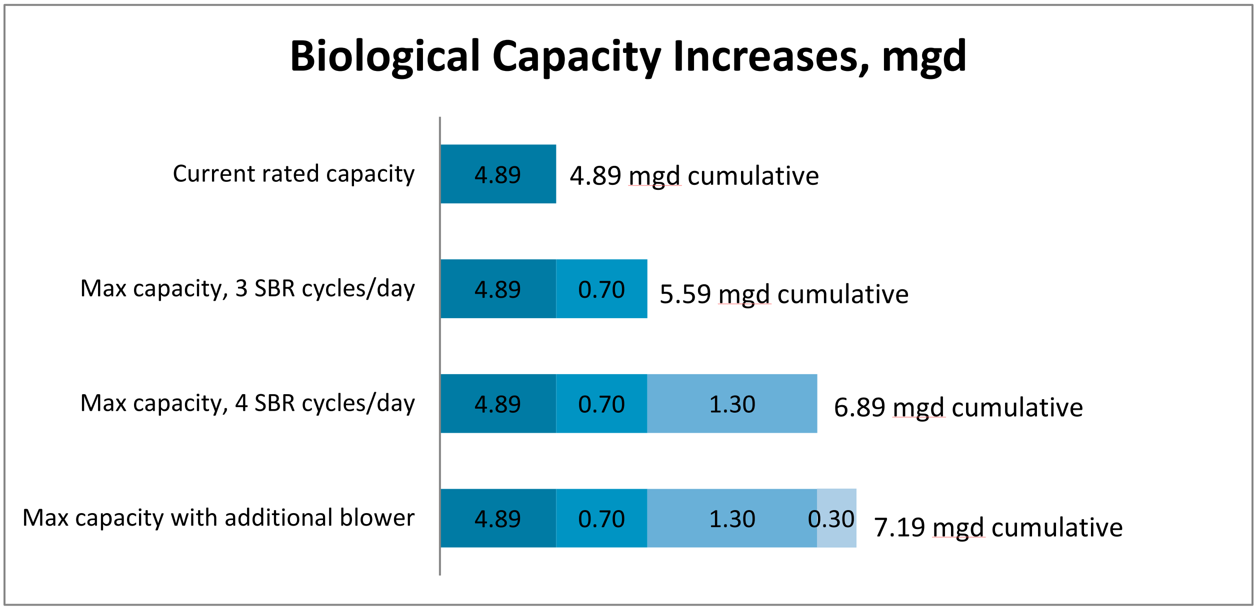

Figure 3-2. Cumulative plant capacity increases based on removal of each capacity constraint

Section 4

Water Quality Requirements

Effluent from the proposed system will be defined as either Class A RW (treated where necessary to reduce nitrogen for indirect groundwater recharge per the requirements of Article 3, Section 2 of the current [1997] RW standards) or IRW, depending on the source of the water. This section describes the water quality requirements for Class A RW and IRW. This section is included to satisfy the ER requirements of WAC 173-240-130(2)(k).

4.1 Class A Reclaimed Water Requirements

RW standards are developed under the authorization and specific requirements delineated with RCW 90.46. RW in Washington is currently regulated by the *Standards for the Use of Reclaimed Water* (Ecology 1997). In 2012, a draft RW rule was proposed with modified Class A RW standards under a new chapter, 173-219 WAC, which would encourage the statewide use and production of RW to help Washington deal with water shortages. This new rule has not yet been adopted by Ecology and is currently still under development.

The IRWTP plans to treat the water to meet the 2012 (i.e., proposed) standards, as a water quality basis, in anticipation of its adoption in 2017. Class A reclaimed water requirements for both the 1997 (current) and 2012 (proposed) standards are summarized in Table 4-1.

As defined in the 1997 current standards, Class A reclaimed water is RW that, at a minimum, is at all times an oxidized, coagulated, filtered, and disinfected wastewater. The wastewater is considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of total coliform organisms does not exceed 23.0 per 100 milliliters in any sample.

Table 4-1. Current and Proposed Class A RW Rule Requirements

Criteria	1997 (current) standards	2012 (proposed) standards
Pretreatment	The permittee shall maintain control over, and be responsible for, all facilities and activities inherent to the production of reclaimed water to ensure that the reclamation plant operates as approved by Ecology and DOH. The permittee shall control industrial and toxic discharges that may affect reclaimed water quality through either a delegated pretreatment program with Ecology or assuring all applicable discharges have permits issued under RCW 90.48 and WAC 173-220 (Article 5, Section 6).	Compliance with state and federal pretreatment standards and restrictions and prohibitions on dangerous waste (WAC 173-219-310).
Allowable treatment	The standards describe allowable beneficial uses, the required level of reclaimed water treatment appropriate for each beneficial use, and any specific statutory requirements from RCW 90.46. Some treatment and beneficial uses are regulated uniquely to reclaimed water projects. The key to these uses is that it specifies "Reclaimed Water" must be generated prior to the allowance for a specific beneficial use. For uses where oxidized, filtered, disinfected reclaimed water is required, pilot plant or other studies may be required to demonstrate that methods of treatment other than those specified in these	Traditional treatment: biological oxidation, coagulation, filtration, and disinfection. Membrane filtration consists of biological oxidation, membrane filtration, and disinfection or membrane bioreactor (combined biological oxidation and filtration) disinfection. Alternative treatment methods must demonstrate an equivalent treatment process in a reclaimed ER (173-219-420(1)).

Table 4-1. Current and Proposed Class A RW Rule Requirements		
Criteria	**1997 (current) standards**	**2012 (proposed) standards**
	standards are capable of reliably producing reclaimed water that is essentially free of measurable levels of viable pathogens. Methods of treatment other than those included in these standards and their reliability features may be accepted if the applicant demonstrates to the satisfaction of Ecology and DOH that the methods of treatment and reliability features will assure an equal degree of treatment, public health protection and treatment reliability (Article 6, Section 1).	
BOD_5	30 mg/L determined monthly, based on the arithmetic mean of all samples collected during the month; 24-hour composite, collected at least weekly (Article 7, Section 1).	30 mg/L monthly average and 45 mg/L weekly average <u>or</u> 10 mg/L monthly average (based on 24-hour composite) measured downstream of filtration (173-219-420(2)).
Dissolved oxygen	Grab, collected at least daily; shall contain dissolved oxygen (Article 7, Section 1).	Dissolved oxygen must be measured and present in the effluent or within the biological oxidation process in all samples (173-219-420(2)).
TSS	Shall not exceed 30 mg/L, determined monthly, based on the arithmetic mean of all samples collected during the month; 24-hour composite, collected at least daily. TSS sampling may be reduced for those projects generating Class A reclaimed water on a case by case basis by Ecology and DOH (Article 7, Section 1).	30 mg/L monthly average and 45 mg/L weekly average (173-219-420(2)).
pH	N/A	Minimum 6.0, maximum 9.0 (173-219-420(2)).
Turbidity (coagulation/ filtration)	Filtered wastewater shall not exceed an average operating turbidity of 2 NTU, determined monthly, and shall not exceed 5 NTU at any time. Continuous recording turbidimeter (Article 13, Section 2, Table 2).	Maximum 2.0 NTU monthly average and 5.0 NTU instantaneous (coagulation/filtration) <u>or</u> maximum 0.2 NTU monthly average and 0.5 NTU instantaneous (membrane filtration) (173-219-420(3); 173-219-420(4)).
Total coliform bacteria	2.2 MPN/100 mL (grab samples, 7-day median); 23 MPN/100 mL (grab samples, maximum) (Definition of "Class A Reclaimed Water" and 173-219-420(5)).	
Virus removal	The reclaimed water shall be subjected to microbiological testing to evaluate the efficacy of the selected treatment process train to produce reclaimed water that does not contain measurable levels of pathogenic bacteria, parasites, and viruses (Article 10, Section 1).	5-log virus removal or inactivation following filtration, <u>or</u> 4-log virus removal or inactivation following filtration preceded by coagulation, flocculation, and sedimentation, <u>or</u> 4-log virus removal or inactivation following membrane filtration (173-219-420(6)).
Chlorine disinfection	Where chlorine is used as the disinfectant in the treatment process a minimum chlorine residual of at least 1 mg/L after a contact time of at least 30 minutes is required (Article 9, Section 5).	1.0 mg/L as free chlorine (C), following a disinfection time (T) of 30 minutes measured at peak hourly flow, and a combined CT value of 30 mg per minute per L (173-219-440(2)).
Chlorine residual	A chlorine residual of at least 0.5 mg/L shall be maintained in the reclaimed water during conveyance from the reclamation plant to the use area unless waived by Ecology and DOH (Article 9, Section 5).	Minimum 0.2 mg/L free chlorine or 0.5 mg/L total chlorine required in distribution system between generating plant and point of use (173-219-510(1)).
TN (additional requirements for groundwater recharge by surface or vadose zone percolation)	10 mg/L (as N) average determined annually, based on arithmetic mean of all samples collected during previous 12 months. Grab or 24-hour composite, collected at least weekly (Article 11, Section 2, Table 2).	10 mg/L monthly average and 15 mg/L maximum (173-219-620(3)).

4.2 Groundwater Antidegradation

In addition to Washington Class A and nitrogen requirements, percolated water—or water stored in unlined lagoons or impoundments—must comply with Washington's antidegradation policy (WAC 173-200-030). The antidegradation policy requires that existing and designated uses are maintained and protected, and it ensures that no degradation is allowed that would interfere with, or become injurious to, existing or designated uses, except as allowed by the policy. Therefore, percolated or infiltrated water must not exceed the background concentrations for constituents in groundwater of the area. Shallow aquifer TDS in the Quincy area ranges from 400 to 650 mg/L TDS. For this analysis, the required TDS concentration for recharge is considered to be 500 mg/L. This is consistent with the requirements of WAC 173-200-040(3) for the protection of beneficial uses of groundwater.

4.3 Industrial Reuse Water Requirements

RCW Chapter 90.46 includes provisions for beneficial use of IRW. IRW is defined by its source or origin as coming from industrial processes. The law does not specifically fund or require the development of new standards or regulations for the water, and water quality limitations must be established on a case-by-case basis. Because the treatment applied in the IWTP is biological and similar to that used in common municipal treatment systems, Class A RW standards are applied in this ER. The IRWTP will apply treatment that matches the standards described for Class A RW, including nitrogen requirements for shallow groundwater recharge, as shown in Table 4-1. However, chlorine residual requirements will be applied, as needed, for each specific use.

Industrial users will have their own requirements for this water. The City will negotiate with Microsoft and others to reach an agreement on delivered water quality. Possible parameters include TH, TDS, silica, iron, ammonia, chloride, and orthophosphate. It is likely that the requirements will not be the same for all users of IRW.

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Section 5

Alternatives Evaluation

In this section, the evaluation process for IRWTP alternative components is described, and the selected preferred alternative is identified. This section is included to satisfy the ER requirements of WAC 173-240-130(2)(v). It begins with a background section that describes a years-long process of incremental infrastructure construction in response to the changing parameters, and explains the elimination of technologies or treatment processes that were considered. It also identifies areas for future improvements as the studies have identified important links between the biological and physical-chemical treatment processes. The background section relies on limited technological descriptions. Further detail on candidate technologies follows the background section.

5.1 Background

The City has been addressing the data center TDS issue for more than 8 years. Developments throughout that period were tracked and their effects on the long-term solution for an IRWTP were analyzed to allow the plan to adjust to more beneficial and cost-effective paths. However, the concepts developed in the 2008 FS have remained with RO selected as the final TDS removal step at the IRWTP. In addition, Microsoft's contribution of its cooling water treatment facility to the City not only anchored IRWTP components at that site, it also established a relationship between the two parties that focused on Microsoft's long-term plans to expand its data centers in Quincy using reuse water for cooling.

5.1.1 Total Dissolved Solids Removal System Development

The treatment system that Microsoft contributed to the City included a dual-bed (i.e., cation-anion) IX water demineralizer (IX Demin), brine holding tank, demineralized water holding tank, chemical storage, and two double-lined lagoons with a total storage capacity of 1.8 MG. These components are housed in a building that has room for more equipment and it was determined that the demineralizer components could be converted for use as part of a HERO system. Conversion to HERO would reduce demineralization (i.e., TDS removal) operational costs as compared to IX Demin alone. In particular, the HERO process was developed to allow high-recovery/low-reject operation at 95 percent/5 percent or better, resulting in smaller brine management systems. It can achieve this performance with a relatively high concentration of silica, whereas non-HERO operations require that the silica concentration in the feed water be limited.

HERO can also operate with a higher silt density index (SDI) than a conventional RO system. This means that feed water containing TSS can be filtered with GMF, which has lower capital costs but does not perform as well as membrane filters.

In 2010, per Microsoft's request, the City developed a service proposal to treat and recycle Microsoft's blow down using HERO converted from the IX Demin system that the City now owns. At the same time, Microsoft was also evaluating a high-cycle, silica-based cooling water chemical system that would allow its cooling system to have no discharge to the sanitary sewer. Microsoft selected the high-cycle technology and soon thereafter announced a major expansion of its data centers. The high-cycle technology required the installation of an IX HES facility with a capacity of more than 900 gpm and room for expansion. The City and Microsoft established a water services agreement under which the City would provide the IX HES infrastructure and deliver the operations services.

Under this arrangement, the City continued to consider HERO with the IX HES system used to supplement the IX Demin part of the HERO components. However, the use of the HERO process is patented. The licensing requirements were studied and it was revealed that because the IX Demin system was provided by Aquatech, Inc. (Aquatech), the conversion to HERO would have to be procured from Aquatech under a sole-source arrangement. The City had grant funding that it preferred to use for the RO system and the grant requirements precluded sole-source procurement. The City then advertised for the RO components. If Aquatech was selected, a conversion to HERO would have been allowable, but Aquatech was not selected. Conventional RO operation with upstream silica removal is required. Despite this, pretreatment with IX HES is likely still beneficial to RO operations and the RO system will be started up with feed from the IX HES system. The initial RO use was planned for TDS control in the MWRF percolation system with known direct consumers of RO permeate.

Microsoft is now abandoning the high-cycle cooling water technology and does not need a direct-softened water supply. The City is now working with Microsoft to transition the cooling systems to low-cycle, low TDS water and wastewater operations with immediately more significant RO operation than planned. The IX HES system is capable of feeding 900 gpm to the RO system, and continued operation of the system will seek to minimize salt use and brine volume generation and increase its capacity.

Optimum operation of the IX HES and RO systems is dependent upon the treatment processes upstream of them. The development of those technologies is explained below.

5.1.2 Chemical, Coagulation, and Filtration Treatment

To produce the reuse water per Class A requirements, coagulation and filtration are required. For municipal water treatment, this is commonly accomplished in one of the following ways:

- Direct-filtration of activation sludge in a membrane bioreactor using microfiltration (MF) or UF membranes
- Filtration with GMF of clarified secondary effluent with the addition of coagulants such as iron or aluminum, or species thereof
- MF or UF clarified secondary effluent with coagulants added

Conversion of the SBRs to a bioreactor system is not feasible. With HERO planning in progress, GMF was evaluated. Several samples of secondary effluent indicated consistent TSS levels, similar to typical municipal secondary effluent, and nominal coagulant doses were expected (e.g., 15 to 30 mg/L of ferric chloride). The concentration of P, which can consume coagulant, was measured to be consistently low (less than 5 mg/L). GMF would be located near the IWTP headworks and primary clarifiers so that GMF backwash could be collected in the headworks with the actively automated and monitored GMF system near the operations staff's main offices. Coagulant would be added in the SBR effluent pump station wetwell from a chemical storage system located near the pump station.

Around 2011–12, plans were being made to install the GMF system, with it located near the staff offices and HERO at the City's property obtained from Microsoft. More SBR effluent samples were collected and chemical dosing tests were planned. The newer samples indicated that P was now consistently high (25 to 30 mg/L as P). Prior to conducting jar testing, it was known that this would increase the coagulant dose significantly, so much so that GMF could not be used without a coagulated TSS sedimentation step ahead of it. It was highly suspected that the source of P is the anaerobic lagoon operation, which was not in place prior to 2011.

With the looming September 2015 wasteway deadline and the lack of probability of HERO use (as noted above), GMF was eliminated. The reuse filter building (RFB), which was already designed and ready for construction, was quickly evaluated for its ability to house a membrane filtration system. The RFB design was determined to be compatible with some of the UF systems that were looked at, and the RFB construction project proceded, including the creation of the 200,000-gallon UF effluent clearwell.

Despite the expected effectiveness of iron or aluminum coagulants at high doses (100 to 200 mg/L) to deal with P in use with UF, the cost of the coagulant would be high. Other coagulants were considered and the analysis was shifted back to a conventional RO (i.e., non-HERO) approach. In a conventional RO approach, softening and silica removal are important to achieve high recovery/low reject. Silica removal can virtually only be achieved at high pH in the presence of magnesium hydroxide. This removal process is most commonly conducted in conjunction with lime softening. Lime softening also removes P, which has detrimental effects on RO systems similar to silica. The application of lime softening was advanced. It requires the use of sedimentation in a clarifier to remove the bulk of the TSS formed in the process.

Lime-softening jar testing was conducted in 2015 to verify its ability to remove P, TH, and silica. During sampling, it was also noted that the SBR effluent water quality, specifically the high bicarbonate alkalinity, would require the use of only lime, and soda ash (i.e., sodium carbonate) would not be needed to increase alkalinity.

To summarize Sections 5.1.1 and 5.1.2, the IRWTP treatment processes will include:

- Lime softening in a reactor clarifier system, with coagulation and sedimentation enhanced by ferric chloride. The overall unit process is referred to as the lime-coag-sed system and it will treat SBR effluent.
- A pressurized or vacuum UF system.
- IX HES for RO feed pretreatment.
- RO operating at 90 percent recovery or higher.

These technologies and their performance bases are described below. Design basis sizing, layout, and flow control are described in Section 6.

5.2 Coagulation-Sedimentation

The UF and RO systems remove constituents through physical separation from the influent water. These processes produce a cleaner effluent while concentrating the constituents retained by the membrane. This concentrating effect can cause membrane fouling, especially by organic colloids, and membrane scaling by precipitation of inorganics. In addition to improving water quality for the ultimate use of the water, the lime-coag-sed system treats IWTP effluent to protect the UF and RO from fouling and scaling. Table 5-1 presents the water quality treatment goals for the lime-coag-sed system.

Table 5-1. Lime-Coag-Sed System Treatment Goals

Parameter	Unit	Goal	Basis
Silica	mg/L as SiO_2	< 30.0	To increase recovery in RO.
Phosphate	mg/L as P	< 1.5	To increase recovery in RO.
Hardness	mg/L as $CaCO_3$	< 150.0	No absolute limit, as the IX system will remove excess, but this goal minimizes the load to the IX system.
TSS	mg/L	< 30.0	Minimizes the load to the UF system.
Colloidal material	N/A	Coagulated	Qualitative goal.
pH	N/A	pH 7–8	Minimizes scaling and corrosion in piping to the UF system. Needs to be lower than the operating point of the lime-coag-sed system. The actual value depends on UF requirements.

The lime-coag-sed system will remove silica, phosphate, TH, suspended solids, and colloids from the IWTP effluent. Lime will chemically remove P, TH, and silica. Suspended solids and colloids will be coagulated by removing the stabilizing effects of surface charge on suspended particles. The resulting precipitated and coagulated solids will be removed in the clarification step. The pH of the clarified water will be neutralized with sulfuric acid, and the water will be pumped to the UF system. The settled solids that form will sludge at up to 10 percent (100,000 mg/L) solids in the bottom of the clarifier, and the sludge will be pumped to the dewatering system.

Lime and caustic soda were compared for use in the coagulation and sedimentation system. The two chemicals have the potential to drastically affect the residual streams for other downstream processes. Based on a mass balance analysis (see the Solids Management Feasibility Study TM in Appendix G), lime was selected (BC 2011). Lime has several advantages over caustic, it adds less TDS to the effluent, silica removal is found to be typically more efficient, and the sludge residual has the potential for reuse as a soil augmentation. The mass balance demonstrated that lime will produces less RO reject and less concentrated brine waste for disposal than caustic.

5.3 Filtration

While filtration is required for reuse water, the concentration of solids in the lime-coag-sed system effluent will also be too high for it to be fed directly to the HES and RO systems, so filtration is needed. Alternative filtration technologies were evaluated, and membrane filtration was selected.

GMF, as it applies to water and wastewater treatment, is the passage of water through a porous granular medium to remove suspended solids. Deep bed filtration using mono media (e.g., sand or anthracite), dual media (e.g., anthracite and sand) or multimedia (e.g., anthracite, sand, and garnet or magnetite) is used for tertiary treatment in many water reuse projects to produce water for landscape irrigation, cooling tower makeup, and other uses (see Figure 5-1 below for a cutaway of a dual media filter). In most cases coagulation and flocculation of the filter influent are required to achieve consistent filtered water quality such as a turbidity of less than 2 nephelometric turbidity units (NTUs). If the filtered water is to be treated further by RO, an SDI of less than 5.0 in feed water is required, and an SDI of less than 3.5 is preferred. Although turbidity is not directly correlated with SDI—which measures the plugging or fouling rate of a 0.45-micron filter subjected to a constant pressure of 30 pounds per square inch gauge (psig) over 15 minutes—a turbidity of less than 1 NTU is usually required for RO feed. For drinking water treatment, GMF can usually achieve a turbidity of less than 1 NTU with proper conventional pretreatment or coagulation/flocculation. However, for tertiary wastewater filtration, achieving less than 1 NTU is not typically achieved from GMF. To optimize RO operation and avoid particulate fouling membrane filtration such by MF or UF is preferred above GMF.

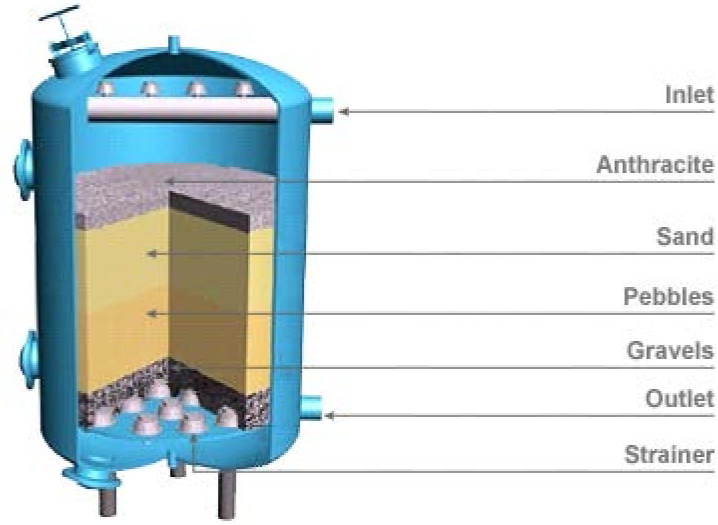

Figure 5-1. Cutaway diagram of a dual media filter

Source: http://cormsquare.com/Corporate-Services/Facility-Management-Services-/37930/Water-Treatment-Plant-Services-

MF and UF accomplish particle removal through size exclusion and their pore sizes are highly uniform; therefore, they are capable of providing "absolute" filtration. MF can remove particles down to 0.10 micron and UF down to less than 0.01 micron, compared with approximately 5 microns for GMF. Since the late 1990s, most advanced treatment systems for water reuse applications in the United States and abroad have used MF or UF as pretreatment for RO. MF and UF are considered equivalent and competitive processes for RO pretreatment as the pore size of MF is adequate for RO protection, although UF can remove smaller particles such as colloidal silica. MF or UF can consistently produce a higher-quality RO feed water than GMF, and thus they improve the reliability and performance with less cleaning and fouling, and improve the service life of the RO membranes. For the Quincy industrial water reuse project, operating the RO system at high recovery (90 percent) is desired to minimize the RO reject or concentrate volume for disposal. Hence, MF or UF is recommended over GMF.

Other than pore size differences, MF and UF systems are very similar in their design and operation. The more popular configurations are hollow fiber and tubular, which allow the membrane to be backwashed and chemically cleaned effectively. They can be operated as cross-flow or dead-end filters. Cross-flow filtration operation uses recycling of the reject stream to create a high velocity at the membrane surface to avoid fouling for high influent TSS applications. For very high influent TSS levels, tubular MF/UF membranes are used and the reject-recycling-to-feed ratio can be many times, and thus high pumping energy is required for the operation. The Duraflow®, LLC (Duraflow) MF system is an example of a tubular cross-flow MF system that is used in industrial applications with high TSS levels (see Figure 5-2 below for a picture of a Duraflow MF system).

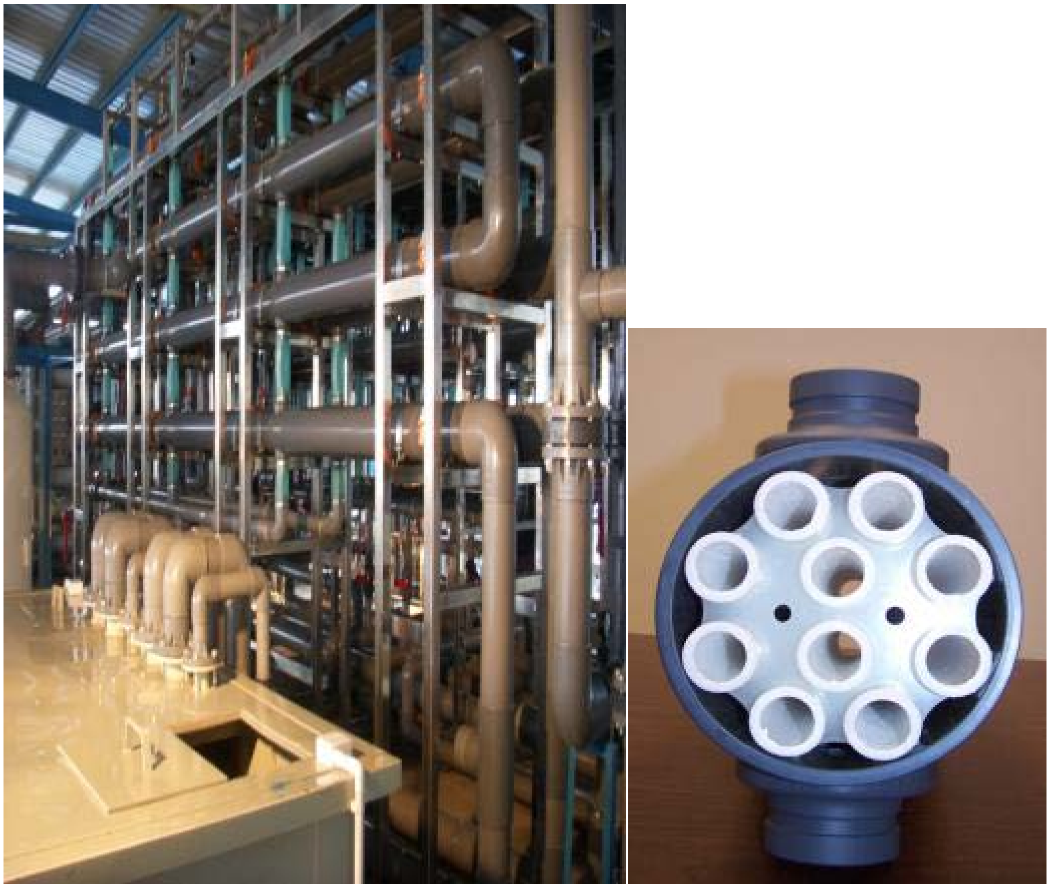

Figure 5-2. Duraflow MF system with tubular MF module

Source: Duraflow brochures and websites

The Duraflow MF system has been used since 2004 in a case of cooling tower blowdown recovery in a power plant where the membrane system is used as both the clarifier and filter after two stages of lime-softening reaction. The reject of the MF system is concentrated to 2 to 3 percent solids for disposal. The MF filtrate is further treated by RO, and the RO permeate is recycled to the cooling tower for makeup. The cooling tower blowdown flow rate is 300 gpm, and the total feed rate to the MF system is 1,500 gpm (with a recycling-to-influent ratio of 4:1), which includes six MF skids (four operating and two standby). Because the tubular membranes have packing densities much smaller than hollow-fiber membranes, they are much more expensive than a MF/UF system with hollow-fiber membranes on an equivalent membrane surface area basis. A preliminary cost comparison for the Quincy project indicated that the Duraflow MF system would be comparable in capital cost, but that the operating cost would be considerably higher than a conventional coagulation/lime-softening system (including clarification) followed by a hollow-fiber MF or UF system. Hence, a conventional coagulation/lime-softening with hollow-fiber MF or UF system is recommended above the cross-flow MF system.

Because of the potential presence of colloidal silica and other small colloidal particles in the lime-softening clarifier effluent, UF is recommended above MF as both are comparable in cost. The hollow-fiber UF membrane system can be designed and operated as a pressurized system or a submerged (i.e., vacuum) system. The pressurized UF system is arranged with multiple, pressurized UF membrane modules mounted in a skid where the influent is pumped through the system and becomes permeate. In a submerged UF system, membrane fibers or un-pressurized modules are immersed in a process tank where permeate is pulled into the hollow-fiber tubes via a vacuum pump and is collected in a header. Both the pressure and submerged UF systems need periodic backwashing, and the particle removal performances are equivalent.

Both systems are acceptable for this application, and the selection will depend on life-cycle cost comparisons (capital and operating costs) and space requirements. The ultimate UF system must fit into an existing filter building at the project site. Figure 5-3 shows example pictures of pressure and submerged MF/UF membrane systems.

Figure 5-3. Pressure and submerged MF/UF membrane systems

Sources (left to right): Pall Corporation, General Electric, and Evoqua Water Technologies, LLC. Photo sources from vendor brochures and websites.

5.4 Ion Exchange and Reverse Osmosis

As discussed in Section 1 above, IX and RO systems are already installed and treating groundwater for use by Microsoft for cooling water makeup. The water is first treated by IX for softening and then by RO for demineralizing. When coagulated, filtered IRW becomes available, and it replaces the groundwater currently being fed to the IX. The existing IX and RO systems are well suited for treating the IRW. The following is a brief evaluation of the use of the IX and RO systems in the IRWTP. A full evaluation is not included in this ER because the equipment is already existing and will not be replaced.

There are presently two IX systems at Quincy: the HES, and the demineralizers. Only the HES system is in service, because the high-cycle cooling tower operation presently used by Microsoft do not require demineralized water, and operating costs are lower for the HES softeners than for the demineralizers. When Microsoft converts its cooling towers back to conventional operation, partial demineralization will again be needed. The RO will serve this purpose.

Quincy could instead choose to restart the IX demineralization system. However, the combination of IX HES followed by RO is less expensive from an operating cost standpoint than IX demineralization. IX demineralization uses a strong acid and strong base for regeneration, and the regeneration wastes must be treated and disposed. Because of the addition of acid and base, there would be a net input of salts into the system if IX demineralization were used—with RO, this input is avoided.

5.5 Residuals Management

Residuals created by the overall IWTP and IRWTP processes include biological anaerobic lagoon and waste activated sludge, lime-softening solids, and brine as IX HES regenerant and RO reject. IRWTP operation has no effect on biological sludge production or management and those processes will not change. For startup and the initial year or so of operation, lime-softening solids will be dewatered and dried for landfilling and brine will collected in evaporation ponds and hauled for processing by a third party.

Lime-softening solids dewatering be either in sludge drying beds or in a mechanical system, such as a centrifuge or filter press. Lime-softening solids can be efficiently dewatered to 50 percent solids or greater. At this value and at first-year IRWTP average flow rates, an estimated 200 to 250 ft^3-d of solids will be produced. The use of sludge-drying beds is the current preferred alternative due to the possibility to repurpose the abandoned IWTP reed beds. The reed beds are set up for reasonable conversion to drying bed operation with 25 storage cells with a granular media and underdrain filtrate collection system. The cell has a total surface area of almost 7 acres. At 250 ft^3-d, a 1-foot dried solids depth would take approximately 6 months to accumulate, making seasonal removal and hauling manageable.

Lime-softening solids are commonly used as a soil amendment for crops, and the City will seek to have the solids certified for land application and will seek land owners that want the amendment qualities. This is further discussed in Section 7.

Brine will continue to be stored and evaporated in the existing system, which will be expanded based upon an increased use of the RO system to produce cooling water supplies. While the disposal alternative evaluation continues, the current solution is to haul the brine to a third-party disposal firm once the brine is concentrated as much as possible in the evaporation pond system. The brine management alternatives evaluation process is discussed in Section 7.

Hauling and disposal cost quotations equate to $0.40 to $0.50 per gallon of brine that is hauled. This value was included in the rates that Microsoft paid for cooling system water supply when the cooling system was using the high-cycle operations and groundwater supply. These costs are not accrued immediately upon IRWTP startup because the pond system will have a storage volume designed to delay hauling from the ponds for at least 1 year after the brine flows begin. The ponds have been in use for nearly 2 years as Microsoft operated on the high-cycle system, and the stored brine has reached approximately two-thirds of the storage capacity. For the increased brine flows expected upon Microsoft's pending conversion to low-cycle operation, the new pond volume that is added will reset the consumed capacity and start the fill clock over. This new demand will start with Microsoft using City groundwater. Refer to the letter titled *Effects of Microsoft's Conversion from High- to Low-Cycle Operation in Quincy* in Appendix C for information on the current pond expansion plans (BC 2016a).

Section 6

Selected Alternative: Process Description

This section presents and describes the selected alternative.

6.1 Process Overview, Layout, and Site Selection

The system uses existing infrastructure to the extent possible. The following are key components, shown on Figure 6-1 below, that will be incorporated. Items that are being installed or that are ready for installation in support of the industrial TDS removal system using groundwater are annotated as such:

- IWTP SBRs
- IWTP equalization pond
- IWTP effluent pump station (requires pump upgrade)
- Pipeline (18-inch) from the IWTP equalization pond to the RFB
- RFB (building constructed with grant funds)
- Reuse water (UF effluent) clearwell (repurposed abandoned primary clarifier, approximately 200,000 gallons)
- IX feed pumps (design complete, ready for bid)
- Pipeline (12-inch) from RFB to water softener building (WSB)
- IX system in the WSB
- Pipeline (12-inch) from the WSB to the RO building
- RO system in the RO building
- Brine ponds at the RO building
- Pipeline (18-inch) from the RO building to the WSB
- Distribution pumping systems in the WSB (design is 80 percent complete)
- Pipeline (8-inch and 10-inch) from brine ponds at the RO building to brine ponds at the IWTP
- Pipeline (12-inch and 18-inch) from the WSB to the MWRF
- Pipeline (12-inch) from the vicinity of IWTP headworks to the MWRF percolation ponds
- MWRF filters, disinfection, and percolation beds

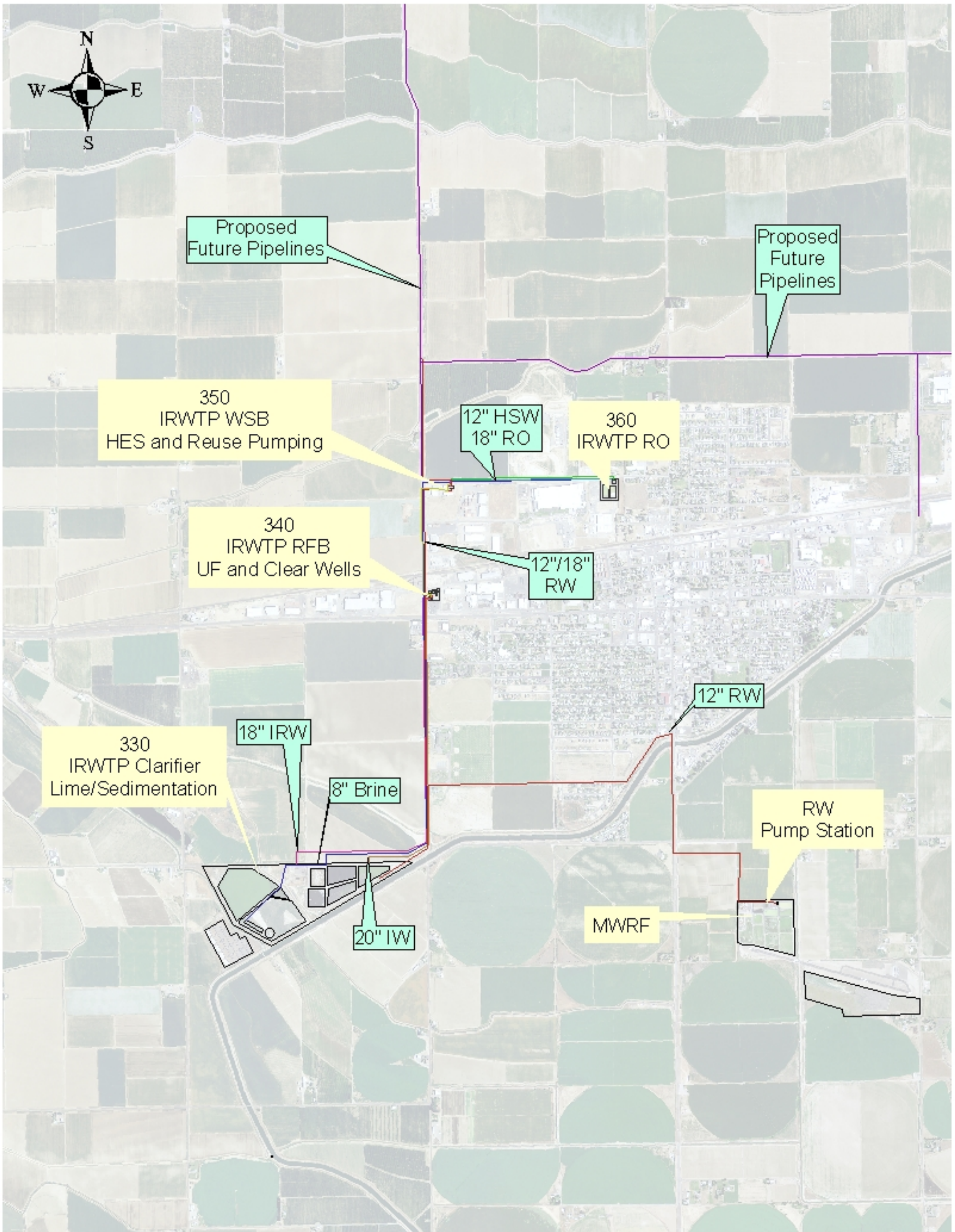

Figure 6-1. Location of IRWTP facilities

IRWTP clarifier lime/sedimentation and UF are future facilities.

6.2 Design Criteria and Sizing

The design criteria are developed in the Lime-Coag-Sed Process TM and the Lime-Coag-Sed Basis of Design Report (BODR), both in Appendix D. The primary design flow rate criteria are copied from the Lime-Coag-Sed

Process TM and are summarized as follows. As the most upstream unit process in the IRWTP, the lime-coag-sed system drives the base flow requirements. The UF, IX, and RO systems follow from that basis.

Historically, the IWTP effluent flow rate averaged around approximately 2 mgd from January 2011 through June 2016. The rate ranged between 0.00 and 3.44 mgd during that period. As additional industrial dischargers connect to the system, the average is expected to increase. In the short term, some SBR effluent will continue to be discharged to the surface water outfall while the rest is diverted to the lime-coag-sed system to meet reuse demands.

The lime-coag-sed system will be constructed in two or more stages. Stage 1, planned to be operational in late 2017, will produce enough water to supply the UF, IX, and RO systems so that the RO system can meet the Microsoft cooling water system peak demand. When the cooling towers require less water, the balance of produced RO water can be used for other purposes such as TDS control at the MWRF percolation beds. The second stage will be constructed several years later to accommodate the need to reuse all IWTP effluent and cease the discharge to surface water. There may be additional stages if the supply of wastewater and the demand for reuse water increase.

6.2.1 Process Diagrams

Process diagrams are included at various stages of development in Appendix E and F. Appendix E contains the following.

- Unit Process Diagrams from the SBRs through the UF system.
- Complete, as-built process and instrumentation diagrams (P&IDs) for the water softener system.
- Final design process flow diagram (PFD) for the RO system, which is under construction at the time of production of this ER

Within the design basis document in Appendix F, preliminary design level P&IDs are shown for the IRW distribution systems. The P&IDs were developed to coordinate full Stage 2 capacity. As noted in Section 6.3 below, only portions of the distribution system are used in Stage 1.

6.2.2 Peak Flows

The following peak flows were estimated for Stage 1 and Stage 2. Stage 1 peak flows, and the resultant design capacity, are considered to be “demand-based.” That is, the design capacity is controlled by the demand for reuse water produced by the IRWTP. The Stage 2 capacity is considered to be “supply based,” meaning that 100 percent of the SBR effluent supply has to be diverted from the current outfall to the cooling systems and other uses. Stage 2 is described first to establish the buildout conditions. Stage 1 is then described to demonstrate that the incremental capacity installation can meet Stage 1 demand.

Estimated Stage 2 Lime-Coag-Sed System Flow Rate. Stage 2 capacity is projected to be required around 2022–25. The peak 2022 IWTP effluent flow is projected to include the following components:

- An existing peak IWTP effluent rate of 3.5 mgd[1] (rounded)
- 0.5 mgd of new industrial wastewater flow to allow for growth
- IRWTP internal return streams (UF backwash, dewatering from sludge beds discussed below)
- 0.6 mgd cooling tower blowdown (allowing for growth), which will be routed to the IWTP headworks once Stage 2 is operational

[1] Currently, the IWTP instantaneous discharge rate is limited to 5 cubic feet per second (3.23 mgd), and excess is stored in lagoon 5. In the future, when SBR effluent is sent to the lime-coag-sed system, little or no water will be discharged, so the 3.23 mgd limit will always be met. Lagoon 5 will still be available for use in equalizing peak SBR effluent flows. Therefore, the lime-coag-sed system does not have to be large enough to treat the instantaneous peak SBR effluent flow.

Using these Stage 2 values, the internal return's stream flow is estimated to be 0.34 mgd and the peak SBR effluent flow is anticipated to be 4.80 to 5.00 mgd. Based on this analysis, and assuming the continued use of lagoon 5 for peak flow control management, 4.80 mgd is the selected lime-coag-sed system Stage 2 design basis flow rate.

Estimated Stage 1 Lime-Coag-Sed System Flow Rate (2017). In ERs submitted to the City in 2014 and updated in 2016, Microsoft provided a peak 2017 estimated evaporation rate of 1.1 mgd in its cooling systems in Quincy. This includes the Microsoft CO1, CO2, CO3/4/5 and MWH01 cooling systems. This is based on operation at 6 cycles of concentration (CoC), except for the CO3/4/5 systems, which operate in a once-through mode of 2 CoC or less. Thus, there will be from 0.1 to 0.5 mgd of blowdown and a makeup demand of 0.5 to 1.7 mgd.

In addition to the users' water demand, the lime-coag-sed system must also treat sufficient water to account for the losses in the UF, IX, and RO systems. IX system losses are negligible in this analysis. RO will recover 90 percent of its feed flow as permeate and have a 10 percent loss as reject. This equates to the reject flow being 11.1 percent (10.0 percent ÷ 90.0 percent) of the RO permeate flow. The IX and RO systems are estimated to need to treat 75 percent of the produced UF water.

At 1.23 mgd permeate flow (or 75 percent of 1.70 mgd flow to Microsoft, since 25 percent will come directly from UF), RO reject flow will be 0.14 mgd. The total UF filtrate production rate requirement is shown in the equation below:

1.70 mgd + 0.14 mgd = 1.84 mgd

The UF system will produce approximately 95 percent of its feed flow as filtrate and have 5 percent loss as backwash. This equates to the backwash flow being 5.3 percent (5.0 percent ÷ 95.0 percent) of the UF permeate flow, or 0.1 mgd. The UF feed (or lime-coag-sed production rate) is therefore:

1.84 mgd + 0.10 mgd = 1.94 mgd

The estimated total flow that must be treated by the Stage 1 lime-coag-sed system is therefore approximately 2 mgd.

Using half the Stage 2 value, the Stage 1 design basis flow rate for clarifier sizing is 2.4 mgd, which is conservatively higher than the projected demands for the next several years, allowing for incremental expansion with equal equipment sizing.

Allowance for Non-Forecasted Growth. The design basis values are based on current reasonable values of industrial growth, but they do not establish hard constraints should unforeseen increases in demand-based or supply based flow scenarios occur. As described in the BODR, the selected lime-coag-sed site can support greater than 4.8 mgd capacity. The existing conveyance piping can support greater than 4.8 mgd as well. Previous analysis of the IWTP current installed capacity indicates that it can support greater than 4.8 mgd, and the UF and RO systems capacities can be expanded modularly.

During the estimated Stage 1 period, if a new industry causes a significant step increase in reuse water demand, the 4.8 mgd design basis capacity can be installed in advance of the projected Stage 2 date.

6.2.3 Stage 1 Average Flows

Projected average flow rates are shown in Table 6-1. They were developed from Microsoft's ERs to the City.

Table 6-1. Estimated Average Lime-Coag-Sed Feed Rate

Year	Flow (mgd)			
	Microsoft cooling water makeup [a, b]	Water to percolation [c]	RO feed rate [d]	Lime-coag-sed feed rate [e]
2016 [f]	0.59	0.10	0.58	0.79
2018	1.02	0.10	0.84	1.14
2020	1.34	0.10	1.08	1.47
2022	1.66	0.10	1.32	1.79
Average	1.16	0.10	0.95	1.29

a. *2016 value shown is the annual average evaporation rates for CO1/2 (0.293 mgd) and MWH (0.182 mgd), multiplied by 1.25 to represent makeup demand in future operation at six CoC.*

b. *Increase in Microsoft cooling water makeup based on addition of three data center phases, one phase every 2 years, each with a demand equal to that of MWH (0.182 mgd * 1.25 = 0.228 mgd).*

c. *Estimated annual average flow rate of IRW to percolation ponds.*

d. *Flow to RO, assuming that 75% of IRW is treated via RO, and RO recovery is 90%.*

e. *Sum of water to RO and water bypassed for blending.*

f. *UF backwash assumed to be 5% of UF feed.*

6.2.4 Lime Softening and Coagulation-Sedimentation

The lime-coag-sed system will treat effluent from the IWTP SBRs. The SBRs are part of the IWTP secondary biological treatment and clarification system. The main lime-coag-sed system components are two 70-foot-diameter circular reactor clarifiers, clarifier influent flow controls, chemical storage, transfer and dosing systems, and sludge pumps.

Details of the lime-coag-sed system design criteria and sizing are provided in the Lime-Coag-Sed Process TM (Appendix D). The BODR includes the SBR equalization basin pump and clarifier effluent pumping system descriptions.

6.2.5 Ultrafiltration

The Stage 1 UF system, which will be installed in the RFB, will be sized for Stage 1 peak flows. The size and number of modules will be determined based on vendor standard equipment and module sizes as it relates to equipment to fit in the RFB. The Stage 1 design basis will be 1.8 to 2.0 mgd for peak flow, plus some oversizing that may occur based on standard module sizing. Stage 1 capacity is expected to readily fit in the RFB. Space available for Stage 2 capacity in the RFB is to be analyzed, and space is available on site to expand the RFB if it is needed.

The type of UF system, whether pressurized feed or vacuum draw, will be selected based on a life-cycle cost analysis, space availability, and the complexity of the piping. The system will be fed from a break tank outside the RFB. That tank is fed by the clarified industrial effluent pump station (CIEPS).

Feed water from the lime-coag-sed system is pumped through the filters and into the clearwell. Ancillary equipment such as clean-in-place (CIP) and backwashing systems will be included. A process diagram is not yet developed as it is vendor-dependent and also dependent upon whether a pressurized or vacuum system is used.

6.2.6 Ion Exchange

The IX system is already in place in the WSB and is currently being used to soften groundwater for cooling tower makeup. It was planned and installed under an agreement between the City and Microsoft. It currently has seven units with a total capacity of 900 gpm firm, 1,050 gpm total, with 150 gpm redundant. However, each 150 gpm unit includes two IX vessels. The system will be investigated for revising it to 14 independent vessels, with an n+3 or n+4 for an upgraded capacity of more than 1,500 gpm.

The IX system is estimated to use 4 to 5 lb of salt per 1,000 gallons treated. Following the aforementioned system revisions, IX regeneration is estimated to create between 10 and 20 gallons of brine per 1,000 gallons treated. The brine is routed via existing piping to an existing permitted and operating evaporation pond system.

6.2.7 Reverse Osmosis

The RO system is currently being installed. It was largely procured with grant funding that was provided to help the City address the data center TDS issues. It was installed with a planned initial operation using groundwater. It is compatible with either potable or reuse water, although its performance will vary between the two sources. Refer to Appendix E for a PFD of the system.

The Stage 1 system has four units, each with a permeate production capacity of 250 gpm for a firm capacity of 750 gpm, 1,000 gpm total. Pending initial testing and tuning, the system was modeled using softened feed water to achieve recovery of 90 percent or greater (see Section 6.2.1). At Stage 1 demands, RO usage will produce an average annual reject flow rate between 50 and 75 gpm, requiring a minimum of 10 acres to 15 acres of evaporation pond surface to evaporate the water. There are 3.2 acres already installed. Additional ponds will be installed in the footprint of lagoon 6 at the IWTP. Lagoon 6 covers approximately 15 acres. Early Stage 1 testing and tuning will investigate methods to increase RO recovery and reduce reject. Methods to enhance the evaporation rate of RO reject will be studied, including mechanical vapor distillation. RO reject flow is equalized in a 30,000-gallon tank in the RO building, and drained to the evaporation pond system. RO reject will be kept separate from IX brine because precipitation would occur if they were combined and because the IX brine is already much more concentrated. IX brine will be stored in the 1.5 MG pond near the RO building.

6.3 System Hydraulics and Flow Controls

For Stage 1 operation, a portion of SBR effluent pumped from the SBR effluent equalization basin will flow to the lime-coag-sed system. System-wide demand will be monitored using flow meters on the distribution system. The total flow demand will be continuously time-averaged during a period of recent 1 to 2 hours of flow. This flow demand signal, adjusted for reuse clearwell level trending, will be the input flow rate to control the lime-coag-sed feed flow controls valves. The reuse water clearwell level will also be monitored. At a low-level set point, the flow demand signal will be set above the recorded flow demand, based on the level trend, to cause the clearwell to fill. At a high-level set point, the signal will be set below the demand to cause the clearwell level to lower. The demand signal to the lime-coag-sed system will be fixed for periods of at least 2 hours and signal changes will be stepwise to allow for stable operations and easier level controls. This is made possible by the significant flow equalization/buffer volume provided in the clearwell. The following is a reasonably expected example scenario:

- Lime-coag-sed feed flow signal is 450 gpm
- 2-hour average reuse water demand is 500 gpm and has been steady
- Clearwell level has been trending down and is below the preferred band
- New lime-coag-sed feed flow signal is 600 gpm
- Clearwell level will then trend up
- 2 hours of flow at a 100 gpm differential flow rate = 12,000-gallon volume increase in the clearwell, or less 10 percent level change

The distribution of reuse water is described in the *Reuse Pumping System Design Basis Summary* TM in Appendix F (BC 2016b). The basis was developed in support of projected Stage 2 operations, with the primary intent of determining the maximum pumping system capacity that can be installed in the WSB. Only a portion of the Stage 2 pumping systems will be used for Stage 1.

Refer to Figure 6-2, below. In the figure, industrial filtered effluent (IFE) is shown. IFE may be used for industrial reuse (e.g., industrial cooling) or for crop production. For industrial supply, IFE is stored in the 200,000-gallon IRW clearwell, shown as IRW IFE. In another clearwell, IFE will be stored for blending with RW, shown as RW IFE. For Stage 1, only the IRW IFE clearwell and pumps will be installed and used.

From the clearwell, the IRW IFE pumps are designed to feed the suction side of the RO feed pumps taking into account the headlosses in the HES IX system and conveyance piping. There is no break tank between the clearwell and RO system. The RO system process diagram is shown on PFD-36 in Appendix E.

Pressurized highly softened water (HSW) enters the RO building and feeds the suction side of the RO feed pumps. After the RO membranes, RO treated water or permeate is collected in a 30-foot-tall, 30,000-gallon RO permeate tank. With this tank one-half to nearly full, enough elevation head is available to feed, via an 18-inch-diameter pipeline, the IRW RO holding tank at the WSB (Figure 6-2) at up to 1,700 gpm. From the holding tank, RO water is pumped into the IRW line at a blending point and blended water is delivered to the reuse water distribution utility. The RW RO pumps and RW booster pump are not used in Stage 1.

System hydraulics are discussed in the *Reuse Pumping System Design Basis Summary* TM (BC 2016b).

6.3.1 Disinfection

State regulations require disinfection of Class A RW and the maintenance of a chlorine residual until the point of use. All IRW will be treated by coagulation, sedimentation, and UF. Although no pathogens are expected in IWTP effluent (because there is no domestic wastewater sent to the IWTP), the UF will act as a disinfectant, as it is an absolute barrier to particles greater than 0.01 micrometer. The City does not intend to chlorinate IRW. RO permeate delivered to the MWRF will pass through the MWRF disinfection system.

6.3.2 Blending

Not all of the IRW will be treated by IX and RO. All will be treated by coagulation-sedimentation and UF, but only a portion of the UF effluent will be further softened by IX and demineralized by RO. That portion will then be blended with the balance of the UF effluent. This blending makes the system more complicated than if all of the water were treated by IX and RO, but it saves money because the RO is smaller, and less brine (IX waste and RO reject) is generated.

Figure 6-2 below shows a representation of the Q1W reuse water distribution system that shows the blending. UF effluent (denoted by the blue lines) can flow to any of the following three places:

- The IRW IFE clearwell, which provides storage. Also shown is a future system that will allow IRW IFE water to be sent to a crop irrigation system.
- The HES system, which softens the water and then sends it to the RO system.
- The IRW RO blending pump station, where water that is not treated via RO is blended with RO effluent (denoted by the red lines) for reuse.

The proportions of UF filtered and RO treated water that will make up the blend(s) sent to Microsoft and other industrial users have not been established. As stated in Section 5 above, each industrial user may have its own requirements. The system will be versatile enough to produce a variety of blends.

In the future, when IRW is permitted to be used for crop production, there will be a means for blending RW from the MWRF with UF effluent and RO effluent. Strategically placed air gaps in the system shown in Figure 6-2 will prevent RW from entering the industrial reuse lines and becoming a component of water sent to Microsoft and other industrial users.

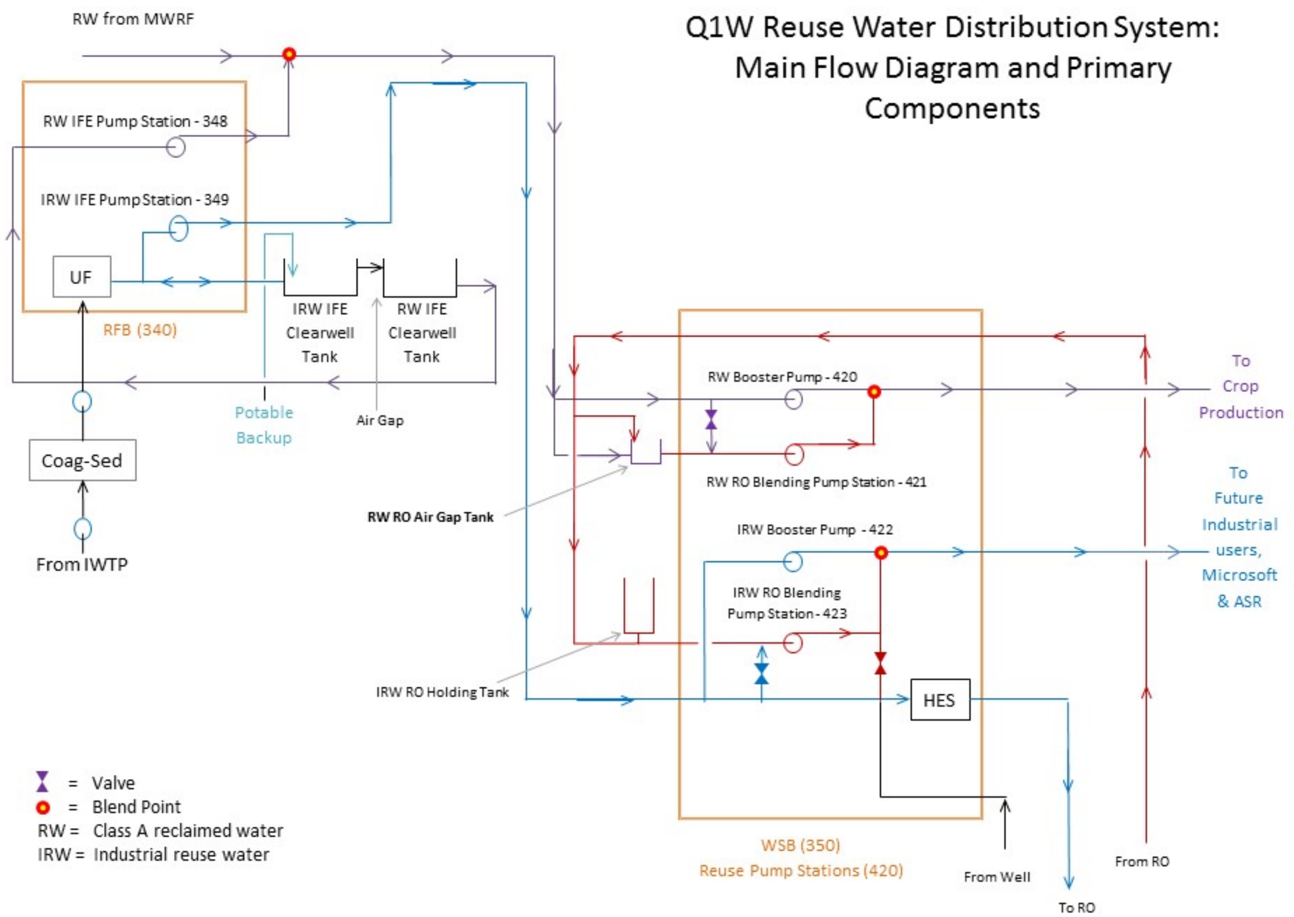

Figure 6-2. Q1W reuse water blending and distribution system

6.3.3 Recharge

Some of the RO treated water will be blended with MWRF effluent and sent to the MWRF percolation beds to mitigate groundwater TDS issues in the area. A sufficient quantity of low TDS water will be routed to the beds to bring the blended water concentration to approximately 500 mg/L. In Stage 1, the flow rate of the MWRF percolation beds is estimated to average 0.1 mgd, although this value may vary depending on cooling water demands.

6.4 Expected Effluent Characteristics

Effluent will meet Class A RW requirements and nitrogen requirements for groundwater recharge, or the equivalent requirements for IRW. These are described in Sections 4 and 5, above. Water used for blending with RW at the percolation beds will have a TDS concentration of approximately 100 mg/L.

Section 7

Residuals

This section discusses the handling and management of solids and other residuals from the system. This section is included to satisfy the ER requirements of WAC 173-240-130(2)(r).

7.1 Biological Process Residuals

Prior to the construction of the anaerobic pre-digestion lagoon in 2011, raw sludge withdrawn from the primary clarifiers was dewatered using centrifuges and then trucked offsite for cattle feed. Waste sludge from the SBRs was pumped to sludge storage lagoon 3. After the anaerobic pre-digestion lagoon began operating in November 2011, the primary clarifiers were taken out of service, because the anaerobic pre-digestion lagoon replaced the primary treatment process. Waste sludge from the SBRs is recycled to the lagoon and can also be pumped to sludge lagoon 3. The current practice is that sludge is removed from the anaerobic pre-digestion lagoon about once a year. The anaerobic sludge is dewatered using a portable centrifuge and it is certified as a fertilizer. The dewatered sludge is then land-applied at local farming fields.

Waste sludge flow and the load pumped from the SBRs to the lagoon are not measured. Calibration of the biological process simulator, BioWin, using sampling data collected in August/September 2012 and March 2013, indicated that about 3 to 6 tons/d dry of waste sludge is sent to the lagoon. Volatile solids from the raw wastewater and the waste sludge are digested in the lagoon. In November 2012, the first time that sludge was removed from the lagoon, about 97 dry tons of sludge were hauled offsite, at 12 to 14 percent solids.

It is expected that current sludge-handling practices will remain the same in the foreseeable future. Sludge production rates were calculated for a number of scenarios that are considered to determine maximum biological process capacity. These scenarios include:

- Current rated flow and loadings with and without primary effluent (PE) bypass
- Current rated flow and higher loadings (per existing influent characteristics)
- Current rated flow and maximum loadings for the existing blower capacity
- Maximum flow and loadings at three cycles per day per SBR
- Maximum flow and loadings at four cycles per day per SBR

The estimated sludge production rates at the lagoon are summarized in Table 7-1, below.

Table 7-1. Estimated Anaerobic Pre-digestion Lagoon Sludge Production

Scenario	Maximum month flow (mgd)	Maximum month loading (lb/d)		Maximum month sludge production (lb/d)	Annual average sludge production (lb/d dry)
		BOD	TSS		
Current rated flow and loads: with flow to lagoon limited to maintain design HRT	4.89	74,000	66,400	3,670	330
Current rated flow and higher loads (per existing wastewater characteristics)	4.89	122,300	102,000	6,800	620
Current rated flow and maximum loads for existing blower capacity	4.89	85,600	71,400	4.540	420
Maximum flow and loads at three cycles per day per SBR	5.94	118,900	99,100	6,600	600
Maximum flow and loads at four cycles per day per SBR at maximum lagoon effluent pump capacity	7.20	117,100	97,600	5,770	530

The results show that when the biological process (both anaerobic lagoon and SBRs) is operated at its maximum capacity, the sludge production rate will increase significantly from the current level. This means that sludge will need to be removed from the lagoon more frequently, or the sludge removal operation will require larger centrifuges or will occur over a longer period.

7.2 Filtration Residuals

UF backwash flow, for both Stage 1 and Stage 2, will be routed back to the IWTP influent pump station, which is adjacent to the RFB. This routing creates a restriction preventing data center blowdown from being routed to the lime-coag-sed system until discharge to the wasteway is ceased. Even though the lime-coag-sed system will not directly interact with the wasteway, by returning the UF backwash flow to the IWTP influent pump station, a fraction of the water will get to the wasteway.

7.3 Softening and Reverse Osmosis Residuals

HES and RO residuals from the IRWTP will be in the form of a liquid stream with a high TDS concentration. The City's existing brine management system, with modular capacity increases as needed, is capable of handling these residuals. This section describes the brine management system.

Microsoft transferred operation of the existing IX treatment process at the IRWTP to the City in 2011. To prepare for the transfer of operational responsibilities, the City developed a system consisting of four evaporation lagoons and the conveyance infrastructure to transfer brine between the lagoons. The system was developed to reduce the volume of industrial water treatment brine waste through the use of evaporation lagoons. Design criteria for the system are shown in Table 7-2, below.

Table 7-2. Lagoon Sizing Information				
Parameter	Lagoon			
	1	2	3	4
Length (feet)	275	275	208	208
Width (feet)	135	120	122	122
Depth (feet)	2	7	8	8
Side slope ratio (horizontal:vertical)	3:1	3:1	2:1	2:1
Freeboard (feet)	3	2	2	2
Evaporation area (ft^2)	34,500	36,300	24,110	24,110
Storage volume (MG)	0.25	1.48	1.25	1.25

Lagoons 1 and 2 are located within the boundaries of the Columbia Data Center, adjacent to the RO building. Lagoons 3 and 4 are located at the IWTP. Lagoons 1 and 2 receive the initial discharge from the existing softeners and will be used to manage the discharge from the RO system once it is in operation. Lagoons 3 and 4 store and further concentrate brine from Lagoons 1 and 2 through evaporation. Periodically, concentrated liquid waste in the IWTP lagoons will be hauled offsite for disposal at a liquid waste facility, and the accumulated settled solids will be removed for landfill disposal.

Hauling may only be implemented on an interim basis, after the RO system is operating, until a more efficient disposal method can be developed. Until then, the primary operational objective is to enhance evaporation in the ponds to the maximum rate possible so that the eventual hauled brine volume is reduced.

An existing 0.8-inch-diameter pipeline conveys concentrated brine from Lagoons 1 and 2 at the Columbia Data Center to Lagoons 3 and 4 at the IWTP. Brine transfer between the two pond systems will be infrequent and will occur as a batch operation. Brine transfer via gravity flow will be tested and, if not successful, a dedicated brine transfer pumping system will be installed. The system was documented in the *Brine Management System* ER (BC 2011b). Once the RO system is in service, RO reject will flow through this same path.

A preliminary review of land application opportunities was conducted and the technical memorandum on this review is provided in Appendix G. In summary, the review indicated that a significant portion of the brine salts can be blended with the waste sludge for land application. This approach, or any similar approach, will require systems that improve drying. Drying systems included enclosed solar drying (e.g., greenhouses) with additional floor heating using anaerobic lagoon biogas and a boiler. This ER relies on brine hauling to address the new IWTP residuals stream. Subsequent ERs will be submitted if resource recovery enhancements are planned.

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Section 8

Schedule

This section is included to satisfy the ER requirements of WAC 173-240-130(2)(w). It describes the Stage 1 schedule and includes past activities that describe the starting point. It also references the overall project phasing scheme developed in the 2008 FS. The phases are:

1. Phase 1: Conveyance corridors between the IWTP, IRWTP RO building, and MWRF were installed in 2010.
2. Phase 2: Extension of the conveyance to the east side of the city when needed. The east side industry can be a customer of reuse water once the cost of the pipelines is justified.
3. Phase 3: Treatment systems in staged implementation in response to demands.
4. Phase 4: Development of reuse water uses for Stage 2 operations including crop production, aquifer injection, and expanded percolation.

Phase 3 was partially completed via the lease agreement between the City and Microsoft. This agreement provided the first component of the IRTWTP facility for integration into the Q1W. Connections of the Phase 3 components to the Phase 2 backbone is complete. This includes the completion of Phase 1 piping to buildings that house treatment systems and the RFB. Phase 3 also includes residuals processing facilities.

The implementation schedule for remaining Stage 1 work is shown in Table 8-1. For reference, the past completed infrastructure is included.

Table 8-1. Stage 1 IRWTP Schedule

Phase/milestone	Description	Completion date
HES IX	Microsoft direct and RO feed	Operational
RO	MWRF effluent blending	01/2017
RO water distribution	Feed pumps in WSB	05/2017
Lime-coag-sed	Feed to UF	12/2017
UF	Feed to HES IX	12/2017
Reuse water flow	Replace groundwater	01/2018

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Section 9

Ownership, Operations, and Maintenance

This section describes ownership, operations, and maintenance of the proposed system. This section is included to satisfy the ER requirements of WAC 173-230 and 173-240-130(2)(2).

The City owns all components of the IWTP, IRWTP, and MWRF. The City uses operation contractors to operate the utility.

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Section 10

Regulatory Issues

Compliance with water quality regulations is discussed in Sections 4 through 6, above. This section discusses additional regulatory issues. This section is included to satisfy the ER requirements of WAC 173-240-130(2)(t) and (x).

10.1 Compliance with State, Local, and Federal Plans

A number of water quality management plans and administrative rules may be applicable to projects in the Quincy area (Ecology 2009). These include, but are not limited to, the following:

- Watershed planning for water resources inventory area (WRIA) 41: lower crab
- Administrative rules for the Quincy groundwater management area (WAC 173-124)
- Administrative rules for Columbia River in-stream resources (WAC 173-563)
- The federally authorized Columbia Basin Project (CBP), a joint project involving Washington State, USBR, the U.S. Environmental Protection Agency, and irrigation districts within the CBP boundaries

The Quincy area is within the Quincy Columbia Basin Irrigation District. The proposed project will not discharge to surface water. Groundwater recharge will comply with the applicable state and local plans.

10.2 Environmental Protection

Both State Environmental Policy Act (SEPA) and National Environmental Policy Act (NEPA) documents will be prepared for the project. This section discusses SEPA and NEPA compliance.

10.2.1 State Environmental Policy Act

A draft SEPA checklist is included in Appendix H. The City intends to issue a Determination of Non-significance for the project. Following the required comment period, the SEPA determination will be finalized.

A copy of the final SEPA determination will be included with the final ER.

10.2.2 National Environmental Policy Act

No federal funding will be used for the remainder of this project, and no NEPA documentation will be developed.

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Section 11

Future Provisions

This ER covers Stage 1 of the IRWTP. Another ER will be prepared and submitted to Ecology before Stage 2 is designed and constructed. Stage 2 will increase the capacity of the IRWTP to meet the additional demand for IRW and allow cessation of IWTP effluent discharge to the wasteway. The City anticipates that industrial production in the city will continue to expand in the future, as will the demand for IRW. The system described in this ER is thus intended to expand in a modular manner, without the addition of major infrastructure, to keep pace with industrial growth.

The modeling presented in Section 4 showed that the ultimate biological capacity of the IRWTP is 7.2 mgd. The IRWTP will be expanded as much as needed to treat the increased IWTP effluent flow.

This section is included to satisfy the ER requirements of WAC 173-240-130(2) (u).

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Section 12

Limitations

This document was prepared solely for the City of Quincy in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Quincy and Brown and Caldwell dated August 15, 2016. This document is governed by the specific scope of work authorized by the City of Quincy; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Quincy and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Further, Brown and Caldwell makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared. All data, drawings, documents, or information contained in this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of Brown and Caldwell unless otherwise provided by the agreement pursuant to which these services were provided.

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Section 13

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Appendix A: Storm Water Pollution Prevention Plans (SWPPP) and Spill Prevention and Countermeasure Plans (SPCC)

Amway, Nutrilite Division Chemical Spill Response Plan, not dated

Amway Spill Response and Reporting Procedures, Quincy, WA Operations, dated October 10, 2016

ConAgra Foods Spill Prevention Control and Countermeasure Plan, Quincy Plant, dated January 27, 2014

ConAgra Foods Storm Water Pollution Prevention Plans, Quincy Facility, Dated January 20, 2014

Quincy Foods, Spill Plan, Quincy Processing Facility, dated November 10, 2014

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NUTRILITE DIVISION
AMWAY CORPORATION

Chemical Spill Response

For information about this Standard, contact the
Environmental, Health and Safety Department at (509) 630-5477

Contents

Chemical Spill Response

1.0 OBJECTIVE

Although Nutrilite is principally a manufacturer of food supplements, there are chemicals and hazardous materials used at our facilities in production and research that employees may come in contact on a regular basis. Nutrilite follows applicable local, state, and federal regulations regarding proper storage and handling of chemicals; however, during the course of normal operations, situations may arise in which chemicals are released outside of normal operating procedures. This Safety Standard has been developed to provide employees with a level of awareness when working with or near chemicals and outlines procedures to be followed by all Nutrilite employees when in the immediate area of a chemical release.

2.0 BACKGROUND

On March 6, 1990, the Occupational Safety and Health Administration (OSHA) issued the Hazardous Waste Operations and Emergency Response (Hazwoper) regulation 1910.120 which became effective for OSHA governed states and employers. Under Washington State Industrial Safety Act (WISHA), WAC 296-824-100 states the minimum requirements that help you protect the safety and health of your employees during a response to a hazardous substance releases in your workplace or any other location.

3.0 DEFINITIONS

3.1 CHEMICAL: Any powder, paste, semisolid, liquid, or gaseous material in any type or size container, including pipes, pails, drums, tanks, etc. Chemical, as defined, includes Nutrilite /Amway raw materials and other material used by Nutrilite/Amway (i.e., glues, inks, cleaning lubricants, cleaning solvents, processing aids, etc.). Chemical, as defined, does not include articles such as machine parts, boxes, mops, parts, etc., which while comprised of chemicals, are formed to be a specific shape or design during manufacture and do not release or otherwise result in exposure to a hazardous chemical during use.

3.2 EMERGENCY RESPONSE: A response effort by employees from outside the immediate release area or by other designated responders to an occurrence which results, or is likely to result, in an uncontrolled release, which may cause high levels of exposure to toxic substances, or which pose danger to employees requiring immediate attention.

3.3 HAZARDOUS MATERIAL: Any chemical substance in quantity or form that may pose an unreasonable risk to health, safety or the environment.

3.4 INCIDENTAL RELEASE: A release or spill of hazardous materials where the substance can be absorbed, neutralized, or otherwise controlled at the time of the release by employees in the immediate area.

3.5 LOWER EXPLOSIVE LIMIT (LEL): The minimum concentration necessary for a specific vapor to ignite.

3.6 MATERIAL SAFETY DATA SHEETS (MSDS): Publications developed by chemical manufacturers for individual hazardous chemicals. These publications are required by OSHA to provide information including the material identity, hazardous ingredients, physical and chemical characteristics, physical hazards, reactivity hazards, health hazards and first aid procedures, precautions for safety handling and use, and spill control procedures.

3.7 UNCONTROLLED RELEASE: A release where significant safety and health risks could be created. Releases of hazardous substances that are either incidental or could not create a safety or health hazard (i.e., fire, explosion or chemical exposure) are not considered to be uncontrolled releases.

4.0 RESPONSIBILITY

4.1 EMPLOYEE:

- Be familiar with chemicals, chemical hazards and spill response procedures in your area before using or transporting chemicals.
- Understand steps to be taken when either an incidental or uncontrolled hazardous material release occurs.
- Report all chemical spills or releases to supervisor or lead.
- Use appropriate personal protective equipment as indicated on labels or Material Safety Data Sheet when handling materials.

4.2 SUPERVISOR:

- Ensure that employees handling chemicals have received training to understand the hazards and proper clean-up procedures of chemicals in their work area.
- Ensure that appropriate clean-up materials and personal protective equipment are available in the work area.
- Participate in awareness level training beyond the scope of this Standard.

- Determine if a chemical spill is incidental and can be handled by department employees or if the spill is uncontrollable and assistance from Security and/or the Safety, Environmental and Health Services (EHS) representative is needed.
- Work with the EHS Department to ensure waste chemicals are handled and disposed of properly.

4.3 SAFETY, ENVIRONMENTAL, AND HEALTH SERVICES DEPARTMENT:

- Provide training to employees in chemical spill response awareness.
- Work with department management to evaluate specific chemical hazards and determine appropriate spill response procedures.
- Assist supervisors and Security in evaluating chemical spills to determine whether or not the spill is incidental and can be handled by employees or if the spill is uncontrollable and outside response is needed.
- Assist supervisors in determining proper disposal of chemical waste.
- Provide auditing to ensure program compliance.

4.4 SECURITY DEPARTMENT:

- Participate in awareness level training beyond the scope of this Standard.
- Assist supervisors and the EHS representative in determining whether or not a chemical spill is incidental and can be handled by employees or whether the spill is uncontrollable and outside response is needed.
- Request outside emergency services as necessary.

5.0 PROCEDURES

Nutrilite employees are **not permitted to respond to uncontrolled releases of hazardous materials** as described above. Instead, the local County HazMat team which employs individuals extensively trained in hazard materials emergency response operations will be contacted to provide emergency response assistance. However, there are practices which Nutrilite employees are to follow to prevent an incidental chemical release from becoming an uncontrolled hazardous material release.

5.1 <u>IDENTIFICATION OF HAZARDS</u>:

Cal-OSHA requires that employers provide information to employees concerning hazardous chemicals used in the workplace to which employees may be exposed. This information is provided to the employee through container labeling, material safety data sheets (MSDS), and employee training.

5.1.1 Labeling:

Washington State's Hazard Communication Rule WAC 296-901-140 requires that all containers of hazardous chemicals be labeled with appropriate hazard warnings for the chemical. Precautionary labels are not intended to include information on the properties of a chemical nor the complete handling details under all conditions. Such information is more appropriately provided through MSDSs. Containers are to be properly labeled by the manufacturer and contain the following information:

- Identity of the chemical
- Signal word (Danger, Warning, etc.)
- Statement of hazards
- Precautionary measures
- Instruction in case of contact or exposure
- Antidotes
- Notes of physicians
- Instructions in case of fire, spill or leak
- Instruction for container handling and storage
- Name and address of the manufacturer, importer, or other responsible

Portable Containers: Portable containers shall be labeled using the Amway HMIS system when transferring potentially hazardous chemicals.

5.1.2 Amway HMIS System:

Amway has developed a stringent version of the Hazardous Materials Information System (HMIS) guidelines to properly identify the hazards associated with chemicals used at Amway/Nutrilite facilities. The Amway HMIS label is to be affixed to all bulk containers, transfer containers, and all portable containers. The Amway HMIS system identifies three categories of chemical hazards including Reactivity hazards, Inhalation hazards, and Contact hazards.

5.1.3 National Fire Protection Agency (NFPA) Hazard Ranking (704M)

The NFPA Hazard Ranking guidelines are used to identify hazards contained within a building and are also used to identify hazards of a specific chemical on containers provided by outside chemical suppliers. The NFPA symbol is diamond-shaped and identifies four categories of chemical hazards, including Flammability, Health, Reactivity and other hazards, each color coded differently.

A copy of the NFPA Hazard Ranking system guidelines is provided in Appendix A. Please refer to Nutrilite's Safety Standard No. 45, Hazard Communications, for a further explanation of the NFPA Hazard Ranking System.

5.1.4 Material Safety Data Sheets (MSDS):

An MSDS contains information on chemicals, such as physical properties, health and safety data, first aid information, and spill clean-up procedures, which is useful in meeting the goals of this program.

This information is supplied to help the employee work more safely and be aware of the hazardous materials used in the course of the job. By knowing the chemical and physical characteristics of the materials used, the employee can better protect him/herself from their hazards.

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5.2 CHEMICAL SPILL RESPONSE PROCEDURES:

When working with or transporting hazardous chemicals, the following practices must be followed:

5.2.1 Prepare to handle chemicals safely

- Employees are to be familiar with chemicals, chemical hazards and spill response procedures ***before*** using or transporting chemicals. Material Safety Data Sheets and container labels are available to all employees to be read prior to handling chemicals. Supervisors and the Safety Advisor may also be consulted about the hazards of the chemical prior to use.
- Use appropriate personal protective equipment.
- Use extreme caution while using or transporting chemicals**.**
- Be aware of the location of spill containment and clean-up materials in your work area.

5.2.2 Chemical release or spill occurs.

- Note the location of the release, hazard classification, the type of material released, the amount released and the severity of the situation. If the material has an Amway hazard code of D-4-4-4 or N-4-4-4 or an NFPA ranking of 1 in any category, the employee or employees from outside the immediate spill area may clean up the spill.
- If the spill has an Amway hazard code other than D-4-4-4 or N-4-4-4, an NFPA ranking of 2 or greater, or no code at all, notify your supervisor immediately.
- Supervisor and employee evaluate situation to confirm hazard classification of material and to determine if spill is incidental or uncontrollable.

∗ **EXCEPTION:**

Laboratories: Employees working in laboratories may proceed with clean-up of incidental spills of chemicals with Amway hazard codes other than N or D for reactivity and less than 4 for inhalation and/or contact hazards without immediately notifying their supervisor provided they are working in a well ventilated area and are wearing appropriate personal protective equipment while handling the chemical. Clean-up procedures must follow those specified in the Chemical Hygiene Plan. Supervisors must be notified following clean-up of the spill. For uncontrolled spills, the steps outlined in this Safety Standard must be followed.

5.2.3 Spill is Incidental or Controllable.

- If the team lead determines that the spill is incidental or controllable and that employees in the immediate release area have appropriate training and personal protective equipment to clean-up the chemical, they may contain and clean-up the chemical spill.
- If the supervisor is unable to determine whether the spill is incidental or uncontrollable, Security or the EHS representative may be contacted to assist in the determination.
- Keep unnecessary employees away from spill.
- Always use buddy system when performing clean-up activities.
- Use appropriate personal protective equipment under acceptable conditions as outlined on chemical MSDS.
- Follow proper decontamination procedures upon completion of clean-up (Section 5.4).
- Notify the EHS representative after spill has been cleaned-up to determine appropriate waste disposal methods (Section 5.5).

Note: The only employees from outside the immediate release area allowed to assist in clean-up of the spilled material are maintenance personnel.

5.2.4 Spill is Uncontrollable.

- Team Lead, Security and EHS representative will determine whether 911 will have to be called to dispatch the Clean Harbors HAZMAT team.
- Ensure that spill area is evacuated and facility as necessary.
- Attempt to remotely confine spill from entering canals, waterways, drains, etc.
- A EHS representative will notify the following offices immediately if a reportable quantity on the “List of List Hazardous Chemicals” is released or within 24 hours of an uncontrolled spill of a hazardous material:
    - ∗ 1) Local Emergency Planning Committee (509) 237-2987
    - ∗ 2) National Response Center (800) 424-8802.

5.2.5 Post clean-up Investigation.

- After immediate danger has passed, a team made up of the department supervisor, involved employees, Security and the EHS representative will investigate the factors that led to the spill.
- Written recommendations will be provided by the team.

Please refer to the Chemical Spill Response flow chart (Appendix B) for an outline of the above response actions.

5.3 CLEANUP OF INCIDENTAL AND/OR CONTROLLABLE SPILLS

5.3.1 Spill Evaluation:

The initial spill evaluation involving employees in the immediate spill area and the department supervisor must consider information upon which the decision will be made whether or not to proceed with containment and clean-up of the chemical spill or whether outside assistance is needed. This initial evaluation will also consider the most effective strategy and tactics for approaching the spill and should ensure that employees or individuals in the surrounding area are not endangered. If the employee and supervisor are unable to obtain this information, then a team made up of the supervisor, Security and/or the EHS representative will work together to evaluate the spill.

OSHA has developed qualitative (subjective) and quantitative (numerical) determinants that will assist those evaluating the spill to determine whether the spill is an incidental, controllable release or requires outside emergency response. Judgments as to whether a release warrants an emergency response are based on the following:

Qualitative Determinants:

- The release poses a life or injury threatening situation. This may be obvious or it may be a judgment call depending on the amount and type of hazardous substance released.
- The release requires employee evacuation.

- The situation requires immediate attention because of danger (for example, a release produces flammable vapors that could reach an ignition source).
- The release causes a high level of exposure to toxic substances.
- The situation is unclear or data are lacking.

Quantitative Determinants:

- The release poses or potentially poses conditions that are immediately dangerous to life or health (IDLH) conditions.
- The hazardous substance release exceeds or could exceed 25% of the lower explosive level (LEL).
- The release exceeds the permissible exposure limits (PEL) by an unknown proportion.

If the above quantitative conditions are not suspected and the qualitative determinants are favorable, then the team evaluating the spill may determine that clean-up activities may proceed. However, if the above quantitative conditions may reasonably exist, if any of the qualitative determinants are unfavorable, or if there simply is not enough information to make a judgment, then an emergency response from outside services may be required.

5.3.2 Spill Containment and Clean-up Tactics:

If it has been determined that the spill is incidental or controllable, then appropriate tactics must be used to contain and clean-up the spilled chemical. Tactics are the methods, procedures, and techniques used to control the released chemicals, or in the case of a potential situation, preventing it from being released. MSDSs are often the best source of information to determine the most appropriate tactics for containing and cleaning up the spilled material.

Tactics that are employed to prevent or reduce the hazards associated with an incidental chemical spill generally include the following:

- Extinguishing fires in the incipient stage.
- Removing materials.
- Plugging, patching, and other methods (containment) to keep materials in their original containers.

- Using dikes, berms, dams, and other techniques to confine spilled materials to the smallest possible physical area.
- Using various chemical and physical methods, for example neutralization, absorption, dilution, transfer, dispersion, solidification, and others to minimize hazards.

Other than removing people from an area that could be affected by the hazardous nature of the incident, most tactics used to protect people also protect property and the environment.

5.4 DECONTAMINATION:

All personnel, clothing and equipment leaving a spill area must be decontaminated to remove any harmful chemicals or infectious organisms that may be adhered to them. Decontamination methods either (1) physically remove contaminants, (2) inactivate contaminants by chemical detoxification or disinfection/sterilization, or (3) remove contaminants by a combination of physical and chemical means.

5.4.1 Physical Removal

In many cases, gross contamination can be removed by physical means involving dislodging/displacement, rinsing, wiping off, and evaporation. Contaminants that can be removed by physical means can be categorized as follows:

A. Loose Contaminants
B. Adhering Contaminants
C. Volatile Liquids

5.4.2 Chemical Removal

Physical removal of gross contamination should be followed by a wash/rinse process using cleaning solutions. These solutions normally use one or more of the following methods:

A. Dissolving contaminants
B. Surfactants
C. Solidification
D. Disinfection/Stabilization

Specific decontamination methods and personal protective equipment used while handling chemicals should be specified in department standard operating procedures.

5.5 HAZARDOUS WASTE DISPOSAL:

The Safety, Environmental and Health Services department must be consulted regarding proper disposal of chemical wastes for materials with an Amway hazard code other than D-4-4-4 or N-4-4-4 or NFPA hazard rankings of 2 or greater in any category. Any material designated for disposal must be properly packaged and the container specifically labeled as to its contents. The EHS department will supply appropriate hazardous waste labels.

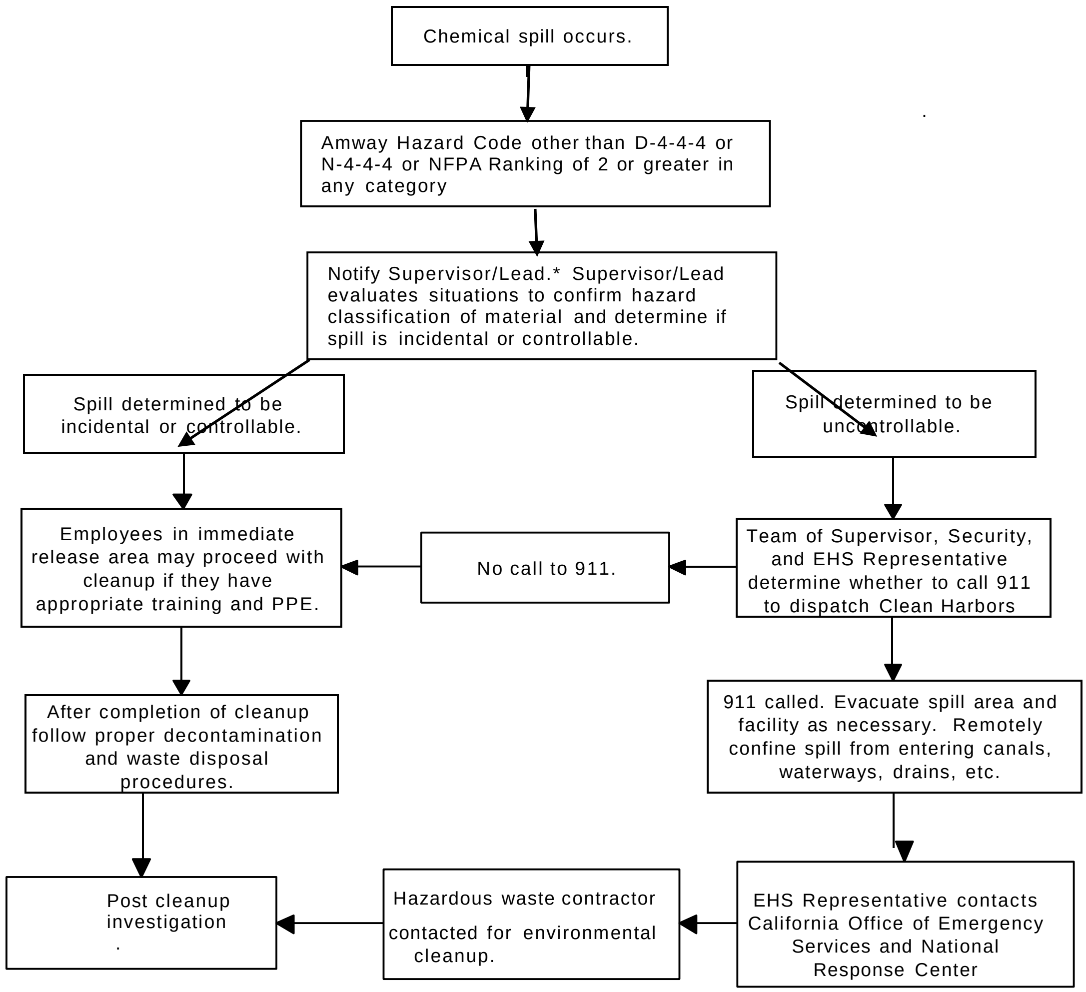
APPENDIX A

NFPA HAZARD RANKINGS

Identification of Health Hazard Color Code: BLUE		Identification of Flammability Color Code: RED		Identification of Reactivity (Stability) Color Code: YELLOW	
	Type of Possible Injury	Susceptibility of Materials to Burning		Susceptibility to Release of Energy	
Signal		Signal		Signal	
4	Materials which on very short exposure could cause death or major residual injury even though prompt medical treatment were given.	4	Materials which will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, or which are readily dispersed in air and which will burn readily.	4	Materials which in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Materials which on short exposure could cause serious temporary or residual injury even though prompt medical treatment were given.	3	Liquids and solids that can be ignited under almost all ambient temperature conditions.	3	Materials which in themselves are capable of detonation or explosive reaction but require a strong initiating source or which must be heated under confinement before initiation or which react explosively with water.
2	Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.	2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	2	Materials which in themselves are normally unstable and readily undergo violent chemical change but do not detonate. Also materials which may react violently with water or which may form potentially explosive mixtures with water.
1	Materials which on exposure would cause irritation but only minor residual injury even if no treatment is given.	1	Materials that must be preheated before ignition can occur.	1	Materials which in themselves are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
0	Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.	0	Materials that will not burn.	0	Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.

APPENDIX B

Hazardous Material Spill Response Flow Chart



PURPOSE:
The purpose of this document is to establish a procedure to respond to emergency spills or releases and to make appropriate legal and regulatory notifications if a spill or release occurs.

SCOPE:
This procedure is applicable to the Amway Nutrilite Facility in Quincy, Washington.

RESPONSIBILITY:
EH&S Manager

REFERENCES:

- WA DOE Notification Requirements: http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm
- WA DOE Emergency Release Reporting Forms: http://www.ecy.wa.gov/epcra/section304.html
- EPA List of Lists http://www2.epa.gov/sites/production/files/2013-08/documents/list_of_lists.pdf
- EPA's Oil Pollution Prevention/Spill Prevention, Containment, and Counter Measures (SPCC) Plan -- 40 CFR, Part 112.7(d) and 112.20-.21; DEQ: Rule 323.1162
- EPA'S Risk Management Plan – 40 CFR, Part 68
- OSHA's HAZWOPER – 29 CFR, Part 1910.120
- EPA's Resource Conservation and Recovery Act Contingency Planning (RCRA) – 40 CFR, Part 265, Subpart D

DEFINITIONS:
(1) Chemical Release: The term "release" means spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing. "Chemical" includes substances considered to be toxic or hazardous as well as seemingly harmless substances.
(2) EPA List of Lists: The EPA published a consolidated list of chemicals subject to SARA Title III and to Section 112(r) of the Clean Air Act called the "List of Lists." The List of Lists includes:

- CERCLA Hazardous substances
- SARA Title III Extremely Hazardous Substances & Section 313 Toxic Chemicals

(3) *Immediate Notification:* Means within 15 minutes after discovery of release.
(4) *As Soon As Practicable*: Means within 7 days after discovery of the release.

Emergency Spill Response:

Guideline F of the Nutrilite Botanical Concentrates Plant Site Emergency Plan directs the emergency response efforts for all incidents involving materials release. The Environmental, Health & Safety (EH&S) Department Environmental Supervisor is designated the Emergency EH&S Coordinator (EEC) in the event of a materials release. This guideline outlines the responsibilities of the EEC in the event of a spill or release. Such responsibilities receiving spill notification, providing situational assessment and guidance to Protection Services, Nutrilite personnel, and Hazardous Materials (HazMat) Emergency Response Team, as well as determining the timely reporting notification requirements of release(s) to the appropriate governmental agencies.

The Emergency EH&S Coordinator (or designee) is expected to coordinate and advise the HazMat Emergency Response Team and provide status updates and exposure estimates and projections to the Emergency Manager and offsite authorities on a regular basis during an onsite emergency. The Emergency EH&S Coordinator must also counsel Amway Senior Management on regulatory reporting requirements and, upon management approval, make the appropriate initial and follow-up notifications to local, state, and federal environmental agencies. Numbers of all environmental agency contacts are found in the General Emergency Action Guidelines.

Onsite and offsite spill reporting procedures are contained in Guideline F and in the HazMat Team Standard Operating Handbook. The HazMat Team Standard Operating Handbook covers incident response, communication, reporting, disposal, and recordkeeping. It sets forth the Emergency Response Plan for the HazMat Team and is intended to fulfill HAZWOPER requirements under OSHA 29CFR 1910.120(q) and provides vital information such as site maps for materials storage and hazardous materials identification and labeling/placarding.

Spill Reporting Procedures:

Initial Notification:

If there is a release that is suspected of exceeding reportable quantities according to the List of Lists or if the spill or release is to the environment and it is migrating beyond facility boundaries, immediately make the following notifications even if the content or quantity has not been fully determined.

- 911 to notify Local authorities (including the LEPC).
- 1-800-645-8265 or 1-800-OIL-TANK to notify Hazardous Materials Emergency Response Team.
- 1-509-329-3400 to notify WA Eastern Regional - Department of Ecology
- 1-800-258-5990 or 1-800-OILS-911 to notify State authorities.
- 800-424-8802 (NRC) to notify Federal authorities.

Investigate and Calculate:

Following these notifications, respond to the spill, reassess the situation, and make additional notifications as required. A follow-up report will provide details that explain why a release was or was not reportable.

1. Identify the hazardous ingredients, reportable quantities, and weight percents using the higher weight percent if a range is given.

2. If the product is a liquid and the reportable quantity of the ingredient is given in pounds, calculate the total weight of the product in pounds per gallon. If the product is a solid, skip this step.

Specific gravity (relative density) of the product x 8.34 lb/gal (weight of water) = weight of the product in lg/gal

Example:	Sodium Hypochlorite, CAS # 7681-52-9 Weight % = 15% (0.15) 100 gallons of Chlorine Bleach was released Specific Gravity (relative density) on MSDS: 1.21 Weight of Water: 8.34 lbs/gal 1.21 x 8.34 = 10.0914 x 100 gallons = 1009 total lbs. Chlorine Bleach released: 1009 lbs.

3. Calculate the release of the ingredient within the product and determine reportability using Appendix A, Release Notification Requirements in Washington.

Weight % of ingredient x Weight of the total release (lbs) = Lbs. released of Regulated Ingredient

Example:	Sodium Hypochlorite = 15% of 1009 lbs. 0.15 x 1009 lbs. = 151.4 lbs Released amount = 151.4 lbs. CERCLA RQ = 100 lbs. SARA EHS RQ = NA SARA Toxic = No Part 5 Rules TRQ = 10 lbs.

Review & Revision History

Date	Name	Description of Revision
6/1/2014		Original
10/6/2016		Review and update of emergency contact websites

SPILL PREVENTION CONTROL AND COUNTERMEASURE (SPCC) PLAN

ConAgra Foods-Lamb Weston, Inc.
QUINCY PLANT

1005 E Street SW
Quincy, Washington 98848
(509) 787-2333

Contact: Lance Bruno, Industrial Engineer

Spill Prevention Control and Countermeasure (SPCC) Plan

ConAgra Foods-Lamb Weston, Inc.
Quincy Plant

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Spill Prevention Control and Countermeasure (SPCC) Plan

ConAgra Foods-Lamb Weston, Inc.
Quincy Plant

Facility Certification Form (40 CFR 112.7)

Certification:

I hereby certify that I have the authority commit the necessary resources to approve actions required to carry out this Spill Protection Control and Countermeasure (SPCC) Plan.

Signature: ______________________ Date: 27 Jan 2014

Name: Mark Peterson Title: Plant Manager

Spill Prevention Control and Countermeasure (SPCC) Plan

ConAgra Foods-Lamb Weston, Inc.
Quincy Plant

Engineer's Certification Form (40 CFR 112.3(d))

Certification:

I hereby certify that I have examined this facility and, being familiar with provisions of 40 CFR 112.3(d), attest that this Spill Protection Control and Countermeasure (SPCC) Plan has been prepared in accordance with good engineering practice.

Signature: ______________________ Date: ______________

Name: Richard D. Routh, P.E. Title: Engineer

Spill Prevention Control and Countermeasure (SPCC) Plan

ConAgra Foods-Lamb Weston, Inc.
Quincy Plant

Review Certification Form (40 CFR 112.5(b))

Certification:

I hereby certify that I have reviewed and evaluated this Spill Protection Control and Countermeasure (SPCC) Plan and will amend the Plan according to periodic review findings.

Signature: ______________________ Date: ______________

Name: Darrel Sunday Title: Environmental Advisor

Spill Prevention Control and Countermeasure (SPCC) Plan

ConAgra Foods-Lamb Weston, Inc.
Quincy Plant

Amendments of SPCC Plan (40 CFR 112.5)

The ConAgra Foods-Lamb Weston Quincy plant follows 40 CFR 112.5 by reviewing and evaluating this Spill Prevention Control and Countermeasure Plan (SPCC) plan every five years and amends the plan within six months to meet facility changes that could affect this plan. A Professional Engineer certifies amendments in accordance with 40 CFR 112.3(d).

Plan Objective (40 CFR 112.7(a))

The objective of this SPCC plan is to prevent discharges of petroleum and non-petroleum oils into navigable waters of the State of Washington and their adjoining shorelines. The implementation of this plan is based on prevention systems, adherence to proper operating procedures, and preventative maintenance supported by positive containment and removal of discharged oils.

Description of Facility (40 CFR 112.7(a)(3))

ConAgra Foods-Lamb Weston, Inc. is a manufacturer of frozen potato products. The Quincy processing facility produces french fries and formed potato products. Processing activities include: raw potato unloading, washing, peeling, sizing, cutting, blanching, drying, batter application, frying, freezing, packaging, cold storage and shipping of finished products. Processing activities are conducted 24 hours per day, five to seven days per week, with a total production year of 260 to 310 days. The facility employs about 450 full time staff and operates three shifts per day. The facility consists of main plant buildings housing process operations, packaging and cold storage, detached dry storage buildings, and yard areas for raw receiving, shipping and miscellaneous activities.

The facility wastewater system discharges into the City of Quincy Industrial Waste Water Treatment Plant (IWWTP), where it receives primary and secondary treatment. Treated effluent from the City's plant is discharged into the U.S. Bureau of Reclamation's DW237 wasteway, eventually reaching the Potholes Reservoir. The facility wastewater system consists of an oil-skimming belt, an aerobic treatment unit and cooling unit. Wastewater flow is metered to record discharged quantities. The City IWWTP monitors the contaminant concentrations to ensure they do not exceed acceptance criteria of the City's utility system and cause clogging or damage to the City's wastewater treatment systems.

Stormwater from the roof of the Raw Receiving Building on the north side of B Street SW is collected by a system of gutters and downspouts and discharged onto impervious surfaces surrounding the building. Stormwater from impervious surfaces surrounding the building is collected by a system of grated inlets, catch basins and underground piping. Impervious surfaces are graded to direct stormwater to the various inlet locations. Outfall from this system is discharged to a swale area located on plant property near the northwest corner of this portion of the plant where stormwater is allowed to evaporate and infiltrate into the ground. The swale contains natural vegetation acting as filtration media. Stormwater from this area of the plant is not discharged offsite.

B Street SW separates the Raw Receiving Building area of the plant on the north side of the street from the main contiguous areas of the plant on the south side of the street. B Street SW is crowned at the center line. Stormwater from the street is directed to inlet locations along either side of the street that also collect stormwater from impervious surfaces of the plant. In addition to the stormwater collection systems described above, there are three dry wells located along B Street SW north of the Co-product Storage Building. Stormwater collected by these dry wells is allowed to infiltrate into the ground.

Stormwater from the roofs of the buildings in the contiguous areas of the plant between B Street SW and E Street SW also is collected by systems of gutters and downspouts and discharged onto impervious surfaces surrounding the buildings. Stormwater from impervious surfaces surrounding the buildings is collected by systems of grated inlets and underground piping. Impervious surfaces surrounding and between the buildings are graded to direct stormwater to the various inlet locations. Outfall from the collection systems is sent to a retention basin located on the SW corner of the property, near the intersection of E st SW, and 12th Ave SW. Stormwater is allowed to evaporate and infiltrate into the ground.

<u>Oil Storage</u> (40 CFR 112.7(a)(3)(i))

The types of oils stored in the facility include cooking oil for preparation of products, and diesel fuel and various motor oils and lubricants for motorized plant equipment. Storage tanks locations, contents and storage volumes are summarized in Table 1 below. Appendix E contains a map of the site showing location of oil storage within and outside the facility.

Cooking oil is stored in steel tanks located in oil storage rooms inside the Plant One building. The rooms have a gutter and an in-floor sump basin to collect waste condensate and oil spills from steam heating equipment associated with the storage tanks. Pumps located in the sump basin discharge into the facility wastewater system.

Cooking oil is used within the cooking equipment for frying of potato products. Cooking oil is also stored in smaller day tanks located adjacent to the cooking equipment where oil is used. These tanks buffer automatic oil level controls associated with the cooking equipment. The cooking equipment area has a system of gutters which drain into the facility wastewater system. Floors in this area are all sloped towards the nearest gutter.

Cooking oils are delivered to the facility by rail car and by truck. Rail cars are parked on a spur track on the east side of facility. Three or four railcars may be parked on the spur track, however only one railcar is unloaded at a time. The area in the vicinity of the unloading station is earthen ground that abuts the main plant buildings, however there are paved surfaces close to the unloading station that oil would readily reach. There is a stormwater grated inlet approximately 50 feet away from the unloading station. Temporary dikes and a drain blocker are used around

2. Cooking oil tank connections are valved and secured to prevent accidental release. (40 CFR 112.8(d)(2))
3. Cooking oil tanks have float systems at filling connections for automatic shutoff to prevent overfill. Level sensors are installed on each tank that are monitored by the operator during transfer operations. (40 CFR 112.8(c)(8)(iv))
4. Railcars and trucks arrive with seals on their outlet connections applied by the oil supplier. Transfer hoses are attached to the transfer pump connections by plant operation personnel, and then connected to the railcar or truck. Both connections are made by a single individual to assure the hoses are properly connected before transfer operations begin. (40 CFR 112.7(h)(3))
5. Cooking oil transfer pumps are located inside the building. Transfer hoses are disconnected from transfer pumps and stored inside the building when not in use and pump connections are secured. Seals on railcar and truck outlet connections are reapplied prior to moving away from the unloading station. (40 CFR 112.7(g)(3))
6. Tanks are visually inspected monthly for weakness and stress points.
7. All tanks are inspected annually using NDE method to ensure mechanical integrity. (40 CFR 112.8(c)(6))
8. All major oil transfers will follow the procedures outlined in Appendix C (40CFR112.7(a)(3)(iii), 40CFR112.8(d)).

Discharge and Drainage Controls (40 CFR 112.7(a)(3)(iii))

Following measures are in place for control of oil in the event a spill should occur:

1. The facility wastewater system is capable of accommodating oil spilled within the facility. Sloped floors direct discharges into the drainage system gutters for collection. (40 CFR 112.8(b)(1)) Oil-skimming belts remove the majority of oils from the wastewater stream for disposal. Remaining oils collect in other wastewater system components. Wastewater flow and pH are measured to ensure they meet acceptance criteria of the City of Quincy Industrial Waste Water Treatment Plant. (40 CFR 112.8(c)(9))
2. Pans are placed on the ground below railcar and truck outlet connections during transfer operations to catch casual drips and small spills. Tanks are visually monitored during transfer operations to prevent overfilling. (40 CFR 112.7(c))

Countermeasures for Discharge Discovery, Response and Cleanup (40 CFR 112.7(a)(3)(iv))

Plant operation and maintenance personnel immediately respond to small spills and notify supervisory personnel. Spill kits, containing absorbent pads and socks, trash bags, protective gloves and sorbents, are located near the unloading stations. Temporary dikes and a drain blocker are used around the storm drain inlet near the unloading station. (40 CFR 112.8(c)(9)) Plant operation personnel also help to contain and minimize the effects of large spills. A contractor is promptly called to take additional measures to complete the cleanup of large spills. (40 CFR 112.8(c)(10))

Method of Disposal for Recovered Materials (40 CFR 112.7(a)(3)(v))

Cooking oil recovered from small spills and from skimming of the facility wastewater system is collected and sold to a renderer. Cooking oil recovered from large spills and absorbent materials expended for containment of spills are collected and disposed of by a contractor. The contractor assumes responsibility for these materials and is obligated to legally dispose of them according to their business operating requirements.

Used motor oils and lubricants removed from plant equipment and vehicles are collected in waste oil tanks. A contractor is periodically called to collect the used oil for disposal or recycling.

Contact List (40 CFR 112.7(a)(3)(vi))

The Team Leader is the contact person for reporting of any spills or discharges. If the Team Leader is not immediately available, backup contacts are:

Name	Title	Telephone
Mark Peterson	Plant Manager	509-787-2345
Jack Flyg	Production Manager	208-589-3594
Mike Ellis	Engineering Manager	509-670-6058
Gary Kraft	Team Leader Maintenance	509-289-0672

Reporting Requirements (40 CFR 112.7(a)(4))

The responding supervisor will call 911 for any spill that poses a threat to life, health, or the environment. The Quincy Fire Department will be asked to evaluate the situation and notify necessary backup agencies.

The responding supervisor will also immediately notify the following agencies:

Agency	Telephone
Washington State Department of Ecology	
Spokane Office	509-329-3400
Statewide 24-hour Response (SERC)	800-258-5990
Grant County Health Department	
Ephrata Office	509-754-6060
After hours	509-762-1160
Local Emergency Planning Commission (LEPC)	888-431-9911
National Response Center	800-424-8802

A follow-up written report is submitted to the Washington State Department of Ecology within 30 days of a spill containing a description of the spill, the exact date and time, material and quantity spilled, actions taken to control and clean up the spill, and steps taken or planned to reduce, eliminate, and prevent reoccurrences of the spill.

Analysis of Potential Discharges (40 CFR 112.7(b))

The potential exists for a spill to occur from any of the oil storage locations. Spills could result from tank integrity failure, accidental damage, or human error. Spills occurring inside the facility have a high probability of being contained. Spills occurring outside the facility require prompt action, however also have high probabilities of being prevented from entering storm water utility systems or taking direct surface paths that ultimately reach waters of the State. Specific discharge scenarios are discussed below.

A spill could occur if one of the large cooking oil storage tanks failed. Oil would be contained within the tank room and would be pumped into the facility wastewater system where it would be captured before it would be discharged to any utility system or waters of the State. Oils would not leave the building, enter any utility system or reach waters of the State.

A spill could occur if one of the fryers or small cooking oil storage tanks failed. The sloped floors in the vicinity of the tank would direct spilled oil to the gutter system where it would be captured by the facility wastewater system. A spill could also occur if automatic level controls at the cooking equipment malfunctioned or by operator error during manual filling of the cooking equipment. These spills would also be directed to the gutter system and would be captured by the facility wastewater system. Oils would not enter any utility system or reach waters of the State.

A spill could occur at the cooking oil unloading station if the transfer hose failed or otherwise was disconnected from the railcar or truck outlet connection during transfer operations. Oil would spill onto earthen ground, however there are paved surfaces close to the unloading station that oil would readily reach. Temporary dikes and a drain blocker are used around the stormwater inlet near the unloading station during transfer operations. The oil would be recovered, along with contaminated soil, by the cleanup contractor. The crown of E Street SW would retard spilled oil from crossing the street and directly entering the State Route drainage ditch on the other side. With prompt action, additional temporary dikes could be put in place and the spilled oil would be contained in the vicinity of the unloading station for recovery. Oils would not enter any utility system or reach waters of the State.

A spill could occur if one of the diesel fuel tank located outdoors failed. The secondary containment structure below is large enough to contain the entire volume of the largest fuel tank. There is a grated trench drain immediately outside the fuel tank secondary containment structure. The concrete apron surrounding the trench drain slopes into the trench. Small spills and drips from transfer hoses are collected by the trench and promptly removed. Oils would not enter any utility system or reach waters of the State.

A spill could occur if motor oil or other lubricant containers were tipped over or otherwise failed. The storage areas are large enough to contain the entire volume of the largest storage container. Oils would not enter any utility system or reach waters of the State.

Containment Systems (40 CFR 112.7(c))

All storage and operating tanks for cooking oil and associated transfer pumps and piping are located inside facility buildings. These buildings ultimately provide secondary containment of any spill from primary containment equipment. Floors are sloped to direct any spill into the gutter system for capture by the facility wastewater system. The gutter system and sloped floors are arranged to preclude any spill from reaching an exterior door to the facility. The new tank room floor is recessed below adjacent areas of the plant and the surrounding grade to form an additional containment basin.

The diesel fuel tank is provided with a secondary containment structure to capture discharges. Containers for motor oils and lubricants are stored within isolated areas to provide secondary containment of spills.

<u>Inspections, Tests and Records</u> (40 CFR 112.7(e))

Records of all spill and discharge incidents, including follow-up reports to appropriate agencies, are kept in the central environmental files.

<u>Personnel Training and Discharge Prevention Procedures</u> (40 CFR 112.7(f))

Employee training classes are held yearly. Training is given to affected employees. Employee training program topics include:

1. Review of safety incidents.
2. Announcement of any changes to the plan.
3. Announcement of any new management practices.
4. Materials handling and storage.
    a. Ensure employees are aware which materials are hazardous and where those materials are stored.
    b. Point out container labels.
    c. Explain recycling practices.
    d. Demonstrate how valves are tightly closed and how drums should be sealed.
5. Good housekeeping practices.
6. Spill prevention and response procedures.
    a. Review and demonstrate basic clean-up procedures.
    b. Clearly identify proper disposal locations.
7. Locations of spill clean-up equipment.

<u>Site Security</u> (40 CFR 112.7(g))

ConAgra Foods-Lamb Weston, Inc. operation and maintenance personnel or site security personnel are on-site at all times. All exterior doors to the facility are controlled. Site security personnel monitor the building perimeter when processing or packaging operations are not ongoing and otherwise not observed by operations and maintenance personnel. Exterior lighting is provided for security purposes and to allow operating and security personnel to discover oil spills outside the facility. Valves, pumps and pump controls, transfer hoses and piping, and other components pertaining to stored oils are accessible only to authorized personnel. Piping terminal ends used for oil unloading are locked out when not in use. Interior lighting is provided to conduct processing operations and to observe the condition oil containing components within the facility.

Facility Tank Car and Tank Truck Loading/Unloading (40 CFR 112.7(h))

Rail cars are parked on a siding track switched off the main rail lines on the east side of the facility. Three or four railcars may be parked on the siding track, however only one railcar is unloaded at a time. Railcars arrive with seals on their outlet connections applied by the oil supplier. Transfer hoses are attached to the transfer pump connections by plant operation and maintenance personnel, and then connected to the railcar. Both connections are made by a single individual to assure the hoses are properly connected before transfer operations begin. Catch pans are placed on the ground below railcar outlet connections during transfer operations to catch casual drips and small spills. There is a stormwater grated inlet approximately 50 feet away from the unloading station. Temporary dikes and a drain blocker are used around the inlet while oil is being unloaded to prevent spills from entering the stormwater utility piping. When transfer operations are completed, valves are closed, transfer hoses are disconnected and retracted inside the facility, and seals are reapplied to the railcar outlet connections.

Trucks back into the unloading station from E Street SW. Only one truck is typically on site at a time. Trucks also arrive with seals on their outlet connections applied by the oil supplier. Transfer operations are conducted similar to railcars.

Conformance With State and Local Requirements (40 CFR 112.7(j))

No monitoring or sampling is required as the plant is not required to have general permit coverage in accordance with NPDES requirements.

APPENDIX A

Emergency Procedure-Substance Spill Releases

TO ASSIST IN AN EMERGENCY
THIS IS A CONDENSED VERSION OF THE EMERGENCY RELEASE NOTIFICATION PROCEDURE
FOR ADDITIONAL INFORMATION AND FORMS, REVIEW THE FULL PROCEDURE

The release of specific chemicals, at or above a certain quantity, requires notification to Federal, State and Local agencies.

A "release" is defined as the following: "Any spilling, leaking, pumping, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment" of any hazardous substance unless permitted by a regulatory. Hazardous substances are listed as on the "EPA List of Lists," in excess of the Reportable Quantity listed.

The materials that we have on this site, with the reportable quantities, are as follows:

CHEMICAL	REPORTABLE QUANTITY
Ammonia	100 pounds or 17 gallons
Oil (petroleum or diesel)	0 gallons
Sodium Hydroxide (caustic)	1,000 pounds or 66 gallons
Nitric Acid	1,000 pounds or 80 gallons
Sulfuric Acid	1,000 pounds or 65 gallons

Note – For additional information, see the Emergency Release Notification Procedure in the Emergency Action Book located in the Supervisor's Offices or Human Resources.

List of personnel to notify in the event of a spill or release of oil or hazardous material:

Mark Peterson .... (509) 308-3788
Jack Flyg .... (208) 589-3594
Mike Ellis .... (509) 670-6058
Gary Kraft 289-0672

911 ....**Incident Commander will call only if beyond control of Plant Personnel**

Within 15 minutes the Incident Commander or Immediate Supervisor must notify the following Agencies:

NATIONAL RESPONSE CENTER .... (800) 424-8802
Department of Emergency Management (SERC) .... (800) 258-5990
Local Emergency Planning Commission (LERC) .... (888) 431-9911
Department of Ecology .... (509) 329-3400

USE THE AGENCY NOTIFICATION FORM IN THE EMERGENCY RELEASE NOTIFICATION PROCEDURE FOR EASE OF DOCUMENTATION
A WRITTEN REPORT MUST BE FILED WITH YOUR (LEPC) AND (SERC) WITHIN 14 DAYS OF THE INCIDENT

APPENDIX D

Certification of the Applicability of the Substantial Harm Criteria

Attachment C-II—Certification of the Applicability of the Substantial Harm Criteria

Facility Name: ConAgra Foods-Lamb Weston, Quincy Plant
Facility Address: 1005 E Street SW, Quincy, WA, 98848

1. Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons?

Yes ___ No _X_

2. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation within any aboveground oil storage tank area?

Yes ___ No _X_

3. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C–III to this appendix or a comparable formula1) such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments? For further description of fish and wildlife and sensitive environments, see Appendices I, II, and III to DOC/NOAA's "Guidance for Facility and Vessel Response Plans: Fish and Wildlife and Sensitive Environments" (see Appendix E to this part, section 13, for availability) and the applicable Area Contingency Plan.

Yes ___ No _X_

4. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C-III to this appendix or a comparable formula1) such that a discharge from the facility would shut down a public drinking water intake2 ?

[1] If a comparable formula is used, documentation of the reliability and analytical soundness of the comparable formula must be attached to this form.
[2] For the purposes of 40 CFR part 112, public drinking water intakes are analogous to public water systems as described at 40 CFR 143.2(c).

Yes ___ No _X_

5. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and has the facility experienced a reportable oil discharge in an amount greater than or equal to 10,000 gallons within the last 5 years?

Yes ___ No _X_

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

[signature]
Signature

Mark Peterson
Name (please type or print)

Plant Manager
Title

27 Jan 14
Date

APPENDIX E

Facility Site Drawing

ConAgra Foods
Food you love

Storm Water Pollution Prevention Plan

ConAgra Foods Lamb Weston
Quincy Facility
1005 E Street SW
Quincy, WA 98848
(509) 787-3567

Contact:

Lance Bruno
Sr. Industrial Engineer
Ext. 69260

Date Revised: 1/20/2014

Storm Water Pollution Prevention Plan
CERTIFICATION

Name of Facility:	ConAgra Foods Lamb Weston Quincy, Washington Facility
Type of Facility:	Potato processing plant
Date of initial operation:	Purchased by Lamb Weston in 1966. Purchased by ConAgra Foods, Inc. in 1988.
Location of facility:	1005 E Street SW Quincy, WA 98848
Name of owner:	ConAgra Foods Lamb Weston, Inc.
Designated person responsible:	Mark Peterson, Plant Manager
Management approval:	Management, at a level with authority to commit the necessary resources toward spill prevention & storm water pollution prevention, extends full approval.
Periodic Review:	An annual review and evaluation of the Storm Water Pollution Prevention Plan will be performed. Any updates/amendments to the Plan will be performed within six months of the periodic review. All updates shall include the latest control and prevention technologies, if they are relevant to pollution prevention.
Key Personnel:	Engineering Manager Industrial Engineer
Signatures	Name: [signature] 29 Jan 2014 Mark Peterson Date Title: Plant Manager Name: [signature] 1-29-14 Mike Ellis Date Title: Engineering Manager Name: [signature] 1-29-14 Lance Bruno Date Title: Sr. Industrial Engineer

Storm Water Pollution Prevention Plan

I. PLAN OBJECTIVES

The objectives of this Storm Water Pollution Prevention Plan are to prevent, contain, and control spills or unplanned discharges of:

1) Petroleum oil or

2) Material which when spilled or otherwise released into the environment are designated Dangerous Waste (DW) or Extremely Hazardous Waste (EHW) by the procedures set for in WAC 173-303-070, or

3) Any organic or inorganic matter that will cause or tend to cause pollution of the waters of the state.

The implementation of this plan is based on prevention systems, adherence to proper operating procedures, and preventative maintenance, supported by positive containment and removal of spills and/or discharges.

The plan includes:

- List of all petroleum and chemicals used, processed, or stored at the facility,
- List of "significant materials" exposed to storm water at this site,
- Descriptions of the measures and facilities which prevent, contain, or treat spills of these materials.
- Reference to the reporting system used to alert responsible managers and legal authorities in the event of a spill.

II. SITE DESCRIPTION

ConAgra Foods Lamb Weston, Inc. is a major supplier of frozen potato products. The Quincy food processing facility produces french fries and formed potato products. Processing activities include raw potato storing, unloading, washing, blanching, batter application, drying, frying, freezing, packaging and shipping of finished products. Activities are conducted at this facility during all months of the year.

The plant site consists of three processing plants with cold storage, raw potato storage buildings, receiving buildings and a boiler facility.

A. "Significant Materials" exposed to storm water at this site include:

- Edible oil & caustic soda unloading – railcar and truck
- #2 low sulfur fuel oil
- Petroleum products storage area
- Chemical products storage area
- Wood/plastic pallets

- Metal and pipe storage
- Feed bin storage--raw product waste
- Used edible oil storage
- Used cardboard storage
- Starch by-product loading area
- Potatoes
- Dirt, vines and rocks from potatoes
- Silt from collection system
- Parking lot litter/winter traction sand
- Solid waste collection containers
- Trash compactor
- Maintenance "boneyard" metal and spare parts storage areas

B. The following items are stored inside a Secondary Container, and are exposed to stormwater only during the unloading of the carrier and during transportation from the Secondary storage to another location in the facility.

1. Lubricants—Petroleum Secondary Storage Container #1 as located in section B on the site map.
    - Multifax HD 00
    - Regal R&O 32
    - Starplex 2
    - Van Guard 460
    - Texcool P-200
    - Mycold AB 68 0001
    - Pro-Kool Heat Transfer Fluid
    - Capela WF 68
    - Meropa 150
    - Lube FG-46
    - QYN-SYN Lube
    - Texaco Anti-freeze coolant bitterant
    - Chevron Lubricating oil FM 100
    - Chevron Gear Compound EP 150
    - Chevron Refrigerant oil WF 68
    - Chevron Rykon 68, 32, 460
    - Texaco Mercon Dexron III
    - Tegra Synthetic Gear Lubricant 220
    - Delo 400 SAE 10W
    - Chevron Machine Oil AW 100
    - Chevron Cylinder oil W 460
    - Chevron ATF Dextron Mercon
    - Jax Poly Guard FG 2
    - Chevron GST oil 32

- Traxon E Synthetic 75w/90
- Druon 10
- Duron E 15w40
- Purity FG WO 90
- Hydrex AW32
- PURITY FG Synthetic Compressor Fluid 46
- REFLO 68A
- PURITY FG Extreme Grease
- Non FG Gear Oil
- Non FG 5% Moly Grease
- Used Oil -- Container is outside of the Secondary Storage Container.
- Empty Oil Drums

2. Chemicals—Petroleum Storage Pad #1 as located in section B on the site map.
   - Argon Bottles
   - Oxygen Bottles
   - Nitrogen Bottles
   - Acetylene Bottles
3. Boiler Facility
   - Water Treatment Chemicals
   - #2 Low Sulfur Diesel

C. The general location of the facility and the area is shown on the attached map.

D. Specific outfall areas:

The site detail is contained on the attached map and shows the storm water outfall legs numbered 1,2,3,4 and 6.

Note—Outfall #5 was deleted when the old "Fresh Plant" building was sold. The old outfall lines to the City of Quincy Storm Water System have been capped.

E. The amount of impervious area drained by each outfall leg is

1. Storm Collection leg 1	51,174-sq. ft.
2. Storm Collection leg 2	154,338-sq. ft.
3. Storm Collection leg 3	157,700-sq. ft.
4. Storm Collection leg 4	15,215-sq. ft.
5. Storm Collection leg 6	169,049-sq. ft.

III. OPERATIONAL CONTROLS OF POTENTIAL SPILLS AND POLLUTIONS

A. Pollution Prevention Team

The team's responsibilities include plan review, inspections, operational BMP application, and overall plan compliance. The members of this team are:

is on dirt or gravel, dig up the dirt/gravel that is contaminated with the oil and place in a drum. Final cleanup and disposition will be conducted by a certified third party.

C. Facility Drainage

All plant drainage is confined to the plant property by discharging to impervious surfaces and then to either natural vegetative swale areas or to the retention/infiltration basin located on the SW corner of the property. Stormwater outfall legs 1, 2, 3, 4, 6 are connected via piping to the retention/infiltration basin. No stormwater is discharged offsite. (See attached facility map).

Preventive measures, containment devices, and emergency response training of key personnel are intended to prevent contamination of the soils and groundwater. Procedures for any spills of process water overflow are managed by plant management personnel.

D. Covered Storage & Manufacturing Areas

1. Areas that could contribute to storm water discharge and are covered by roof structures include (see attached facility map):
   a) Manufacturing plant (Plant 1, 2, 3 and cold storage)
   b) Maintenance/Dry Supply
   c) Raw product storages
   d) Scale House/Raw Receiving
   g) Guard office
   h) Covered smoking area
   i) Disposal
   j) Chemical storage containment
   k) Truck Shop
   l) Boiler Room
2. Areas that could contribute to storm water discharge but are not economically feasible to cover include:
   a) Manufacturing plant and building roofs
   b) Pallet storage area
   c) Metal and spare parts storage area
   d) Parking lot
3. The following special controls will be implemented in areas that are not economically feasible to cover:
   a) Good housekeeping practices
   b) Routine sweeping of potato debris
   c) Properly label and rinse all chemical drums
   d) Prompt and proper clean-up of spills in accordance with the plant's spill clean-up procedures
   e) Reduction/elimination of non-essential chemicals and substances

f) **Minimize old parts stored over impervious areas**

g) **Routine cleaning of rooftops (dry sweeping or pressure wash & capture runoff)**

V. ATTACHMENTS -- Facility Map

SPILL PLAN

QUINCY FOODS, LLC

Quincy Foods, LLC

Quincy Processing Facility

Quincy, Washington

(Revised-Updated)

November 10, 2014,
2014

Application

This plan applies to all stored hazardous substances and oils used at the Quincy Vegetable Processing Facility.

Purpose

To prevent, contain, and control spills or accidental discharges of petroleum or hazardous substances to the City of Quincy treatment systems.

Location of Plan

A copy of this plan will be on file in the following locations and or offices.

1. Norpac Foods Corporate Environmental Office
2. Quincy Vegetable Processing dba Quincy Foods, LLC – Plant managers office
3. Operation locations
   a. Maintenance Office
   b. Boiler Room
   c. Maintenance Shops
   d. Sanitation Office
   e. Production Offices

Updates

This plan will be reviewed annually, or as changes in operations, if any, dictate, whichever is sooner.

Responsibilities

The Maintenance Manager is responsible for carrying out inspections of storage areas and making recommendations to management.

General

All employees handling chemicals and oils (including food grade oils) are responsible for spill prevention and notification. If a spill occurs, the shift or area supervisor shall be notified at once, and, if danger exists to employees, the area shall be evacuated immediately. The Maintenance manager, or maintenance supervisors, and plant manager **MUST** be notified immediately of any spill that has potential to enter the city wastewater or storm water systems.

Methods of Prevention

All chemicals in use are stored in locked caged areas. Properly trained individuals only have access to these chemicals. (Except boiler area) In the case of the boiler room, dry chemicals or gels are generally used that can easily be cleaned up in the event of a spill. The Hydraulic reservoir(s) is housed in a containment pan that will contain all oil stored in the reservoir should a leak occur. Additionally the hydraulic pumps incorporate low oil cut off switch in the event of a major rupture in the lines. Sacks of absorbent particles and oil containment socks, in addition to spill kits, are retained on site.

All sanitation personnel are trained in the use, handling and application of sanitation chemicals. Additionally annual training is conducted with respects to spill clean up and safety. Maintenance is responsible for the safe handling of all lubricants in the facility in addition to training

The Company utilizes the service of Emerald Services Inc.(1), a company trained, licensed and insured to pick up, transport and otherwise handle all forms of waste materials, including regulated items and non-regulated materials. The Company rents parts washer equipment from Emerald Services (1). Additionally, aliphatic petroleum distillates are supplied and handled by Emerald during routine servicing of the washers. Using trained, insured and professional services such as Emerald minimizes any risk of spills and potential issues.

The facility waste water handling system can be isolated in the event of a spill simply by shutting down the discharge pumps, and turning off all process water. This action will effectively contain any quantities of spilled materials on site, preventing any unauthorized discharge to the city treatment plant.

1

[1] Emerald Services, 3808 N. Sullivan Road, Bldg 5, Spokane WA 99216
888-832-3008

Spill Action Plan

If a spill should occur, the following steps shall be followed.

1. The source of the spill will be identified and isolated.
2. If the spill is capable of reaching the wastewater drain, process water will be shut off and wastewater discharge pumps will be turned off.
3. The proper notification sequence will be started. (See below).
4. The spill will be cleaned up using appropriate methods (brooms, absorbents, etc.) Dry powder spills may be returned to their original containers.
5. Clean up materials will be disposed of according to the applicable Laws in the State of Washington. Emerald Services [1] will consult Quincy Foods Employees as to the appropriate disposal method of clean up materials prior to disposition.
6. A report of the incident will be logged for review by management (see attachment 2) If a spill is at or above reportable quantities, follow step 7 carefully.
7. Supervisory staff will notify all appropriate agencies if the amount released is near or exceeds the RQ. (See attachment 1) Supervisors will document all communications with the various agencies by utilizing the Spill Reporting Telephone Log (see attachment 3). **Notification to the National Response Center must be made within fifteen (15) minutes from the time you should have know about the release.** After notifying the appropriate agencies/individuals the supervisor will coordinate any outside response as needed.

Reporting System

When a spill occurs the following reporting order will be used.

Name	Position	Work Ext	Home #	Cell#
Kelly Norris	Maintenance Mgr.	3511	509-787-1629	509-398-3574
Megan Lemons	QA & Sanitation Manager	3609		509-264-4794 509-750-7608
Chris Scott	Plant Manager	3574		509-237-8109
Shad Stenz	Asst. Maintenance Manager	3530 3511	509-393-2072	509-398-1306 509-398-3574
Mark Houghton	Production Mgr.	3513	509-754-5389	509-398-1306
Sharon Riley	Production Mgr.	3649	509-754-9450	509-398-2442

[1] Emerald Services, 3808 N. Sullivan Road, Bldg 5, Spokane WA 99216
888-832-3008

For reportable quantities the additional sequence will be required

	DAYS	EVENINGS/WEEKENDS	CELLULAR	
1. Ray Noble	503-769-2101	503-540-7639	503-510-8176	
2. Ed Beal			503-932-0447	
3. Randy Bentz			503-551-0451	
4. Bill Burich	503-769-2101	503-315-8999	503-580-8823	
5 George Smith			503-769-7858	
6. Department of Ecology - SPOKANE				509-329-3400
7. National Response Center				800-424-8802
8. Grant County Hazmat-Response Center				509-762-1462[1]
9. City of Quincy, Waste water treatment facility (Earth Tech)				509-787-2423
10. Local emergency response (If needed)				9-911

Attachment 1

Chemicals stored on site and reportable quantity (RQ)

Chemical	Amount	Units	RQ	Map Location (PG 11)
Hydraulic Oil	5000	gals	N/A	A
Aliphatic petroleum distillates	42	gals	N/A	B
Enamel paints	20	gals	N/A	D
Lubricating Grease	200	lbs	N/A	A
Boiler Chemicals				
Mildly Alkaline – 6050	450	lbs.	N/A	I
Mildly Alkaline – 6013	1040	lbs	N/A	I
Moderately Alkaline – 6656U	500	lbs.	N/A	I
Moderately Alkaline Compound	110	gals	N/A	I
Sodium Chloride - Salt	4650	lbs/pellets	N/A	I
Production Chemicals				
Sodium Acid Pyrophosphate	10,000	lbs	N/A	F
Calcium Chloride Anhyd	2,000	lbs	N/A	F
Defoamer	1,000	gals	N/A	F
Salt	60	tons	N/A	E

Attachment 1 (cont)

Sanitation Chemicals

Chemical Name & Location	Container Size	Max quantity Gals/lbs
Quadexx 100 {K} Sodium Hydroxide, Potassium Hydroxide	250 gal barrel	500
Quadexx 200 (K) Cocamine oxide, Sodium xylene sulfonate	55 gal barrel	110
Quadexx 400 {K} Poly(oxy-1,2-ethanediyl),.alpha.-(2-ethylhexyl)-.omega.-hydroxy, 1-octanamine , n,n-dimethyl-,n-oxide	55 gal	110
Quadexx 500 {K} Sodium hydroxide, Potassium hydroxide	55 gal	110
Quadexx 600 {K} Potassium silicate	15 gal	900
Quadexx 700 {K} Sodium Hyproclorite	250	500
Quadexx 800 {K} Ethosydiglycol, butoxydiglycol, benzenesulfonic acid, methyl-, potassium salt, Sodium xylene sulfonate	55	110
Vortexx {N} Acetic acid, peracetic acid, hydrogen peroxide, octanesulfonic acid	55 gal barrel	110
Tsunami 100 {N} Acetic acid, peracetic acid, hydrogen peroxide	50 gal barrel	200
Famic?Sulfam Plus {M} {SULFAMIC ACID CLEANER}	400 lb fiber barrel	800 lbs
Quorum Clear V {O} benzyl-c12-c16-alkyldimethyl, chlorides,	55 gal barrel	110
Boost 3200 (K) Hydrogen peroxide, Quaternary ammonium compounds, c12-14-alkyl[(ethylphenyl)methyl]dimethyl, chlorides, quaternary ammonium compounds, benzyl-c12-18-alkyldimethyl, chorides	55 gal	110
Boost 3201 (K) Potassium carbonate, Sodium carbonate Tetrasodium EDTA	55 gal	110

Spill Prevention Inspection Report

Date:_______________

Inspector: ________________________

Area	Condition	Comment
1)Boiler room		
2) Hydraulic Room		
3) Maintenance Shops		
4) Sanitation Chemical Cage		

General Plant Area

Attachment (2)

Spill Incident Report

Company: Quincy Foods, LLC Phone Number 509-787-4521

Address: 222 Columbia Way City: Quincy State: WA Zip: 98848

Date:______________ Time:______________

Report made by:________________________________ Title: ____________

Did Injury or property damage occur ? ☐ yes ☐ no

If injury is yes, name(s) ____

Location/Area:____

____

Nature of spill/release____

____

Chemical :____

Quantity :____

Cause of spill:____

Was spill contained ☐ yes ☐ no

Please describe answer above question:

____

____

____

Clean up actions:

Attachment (3)

Notifications Made

Agency	Date	Time	Contact Name	Notes
NRC				
State				
Local				
Corporate				

Appendix B: Draft Technical Memorandum: Anaerobic Lagoon and SBR Evaluation

Dated July 23, 2013

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Brown AND Caldwell

701 Pike Street, Suite 1200
Seattle, Washington 98101
T: 206-624-0100
F: 206-749-2200

Technical Memorandum

Prepared for: City of Quincy

Project Title: Quincy Industrial Reuse Program Management

Project No.: 141200.033.200

Technical Memorandum

Subject: Anaerobic Lagoon and SBR Evaluation

Date: July 23, 2013

To: File

From: Patricia Tam

Prepared by: ______________________________

Patricia Tam, P.E., WA License no. 35722, Exp. 9/10/15

Reviewed by: ______________________________

Rick Kelly, Ph.D., P.E., WA License no. 45235, Exp. 6/30/15

Section 1: Introduction

As part of the engineering report prepared for the City of Quincy to provide the Department of Ecology updates on the current operation at the Industrial Wastewater Treatment Plant (IWTP), recent upgrades, and upcoming improvements, an assessment of the biological treatment processes was completed. These include a 24.3 million gallon (Mgal) covered anaerobic lagoon and two sequencing batch reactors (SBRs). The former was converted from an existing solids storage lagoon in 2011. With addition of the anaerobic lagoon, which replaces primary treatment and provides sludge treatment, the overall biological treatment system performance and capacity have changed. This assessment determines the hydraulic and organic loading capacity of the biological processes, which will allow the City to determine spare capacity currently available for new food processors. The assessment takes into consideration effluent quality that is compatible with the future downstream tertiary processes to produce Class A reclaimed water.

This memorandum includes discussion of the following elements of the evaluation:

- Existing Process Description and Design Criteria
- Wastewater Characterization
- Anaerobic Lagoon Evaluation
- Biological Process Simulator Calibration
- Overall Biological Process Capacity Evaluation

Section 2: Existing Process Description and Design Criteria

This section provides a brief description of the existing biological treatment processes and original design capacities.

2.1 Existing Process Description

Process wastewater from the two largest food processors, ConAgra Foods and Quincy Foods, is conveyed separately to the primary treatment facility. Since the anaerobic lagoon began operating in 2011, only one primary clarifier is in operation, receiving the raw wastewater from both industrial dischargers. Prior to the lagoon conversion, sludge withdrawn from the primary clarifiers was dewatered using centrifuges and then trucked off-site for cattle feed. Currently, with operation of the anaerobic lagoon, no sludge is withdrawn from the primary clarifiers. As a result, minimal treatment is provided in the primary clarifier.

The clarifier effluent is pumped via an 18-inch force main approximately one mile to the secondary treatment facility. There, it enters the anaerobic lagoon via an influent structure and manhole. The low-rate anaerobic lagoon was converted from one of the solids storage lagoons (Lagoon 2) in 2011, when it was covered and equipped with a biogas recovery system. The lagoon was retrofitted with a base liner and a floating cover made of high-density polyethylene (HDPE) geomembrane panels. A biological scrubber system was included to remove hydrogen sulfide from the biogas. The treated biogas is currently routed to a flare; in the future, it can be used as fuel in process boilers or micro-turbines for power generation.

Lagoon effluent is pumped to the SBR influent splitter box, where it is split between the two SBR units. Currently, a portion of the primary effluent bypasses the anaerobic lagoon and is routed directly to the splitter box. There is currently no flow meter along the bypass line, so the bypass flow and degree of bypass (as a percentage of the total influent flow) are not known. The two SBRs were constructed in 2002 to provide secondary treatment. SBR #1 is slightly larger than SBR #2. Each reactor basin includes six floating mixers, two floating decanters, air distribution piping, control valves and diffusers, and two waste sludge pumps. The original tubular type air diffusers have been replaced by disc type membrane diffusers. Three multistage centrifugal blowers, including one as a standby, provide air to the two SBRs.

The SBR process is similar to a conventional activated sludge system, but with reaction and settling occurring in the same basin so that no secondary clarifiers are needed. Each SBR basin is operated in batch mode, with the influent flow directed alternately between SBR #1 and SBR #2. Each treatment cycle consists of the following steps or phases (and current operating times):

1. Anoxic fill (mixers on, air off) (70 min)
2. React fill (mixers off, air on) (170 min)
3. React (mixers off, air on) (no feed) (70 min)
4. Settle (mixers off, air off) (no feed) (60 min)
5. Decant (mixers off, air off) (no feed) (110 min)
6. Idle (mixers off, air off) (no feed) (none)

Currently, total cycle time is 480 minutes and each SBR operates 3 cycles per day. Sludge wasting takes place at the end of the decant phase. The constant-speed waste sludge pumps transfer the sludge to the anaerobic lagoon for further treatment. The sludge can also be pumped to Sludge Lagoon #3. SBR effluent removed during the decant phase is typically routed to the equalization basin prior to conveyance to the downstream tertiary processes. Flow in excess of what the equalization basin can accommodate is routed to Lagoon No. 5, which serves as an off-line storage basin. The effluent from Lagoon No. 5 is returned to the SBR system for re-treatment. Typically, flow equalization in Lagoon No. 5 is needed during the later summer and early fall when harvest and food processing operations are at their peak.

2.2 Existing Design Criteria

The current rated capacities of the IWTP, as defined in the NPDES permit, are summarized in Table 2-1. While the SBR system is currently rated for a maximum month flow of 4.89 mgd, the plant discharge is currently limited to 3.23 mgd based on a hydraulic restriction in the receiving waterway. This restriction will be eliminated when the outfall is decommissioned in 2015 and the secondary effluent is further treated to produce Class A reclaimed water.

Table 2-1. Existing Plant Design Criteria

Design Criteria	Design Quantity
Max month flow	4.89 mgd
Max month BOD loading	74,000 lb/d
Max month TSS loading	66,400 lb/d
Max month TKN loading	4,700 lb/d

Source: NPDES Permit effective June 1, 2012.

Design data for the major components and equipment in the biological treatment system are given in Table 2-2.

Table 2-2. Biological System Major Equipment Design Data		
Process Element	Units	Design Value
Anaerobic lagoon	1	
Volume, million gallons		24.3
Anaerobic lagoon effluent pumps	1	
Capacity, each, gpm		3,475
Sequencing batch reactors	2	
Sidewater depth, ft		19 (max), 18 (min)
Volume @ max SWD, each, ,million gallons		13.5 (SBR #1)
		11.2 (SBR #2)
Decanter	4	(2 per SBR)
Capacity, each, gpm		4,500
WAS pumps	4	(2 per SBR)
Capacity, each, gpm		2,000
Aeration blowers	3	
Capacity, each, scfm		9,200
Equalization lagoon	1	
Volume, million gallons		1.4
Equalization lagoon effluent pumps	2	
Capacity, each, gpm		2,275
Lagoon No. 5 (offline storage)	1	
Volume, million gallons		42

Section 3: Wastewater Characterization

The intent of the wastewater characterization program is to collect special sampling data for individual wastewater and solids streams in the IWTP for use in calibrating biological process simulator to determine plant capacity and for assessing impact on effluent disposal. The program consists of two sampling periods to represent the two different food processing campaigns (as well as high and low production periods). The first sampling period consists of composite and grab samples collected on August 29 and 30 and September 4 and 5, 2012. During that time, the two largest food processors were processing potatoes, peas, corns and lima beans. The second sampling period took place on March 5 and 6, 2013, when there is minimal flow from Quincy Foods, so that the plant influent consists of predominantly potato processing wastewater from ConAgra Foods. During both sampling periods, 24-hour composite samples of the raw influent, anaerobic lagoon effluent and secondary effluent were collected. Because the fixed composite samplers are currently located at the two food processors sampling each waste stream separately, the plant raw influent composite samples were combined composites of the two food processor samples at a ratio similar to the expected flow contribution of each processor to the IWTP. During the August/September sampling period, composite sample of the primary effluent was collected on one day and grab samples of the mixed liquor and waste activated sludge (WAS) were also collected to analyze for TSS and VSS concentrations of the sludge samples. In addition, concentrations of volatile fatty acids (VFAs) were measured for raw influent, primary effluent and lagoon effluent samples on one day to assess the impact of the digestion process in the lagoon on the SBR influent characteristics.

The sampling data for both sampling periods are tabulated in Attachment A. The following observations were made about the sampling data:

- The sampling data indicate a minimal amount of inert solids (minimal difference between TSS and VSS concentrations) as well as soluble organic TKN (minimal difference between soluble TKN and ammonia-nitrogen concentrations) in the raw influent.
- Raw influent COD to BOD ratios are generally lower during the August/September period than during the March period, suggesting that the organic materials during the former period are more biodegradable.
- Primary effluent data (collected on one day during the August/September period) indicate a slight increase in solids and nitrogen concentrations and a reduction in COD and BOD concentrations. Because sludge is not withdrawn from the primary clarifier, minimal treatment is expected but settling and re-suspension may occur, affecting the primary effluent concentrations on a day-to-day basis. There may be some fermentation occurring in the clarifier, but the limited VFA data do not indicate an increase in VFA concentrations across the clarifier.
- Comparison of raw influent and lagoon effluent concentrations show considerable removals of solids, COD, and BOD across the lagoon (see discussion below). In contrast, ammonia and soluble phosphate concentrations increase significantly across the lagoon. This is expected as the digestion process in the lagoon results in release of ammonia and phosphates from the biomass.
- The VFA data collected during the August/September period show a moderate increase (about 30 percent) from raw influent to lagoon effluent, suggesting partial digestion and net generation of fermentation products in the lagoon.

Section 4: Anaerobic Lagoon Evaluation

The concept of the low-rate anaerobic lagoon, as originally proposed by Environmental Management Corporation (EMC), is to bypass primary treatment and pretreat the combined industrial process wastewater in the lagoon followed by aerobic polishing in the SBRs. The pond would serve to both reduce the volume of solids for disposal and generate biogas for re-use. The lagoon design basis was described in a report prepared by the Stover Group and Pharmer Engineering for EMC (“Preliminary Process Engineering Evaluations and Capital Development Review for Anaerobic Treatment of the Quincy, Washington Industrial Wastewater Process Streams”, December 2009) and also evaluated in a technical memorandum previously prepared by Brown and Caldwell (“Anaerobic Pretreatment of Industrial Wastewater Process Streams”, August 16, 2011). This section provides a summary of the design basis and previous analysis, as well as a discussion of the lagoon performance as derived from the special sampling data.

4.1 Lagoon Design Basis

The anaerobic lagoon installed at the IWTP is a variation of the low-rate anaerobic treatment systems that have been in service throughout the world since the mid-1970s. Some of the earliest systems were implemented by ADI Systems Inc. (ADI), which developed the patented bulk volume fermenter (ADI-BVF®) technology designed for treatment of food processing wastewaters. Design organic loadings for the ADI-BVF systems range from 60 to 180 lb COD/1,000 ft^3-d at a hydraulic retention time (HRT) of more than 7 days. For the Quincy IWTP, the Alternate Energy Resources Group (AERG) provided the design and installation. Pipes are evenly spaced throughout the base of the anaerobic pond that allows the settled sludge to be pulled through a header system back to the pond sludge transfer pump. The floating cover consists of several HDPE geomembrane panels joined together by thermal welding. Supplemental heating is not provided. This type of system is typically designed for lower treatment efficiencies during the winter months when the water temperature in the lagoon is lower than in the summer months. The pond temperature under the cover during the summer months in Quincy (estimated at more than 90 deg F) should be adequate for methanogenesis to occur. Literature indicates that a temperature as high as 70 deg F is possible during the winter months based on observations at pond sites in northern climates. A temperature of 70 deg F is not optimal for anaerobic treatment and methane production would be greatly reduced even at the lower organic loading rates during the winter months in Quincy.

The EMC-AERG design for the anaerobic lagoon was based on a HRT of 11.2 days at average daily flow conditions and an average organic loading of 10.2 lb BOD/1000 ft3-d (or 23.7 lb COD/1,000 ft^3-d), which corresponds to an influent flow rate of 2.18 mgd and BOD loading of 33,120 lb/d, respectively. The minimum HRT requirement to prevent washout of methanogenic bacteria is 8 to 9 days and the maximum organic loading requirement for a low-rate anaerobic lagoon is 60 lb COD/1,000 ft^3-d. It was noted that while the organic loading will stay below the design level most of the year, the plant flows vary greatly and will often exceed 2.18 mgd during the high production period, resulting in lower HRTs in the lagoon. Assuming a minimum HRT of 7 days during the warmer months to allow methanogenesis in the lagoon, the corresponding influent flow rate is about 3.5 mgd. It should be noted that currently biogas recovered from the lagoon is flared and not re-used. Therefore, complete digestion (i.e., methanogensis) is not critical, so that the HRT design criterion is not considered a stringent requirement in assessing overall capacity of the biological treatment system. In the future, when the biogas is re-used, either in boilers or for power generation, lagoon HRT will become an important factor. Because the lagoon effluent pump station has a rated capacity of 3,475 gpm (or about 5 mgd), this will serve as the current maximum flow limit through the lagoon if the HRT is allowed to drop below 7 days.

For organic and solids removal, the EMC-AERG design assumes a BOD or COD removal of 75 percent and a solids removal of 40 percent. Sludge yield of 0.1 lb TSS/lb BOD removed was assumed, while the typical range for anaerobic treatment is 0.08 to 0.12 lb TSS/lb BOD removed.

4.2 Observed Lagoon Performance

EMC does not regularly monitor the anaerobic lagoon performance, including collection of lagoon effluent samples. Lagoon effluent samples were collected in January and February 2012, as well as during the special sampling periods in August/September 2012 and March 2013. These sampling data are summarized in Table 4-1. The limited sampling data indicate large variability in the lagoon effluent concentrations. Even between the data collected in January/February 2012 and those collected in March 2013, both of which were during the low production periods, there are significant differences in the concentrations of some of the constituents including COD, BOD and TSS. The values for percent changes shown in the table indicate significant reduction in COD and BOD in the lagoon, higher than the assumed value of 75 percent in the original EMC-AERG design. TSS reduction is more variable, averaging at 89 percent during the August/September period but only 43 percent during the March period. The data for both periods indicate considerable increases in ammonia and ortho-phosphate, as expected in an anaerobic digestion process. Large increases are also observed in alkalinity.

Table 4-1. Summary of Anaerobic Lagoon Sampling and Performance

Parameter	Jan – Feb 2012	Aug – Sept 2012	Mar 2013
Lagoon Effluent Concentrations (mg/L)[1]			
COD	432 (356 – 503)	403 (281 – 480)	843
BOD	208 (164 – 260)	95 (80 – 108)	124
TSS	53 (40 – 68)	148 (90 – 181)	880
TKN	157 (149 – 162)	90 (72 – 101)	183
NH_3-N	96 (15 – 156)	82 (64 - 94)	137
TP	48 (42 – 54)	29 (24 – 31)	41

Table 4-1. Summary of Anaerobic Lagoon Sampling and Performance			
Parameter	Jan – Feb 2012	Aug – Sept 2012	Mar 2013
PO_4-P	39 (34 – 48)	27 (25 – 31)	39
Alkalinity	1117 (1070 – 1170)	778 (714 – 818)	1080
Changes across lagoon [2]			
COD	-	- 91% (-87 to -97%)	-83%
BOD	-	-97% (-96 to -97%)	-94%
TSS	-	-89% (-84 to -96%)	-43%
TKN	-	-26% (-10 to -37%)	+60%
NH_3-N	-	+ 205% (+154 to +266%)	+759%
TP	-	+41% (+21 to +55%)	+96%
PO_4-P	-	+105% (+26 to +129%)	+254%
Alkalinity	-	-	+558%

[1] Average concentrations (and range) shown for each sampling period. Only the average concentrations are shown for the March 2013 period since only two samples were collected.

[2] Calculated percent changes between raw influent and lagoon effluent samples. A negative percentage indicates reduction and a positive percentage indicates increase.

Section 5: Biological Process Simulator Calibration

The biological process model for the SBR process at the Quincy IWTP was created using the BioWin simulator, developed by EnviroSim Associates Ltd In Hamilton, Ontario, Canada. BioWin is a PC-based simulator that uses a series of mechanistic and empirical models to represent material transformations and pollutant removals in both the liquid and solid streams of a biological treatment system. It enables the user to simulate carbonaceous oxidation, nitrification, denitrification, and enhanced biological phosphorus removal.

Simulation of plant performance requires that the simulator be set up to conform to the major attributes of the treatment facility. A flow sheet of the SBR process at the IWTP was created as shown on Figure 5-1, and the physical characteristics of the system such as SBR and EQ tank volumes were specified in the simulator. SBR influent flow and concentrations were specified, as were the SBR cycle settings including total cycle time, start times for aeration, settling and decanting, and the wastage rates during each cycle.

For a well-calibrated model, there should be close correspondence between the simulated and observed behavior. When major discrepancies appear between measured and predicted values for effluent characteristics or major operating variables such as mixed liquor volatile suspended solids (MLVSS) and sludge yield, investigation of the plant data is needed to determine their cause.

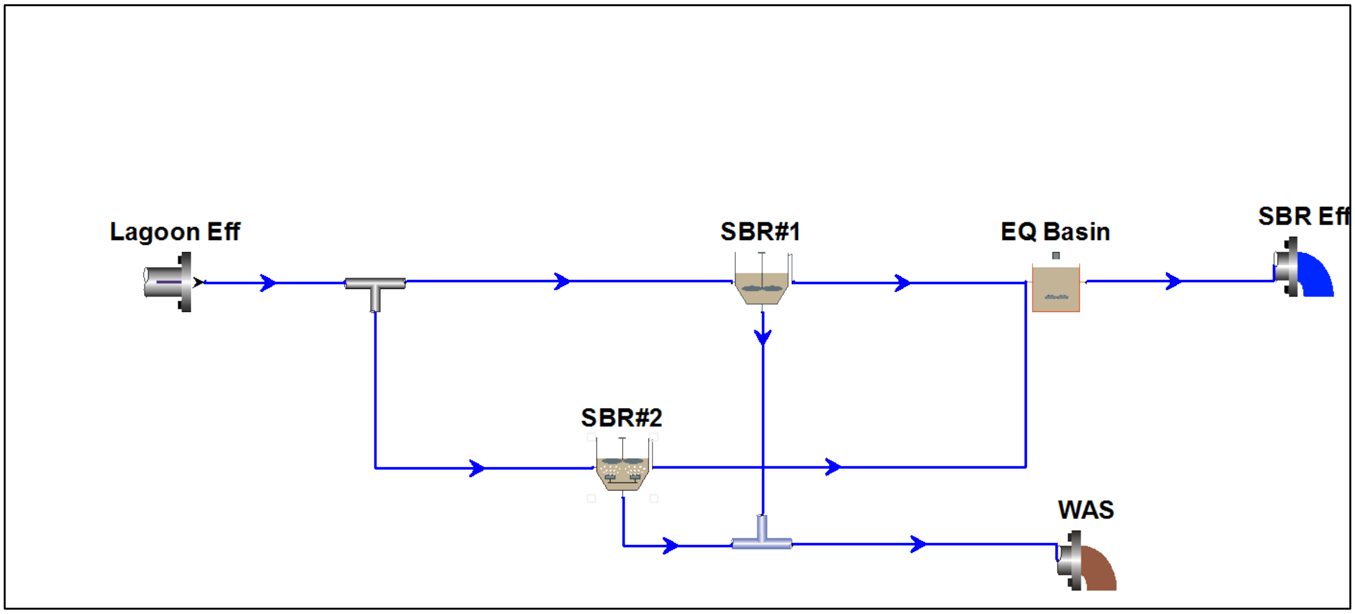

Figure 5-1. Quincy IWTP SBR Process Flow Sheet in BioWin

Tables 5-1 and 5-2 summarize the inputs to the simulator and compare the model predictions with the plant measurements for the August/September 2012 and March 2013 sampling periods, respectively. Initial results of the August/September calibration assuming no primary effluent (PE) bypass indicated inadequate denitrication that resulted in predicted effluent nitrate concentrations considerably higher than the measured concentrations. The bypass flow is not measured; plant staff estimated that about 30 to 40 percent of the influent flow bypasses around the lagoon. Because the lagoon removes a significant amount of organics but generates ammonia as a result of the anaerobic process (as shown in Table 4-1 above), the COD to TKN ratio decreases from the raw influent to the lagoon effluent and there is less carbon available for denitrification. Bypassing flow around the lagoon increases the amount of carbon available for denitrification. It also allows adequate biomass growth for proper operation of the two SBR units, which is particularly critical during the low production period when the influent loadings are lower. For the August/September 2012 calibration, a bypass value of 23 percent was assumed, while for the March 2013 calibration, a bypass value of 20 percent was assumed.

A reasonable match of the MLSS and MLVSS concentrations and SBR effluent concentrations were achieved for the August/September calibration, except for the effluent CBOD concentrations. The predicted WAS TSS concentrations were considerably higher than the measured concentrations; however, the measured WAS TSS concentrations, averaging at 3,443 mg/L, seem unreasonably low. Because the WAS flow rate or total volume of sludge wasted is not measured, it is not possible to calibrate the model based on an observed sludge wastage rate from the system. For the March calibration, WAS TSS concentration was not measured. The simulation was set up to provide a reasonable agreement between the observed and predicted MLSS and effluent concentrations. The simulator calibration for the two sampling periods is considered adequate to allow using the simulator for assessing the SBR capacity described in the next section.

Table 5-1. BioWin Calibration Summary for August/September 2012 Sampling Period				
Parameter	Units	Observed	Assumed	Predicted
SBR influent				
COD		1,081[2]	-	-
COD/BOD		1.79[2]	1.96	-
Fractions[1]:				
F_{bs}		-	0.30	-
F_{us}		-	0.04	-
F_{up}		--	0.14	-
F_{xsp}		-	0.75	-
F_{ac}		-	0.25	-
F_{na}		-	0.71	-
F_{po4}		-	0.88	-
% PE bypass		-	23	-
WAS flow – vol/cycle/SBR	gal	-	7,710	-
- - total vol per day	gpd	-	46,250	-
TSS concentration	mg/L	3,443	-	15,790
TSS load (total per day)	lb/d	-	-	5,947
SBR #1/SBR #2				
MLSS	mg/L	2,090[3]	-	1,728/2,490
MLVSS	mg/L	1,417[3]	-	1,157/1,656
MLVSS/MLSS		0.68	-	0.67/0.67
SRT	days	-	-	4.5
Net yield	lbVSS/lbBODrem	-	-	0.36
SBR effluent				
COD	mg/L	73	-	63
Soluble COD	mg/L	47	-	44
CBOD	mg/L	9.3	-	2.2
Soluble CBOD	mg/L	6.2	-	0.7
TSS	mg/L	17	-	19
TKN	mg/L	2.3	-	4.3
NH_3-N	mg/L	0.2	-	0.05
NO_3-N	mg/L	9.3	-	17
NO_2-N	mg/L	0.1	-	0.01
TP	mg/L	21	-	23
PO_4-P	mg/L	20	-	23
Alkalinity	mg/L $CaCO_3$	454	-	427

[1] *F_{bs} = fraction of total COD that is readily biodegradable.*

F_{us} = fraction of total COD that is unbiodegradable and soluble.

F_{up} = fraction of total COD that is unbiodegradable and particulate.

F_{xsp} = fraction slowly biodegradable COD that is particulate.

F_{ac} = fraction of readily biodegradable COD that is VFAs.

F_{na} = fraction of TKN that is ammonia.

F_{po4} = fraction of TP that is orthophosphate.

[2] *COD concentration and COD to BOD ratio for combined lagoon effluent and bypassed primary effluent based on assumed % bypass value.*

[3] *Observed MLSS and MLVSS concentrations are the averages excluding the data on 8/29/13 due to unreasoanably high MLSS value on that day. The mixed liquor samples were collected from SBR #1 on 8/29 and 8/30, and from SBR #2 on 9/4 and 9/5.*

Table 5-2. BioWin Calibration Summary for March 2013 Sampling Period				
Parameter	Units	Observed	Assumed	Predicted
SBR influent				
COD		1,665 [2]	-	-
COD/BOD		3.10 [2]	3.10	-
Fractions[1]:				
F_{bs}		-	0.18	-
F_{us}		-	0.04	-
F_{up}		--	0.42	-
F_{xsp}		-	0.90	-
F_{ac}		-	0.30	-
F_{na}		-	0.67	-
F_{po4}		-	0.78	-
% PE bypass		-	20	-
WAS flow – vol/cycle/SBR	gal	-	16,670	-
- - total vol per day	gpd	-	100,000	-
TSS concentration	mg/L	-	-	14,282
TSS load (total per day)	lb/d	-	-	11,931
SBR #1/SBR #2				
MLSS	mg/L	1,145[3]	-	1,457/1,498
MLVSS	mg/L	-	-	1,142/1,177
MLVSS/MLSS		-	-	0.78/0.78
SRT	days	-	-	24.0
Net yield	lbVSS/lbBODrem	-	-	1.08
SBR effluent				
COD	mg/L	68	-	79
Soluble COD	mg/L	60	-	68
CBOD	mg/L	4.8	-	1.6
TSS	mg/L	14	-	9.1
TKN	mg/L	2.9	-	5.4
NH_3-N	mg/L	0.6	-	0.20
NO_3-N	mg/L	67	-	63
NO_2-N	mg/L	2.9	-	0.1
TP	mg/L	33	-	24
PO_4-P	mg/L	31	-	24
Alkalinity	mg/L $CaCO_3$	350	-	287

[1] *F_{bs} = fraction of total COD that is readily biodegradable.*

F_{us} = fraction of total COD that is unbiodegradable and soluble.

F_{up} = fraction of total COD that is unbiodegradable and particulate.

F_{xsp} = fraction slowly biodegradable COD that is particulate.

F_{ac} = fraction of readily biodegradable COD that is VFAs.

F_{na} = fraction of TKN that is ammonia.

F_{po4} = fraction of TP that is orthophosphate.

[2] *COD concentration and COD to BOD ratio for combined lagoon effluent and bypassed primary effluent based on assumed % bypass value.*

[3] *Average MLSS concentration measured on 3/4/13 and 3/7/13 for SBR #1 based on samples measured in plant lab.*

Section 6: Overall Biological Process Capacity Evaluation

This section describes the assessment of the overall capacity of the existing biological process at the IWTP, including both the anaerobic lagoon and the SBRs. Lagoon performance data from the sampling results and from the original design basis and the calibrated BioWin model were used to simulate a number of operating scenarios and determine overall system capacity. Because plant flows and loadings are lower during the low production period, usually between December and May, the capacity assessment was performed for the high production period only.

6.1 Simulation Scenarios and Assumptions

The Quincy IWTP currently operates with one primary clarifier, anaerobic lagoon and two SBRs. Because no sludge is withdrawn from the primary clarifier, the clarifier is operated like a "wide spot in the line" with minimal treatment. In this analysis, it was assumed that the wastewater characteristic remain the same across the primary clarifier. The following scenarios were evaluated:

1. Current rated flow and loadings with and without PE bypass
2. Current rated flow and higher loadings (per existing influent characteristics)
3. Current rated flow and maximum loadings for existing blower capacity
4. Maximum flow and loadings at 3 cycles per day per SBR
5. Maximum flow and loadings at 4 cycles per day per SBR

Wastewater characteristics and assumptions used in the analysis are summarized in Table 6-1.

Table 6-1. Wastewater Characteristics and Assumptions in Capacity Evaluation

Parameter	Value	Basis
Raw influent ratios		
COD/BOD	2.00	From 2010-2012 plant data and Aug/Sept 2012 sampling data
VSS/TSS	0.90	From Aug/Sept 2012 and Mar 2013 sampling data
COD/TKN	35.0	From Aug/Sept 2012 sampling data
COD/TP	208	From Aug/Sept 2012 sampling data
COD/Alkalinity	405	From Aug/Sept 2012 sampling data (alkalinity in terms of mmol/L)
NH_3-N/TKN	0.23	From Aug/Sept 2012 sampling data
Anaerobic lagoon performance		
COD or BOD removal	75%	Same as design basis for EMC-AERG design
TSS removal	50%	From Aug/Sept 2012 and Mar 2013 sampling data (per raw influent and lagoon effluent data)
TKN removal	25%	From Aug/Sept 2012 sampling data
TP increase	40%	From Aug/Sept 2012 sampling data
Alkalinity increase	150%	Assumed
Net sludge yield (lbTSS/lbBODrem)	0.08	Same as design basis for EMC-AERG design (range is 0.08-0.12)
Max month to annual avg sludge yield	2.0	Assumed based on historical BOD loads
Lagoon effluent	3.25	From Aug/Sept 2012 and Mar 2013 sampling data
COD/BOD	0.82	From Aug/Sept 2012 and Mar 2013 sampling data
NH_3-N/TKN		
SBR		
Mixed liquor temperature	24.5 deg C	From Aug/Sept 2012 sampling data

6.2 Controlling Parameters

The biological process capacity is potentially limited by a number of factors. These include target secondary effluent quality, anaerobic lagoon HRT and organic loadings, SBR decanter capacity, and blower capacity. The limiting values for these controlling parameters are summarized in Table 6-2.

The effluent limits for BOD and TSS are based on Class A reclaimed water requirements. Because at least a portion of the plant effluent will be used for groundwater recharge seasonally (via percolation beds), total nitrogen (TN) removal will be required, typically down to a TN concentration below 10 mg/L. The down-stream reverse osmosis (RO) process will remove nitrates, so that the biological system does not need to achieve effluent TN concentration below that level. It was assumed that if at least a quarter of the plant effluent will be treated in the RO process, which would remove almost all of the nitrates in that stream, then the maximum allowable nitrate level in the secondary effluent is about 40 mg/L. The alkalinity limit of 500 mg/L corresponds to the estimated alkalinity level for optimal operation of the sand filter downstream of the SBR system.

Table 6-2. Maximum Operating Limits	
Parameter	Basis
Effluent quality	BOD: 30 mg/L monthly average TSS: 30 mg/L monthly average NO_3-N: 40 mg/L Alkalinity: 500 mg/L (minimum)
Anaerobic lagoon	
HRT	7 days
COD loading	60 lb/1,000 ft^3-d
Effluent pumping capacity	3,475 gpm or 5 mgd
SBR	
Decanter capacity	9,000 gpm per cycle per SBR
Aeration blowers	
Air flow capacity	18,400 scfm (2 blowers)
Field oxygen transfer rate	2,046 lb/hr (max month)
Primary effluent pump station	
Total firm pumping capacity	7.3 mgd with 2 pumps operating

For the anaerobic lagoon, minimum HRT of 7 days and maximum COD loading of 60 lb/1,000 ft^3-d are based on the original design basis for a low-rate anaerobic lagoon system (design for the ADI-BVF system described in Section 4 above). The relatively high HRT and low organic loading rate limits were established to ensure process stability and digestion of the influent solids and waste biomass. This would be particularly important if biogas is captured and used either in boilers or for power generation. Lastly, the capacity of the lagoon is currently limited by the lagoon effluent pump station capacity at 3,475 gpm or 5 mgd.

Hydraulic capacity of the SBRs is mainly constrained by the decanter capacity. Each SBR is equipped with two decanters, each with a capacity of 4,500 gpm. This corresponds to a maximum decanting flow of 9,000 gpm per cycle per SBR. The influent flow limit on a continuous basis depends on the length of the decanting phase and number of cycles per day. For the current operation of 3 cycles per day per SBR and a decanting period of 110 minutes, the maximum influent flow is 5.94 mgd.

The aeration blower capacity is based on the total capacity of two blowers with the third blower serving as a backup. This results in a total air flow rate of 18,400 scfm. The original design maximum month oxygen requirement is 70,714 lb/d. The corresponding design maximum month air requirement is 17,400 scfm. It was assumed that the additional air flow available from the blowers will allow the blowers to meet aeration requirements beyond the maximum month value. Therefore, for this analysis, the blower capacity was assumed to correspond to a field oxygen transfer rate of 70,714 lb/d or 2,946 lb/hr on a maximum month basis. It was assumed this transfer rate was originally calculated by accounting for the diffuser efficiency, diffuser depth, alpha (ratio of process to clean water oxygen transfer rate), dissolved oxygen concentration and mixed liquor temperature. This is the maximum oxygen transfer rate (OTR) during the period in each cycle when the SBR is aerated. The blowers provide air to only one SBR at a time.

Lastly, the maximum flow to the IWTP is currently limited by the primary plant effluent pumping capacity. The primary effluent pump station consists of three pumps each with a rated capacity of 6.3 mgd. With two pumps in operation (and the third pump serving as the standby pump), the total capacity is 7.3 mgd.

6.3 Results of Capacity Analysis

The five scenarios listed above were simulated. The results are summarized in Table 6-3.

In scenario 1, the analysis was performed using the current rated flows and loadings. This scenario was simulated both without and with bypass around the lagoon. In the first case, the lagoon HRT drops to 5 days, less than the original design criterion of 7 days. It was found that without any bypass, the SBRs will not provide adequate denitrification, Therefore, in the second case, a 20 percent bypass was assumed, which reduces the effluent nitrate to below the target concentration of 40 mg/L, while the lagoon HRT is slightly higher at 6.2 days, but still below the original design value. A third case was evaluated where the flow to the lagoon is kept at 3.5 mgd to meet the 7-day HRT criterion. This results in a higher bypass flow, and thus higher organic and solids loadings to the SBRs. The oxygen requirements and waste production rate increase, but the former remain below the design value and the effluent concentrations meet the target levels. Therefore, under the flow and loading conditions for this scenario, the SBRs have adequate capacity to treat the additional flow that bypasses around the lagoon in order to maintain a lagoon HRT of 7 days.

In scenario 2, the influent concentrations and loadings were increased to match influent concentrations during maximum month loadings as observed from plant data from 2010 to 2012. The resultant influent loadings are about 50 to 65 percent higher than the current rated loadings. By allowing 20 percent of the flow bypassing the lagoon, the SBRs would then produce the desired effluent quality. However, in this case, the higher loadings would result in aeration requirements that exceed the existing blower capacity. Therefore, addition of new blowers or replacement of the existing blowers with higher-capacity blowers would be required.

In scenario 3, the maximum influent loadings were determined to not exceed the existing blower capacity. The results show that the biological system can accommodate about 16 percent higher BOD loadings and about 4 percent higher TKN loadings than the current rated loadings without exceeding the blower capacity. It should be noted that because the anaerobic lagoon removes a significant amount of organics (75 percent COD removal assumed in this analysis, which is considerably higher than typical removal across a primary clarifier), it would be expected that the system can accommodate much higher BOD loadings without exceeding the existing blower capacity. However, ammonia loading to the SBR system, and to a lesser extent TKN loading, has increased substantially with addition of the anaerobic lagoon due to release of ammonia in the anaerobic process. Because it takes about 4.6 pounds of oxygen to oxidize one pound of ammonia, the oxygen requirements associated with nitrification in the SBRs have increased substantially from the original design. Denitrification provides recovery of oxygen equivalents, but there is still a net addition of oxygen requirements due to the higher ammonia load and it was assumed in this analysis that the SBRs would not provide complete denitrification. Under the current operation, however, even with the additional ammonia loading generated in the lagoon, the existing blowers have excess capacity as the current maximum month BOD loading (at about 70,000 lb/d) is almost 20 percent less than the BOD loading capacity determined for this scenario. During the low production period, the BOD loading is significantly less than the capacity value and may result in air flow requirement less than the minimum blower air flow.

In scenario 4, the maximum flow and loadings were determined assuming the current SBR operation of 3 cycles a day per SBR unit. As described above, the hydraulic capacity of the SBRs is mainly dictated by the decanter capacity. With 3 cycles per day per SBR and assuming the same decanting period per cycle (110 minutes), the maximum plant influent flow is 5.94 mgd. The analysis shows that at this influent flow rate, up to about 119,000 lb/d of BOD can be treated in the biological system. Similar to scenario 2, the blower capacity will be exceeded, thus requiring addition of new blowers or replacement of the existing blowers with higher-capacity blowers. The hydraulic capacity of the SBRs can be increased by increasing the decanting period in each cycle or by replacing the existing decanters with higher-capacity decanters. For the same cycle time (8 hours for this scenario), a longer decanting period would require a reduction in the react or settle period or both.

Table 6-3. Summary of IWTP Capacity Analysis

Influent Wastewater				Anaerobic Lagoon			SBR			SBR Effluent					Sludge Production	
Flow (mgd)	BOD (lb/d) (mg/L)	TSS (lb/d) (mg/L)	TKN (lb/d) (mg/L)	Flow to lagoon (mgd)	HRT (day)	COD load (lb/1000ft^3-d)	Avg MLSS (mg/L)	Max OTR (lb/hr)	SRT (day)	BOD (mg/L)	TSS (mg/L)	NH_3-N (m/gL)	NO_3-N (mg/L)	Alkalinity (mg/L)	WAS (lb/d)[1]	Lagoon sludge (DT/yr)
Scenario 1: Current rated plant flows and loadings																
4.89	74,000 (1,814)	66,400 (1,628)	4,700 (115)	4.89	5.0	52	3,720	1,960	38	1.2	9.6	0.03	70	500	19,830	450
4.89	74,000 (1,814)	66,400 (1,628)	4,700 (115)	3.9	6.2	45	2,990	2,506	24	1.6	8.7	0.1	32	500	25,240	370
4.89	74,000 (1,814)	66,400 (1,628)	4,700 (115)	3.5	7.0	43	2,820	2,710	20	1.8	8.6	0.1	14	530	28,160	330
Scenario 2: Current rated flow and high loadings																
4.89	122,300 (3,000)	102,000 (2,500)	7,000 (170)	3.9	6.2	74	3,350	3,755	18	2.0	9.2	0.2	33	500	38,000	620
Scenario 3: Current rated flow and max loadings for current blower capacity																
4.89	85,600 (2,100)	71,400 (1,750)	4,900 (120)	3.7	6.5	51	2,840	2,900	18	1.9	8.6	0.1	20	520	31,060	410
Scenario 4: Max flow and loadings at 3 cycles per day per SBR																
5.94	118,900 (2,400)	99,100 (2,000)	6,800 (137)	4.8	5.1	74	3,650	3,814	18	1.3	9.8	0.2	30	500	41,240	600
Scenario 5: Max flow and loadings at 4 cycles per day per SBR																
7.20	120,100 (2,000)	100,100 (1,667)	6,900 (114)	5.8	4.2	74	3,600	4,110	18	5.0	31	0.2	25	570	39,840	610
7.20	117,100 (1,950)	97,600 (1,625)	6,700 (111)	5.0	4.9	67	3,650	4,295	16	5.9	32	0.3	8	550	44,920	530

[1] *WAS removed from the SBRs was assumed to be pumped to the anaerobic lagoon.*

In scenario 5, the maximum flow and loadings were determined assuming the SBR operation is changed to result in 4 cycles per day per SBR unit. The cycle time will be reduced from 8 to 6 hours. The assumed operating scheme is as follows:

1. Anoxic fill - 50 min
2. React fill - 130 min
3. React - 50 min
4. Settle - 30 min
5. Decant - 100 min

This scheme assumes both shorter react and settle periods. A shorter settle period is considered acceptable based on results of the mixed liquor settleability tests conducted in May 2013. The test results indicate that settling is essentially complete after a 30-minute period, with the sludge volume at 30 minutes about the same as the sludge volume at 60 minutes after settling was initiated. The simulator predicted higher effluent BOD and TSS concentrations than in the other scenarios due to the shorter settle phase. However, because the actual settling characteristics may be better than those assumed in the simulator, the actual effluent concentrations may be lower. Two cases were evaluated for this scenario: in the first case, 20 percent of the influent flow bypasses around the lagoon, resulting in a flow of 5.8 mgd going to the lagoon. This exceeds the capacity of the existing lagoon effluent pump. In the second case, the flow to the lagoon is limited at 5 mgd, the same as the effluent pump capacity. The analysis shows that the system can treat up to about 120,000 lb/d of BOD in the first case and up to about 117,000 lb/d in the second case. In both cases, the lagoon HRT is below the design value of 7 days and lagoon COD loading exceeds the design limit of 60 lb/1000 ft^3-d. Blower capacity for aeration in the SBRs is also exceeded.

In all simulation scenarios described above, the lagoon HRT is less than the design value of 7 days, and the COD loading is higher than the design limit of 60 lb/1000 ft^3-d in all scenarios except for scenario 1. These original design criteria were based on those for low-rate anaerobic lagoons to provide digestion of the raw and waste sludge solids and for optimal biogas generation. Because biogas from the lagoon is currently flared and not re-used, the anaerobic lagoon at the IWTP currently functions more like a pre-treatment system for the SBRs. If bio-gas utilization is implemented in the future, either in boilers or for power generation (such as in micro-turbines), then the lagoon HRT will become a more important factor in the overall system capacity. To assess lagoon performance when the HRT is close to or drops below 7 days, grab sampling data of primary effluent and lagoon effluent could be collected during the peak food processing period (typically in September and October) with no flow bypassing around the lagoon.

Section 7: Conclusions and Recommendations

This technical memorandum describes the procedures and results of the capacity assessment of the biological treatment processes at the Quincy IWTP, including the anaerobic lagoon and two SBR units. The assessment includes wastewater characterization, review of previous evaluation of the lagoon design, and process simulation. The results show that the system can accommodate higher flow and loadings than the current rated flow of 4.89 mgd and rated loadings of 74,000 lb/d of BOD, 66,400 lb/d of TSS and 4,700 lb/d of TKN. Maximum influent flow is limited at 5.94 mgd by the SBR decanter capacity assuming 3 cycles per day per SBR and a decanting period of 110 minutes per cycle. If the SBR is operated at 4 cycles per day with a decanting period of 100 minutes per cycle, the influent flow capacity can be increased to 7.2 mgd. The organic and TKN loadings are limited by the existing blower capacity at about 85,600 lb/d and 4,900 lb/d, respectively. The loading capacities are greatly influenced by the additional ammonia loads in the lagoon effluent that is subsequently treated in the SBRs. In almost all scenarios simulated, the lagoon HRT is less than the design value of 7 days and the COD loading is higher than the design limit of 60 lb/1000 ft^3-d. Because the biogas from the lagoon is currently not re-used for energy recovery, less-than- optimal digestion in the lagoon due to low HRT and high COD loading is considered acceptable. In the future, if biogas utilization is implemented, then flow and loadings to the lagoon may need to be limited to provide a more complete and stable digestion process.

Recommendations for process improvements and recommendations for increasing system capacity in the future include the following:

- Install a flow meter (and control valve) along the bypass line for the lagoon bypass. This will allow monitoring of the bypass flow and potentially automatic adjustment of the bypass flow to achieve the desired secondary effluent quality. The adjustment could be based on on-line nitrate and alkalinity measurements of the SBR effluent.
- Perform a more detailed analysis of the blower capacity, including turndown capability to match the current aeration requirements. The analysis could also include a life-cycle evaluation of replacing the existing blowers with high-efficiency high-speed blowers versus keeping the existing blowers.
- Perform additional settling tests to confirm the potential of reducing the time for the settle phase during a SBR cycle. By shortening the settle phase, a longer decant phase may be used, which would increase the SBR hydraulic capacity.
- Assess performance of the anaerobic lagoon when the HRT is close to and drops below 7 days by collecting grab sampling data of primary effluent and lagoon effluent under high plant flow conditions with no bypass flows around the lagoon. This will help determine if lagoon HRT will be a capacity-limiting factor for the biological treatment system. Because the SBRs are currently underloaded and total nitrogen removal is not required until the plant begins to produce Class A reclaimed water, the plant effluent is expected to meet current permit requirements with no lagoon bypass for a limited time period.
- Add new blowers or replace existing blowers with higher capacity blowers to increase loading capacity (if this has not been done as a result of the blower capacity analysis mentioned above). New blowers to increase aeration capacity is not expected to be needed in the near future, until the plant loadings increase to the levels estimated in this analysis (as shown in Table 6-3).
- Replace existing decanters in the SBRs with higher-capacity decanters to further increase the hydraulic capacity of the SBRs.

Appendix C: Letter: Effects of Microsoft's Conversion from High to Low Cycle Cooling System Operations in Quincy

Dated September 28, 2016

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Brown AND Caldwell

September 28, 2016

Mr. Tim Snead
City Administrator
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Subject: Effects of Microsoft's Conversion from High- to Low-Cycle Cooling System Operations in Quincy

Dear Mr. Snead,

This letter describes impacts on the City of Quincy's (City's) water and wastewater utility that will need to be addressed in response to Microsoft eliminating the use of its high-cycle cooling water technology. Microsoft will be shifting to the use of conventional low-cycle operations and it is assumed that Microsoft will also eliminate its direct need for operation of the high-efficiency water softener (HES) system in the water softener building (WSB) that is managed by the City. The effects described herein are those that are currently identified and include operational, infrastructure, and service agreement effects. Further evaluation and design will be needed before all effects are identified, final decisions are made, and changes are implemented.

This letter continues with a review of the background of the water and wastewater utility development in the city as it relates to Microsoft's needs. Next, the basis of the high-cycle system is reviewed and established as a baseline reference for moving off of that system. The new operational considerations are then presented, focusing on interim operations and briefly addressing long-term plans.

The background review and review of pending changes are presented in the context of the development of the Quincy 1Water Utility (Q1W) and the Industrial Reuse Water Treatment Plant (IRWTP). Because Microsoft has been projected to be a major customer of the Q1W and IRWTP, review of the elimination of high-cycle cooling system operation will take into account Q1W and IRWTP development.

Quincy Industrial Cooling Water Operations Background

For the past several years, the City has been addressing the need for various water supply and wastewater service improvements associated with data center and other industry development, residential growth, and the pending loss of the outfall for the Industrial Wastewater Treatment Plant (IWTP). Regarding data centers, their proliferation in Quincy has increased the demand on Quincy's water supply for cooling, and their cooling systems generate blowdown (i.e., wastewater) with high concentrations of total dissolved solids (TDS). Data centers are prohibited from discharging to the IWTP (because of limitations in the IWTP's own discharge permit), and cooling water discharge to the sanitary sewer system is tightly regulated.

Per the City's sanitary sewer system and Municipal Water Reclamation Facility (MWRF) permit, the system is not allowed to receive significant quantities of non-contact cooling water. Via individual data center permits, the Washington State Department of Ecology (Ecology) allowed temporary use of the sewer through 2013, with a special condition in each permit that a plan to cease sewer discharge be developed. Among the concerns for cooling water discharge is degradation of the aquifer below the MWRF percolation beds by increasing the TDS.

The IRWTP is being developed, in part, to support data center water supply and wastewater discharge needs. It will allow each industry to minimize its onsite infrastructure and operations related to wastewater management. For initial operations, the IRWTP will treat well water or city potable water. As the demand for water increases and redundant source supplies are needed, IWTP effluent will be treated for feed to the IRWTP to create reuse water.

In a 2009 feasibility study (2009 FS), both high-cycle and low-cycle cooling system operations were evaluated (BC 2009). The City and Microsoft continued to work together to develop solutions for Microsoft. The evaluation included a review of reverse osmosis (RO) as reported in the High Efficiency Reverse Osmosis Feasibility Study (HERO FS) (EMC 2010). Microsoft selected high-cycle operations to meet the Ecology 2013 deadline. Since then, the City proceeded with the installation of an RO system for other IRWTP needs and the RO system can be ready to respond to Microsoft's changes using methods similar to that reported in the HERO FS (EMC 2010).

Microsoft High-Cycle Basis

Per the 2009 FS, high-cycle operation was specifically noted to not require RO system treatment to meet cooling system feed water quality requirements (BC 2009). This provided a benefit by minimizing the City's RO operations dependency within the IRWTP. In addition, high-cycle cooling systems operated at 50 to 100 cycles of concentration (CoC) reduce the blowdown rate to 1 to 2 percent of the cooling system's evaporation rate. This low blowdown rate conserved water by reducing waste to the sewer and was small enough that it could be sent directly to brine ponds. As early as 2010, ponds and existing pipelines designated for brine transfer between existing ponds were ready to support high-cycle operations.

The HES system was installed and Microsoft began high-cycle operations in 2014 under a water services agreement with the City. Within that agreement, the HES system performance was specified to generate approximately 1.5 percent brine volume per unit volume of water softened. The installed system was observed to generate 2.2 percent, or about 50 percent more than the agreement stated. Microsoft's engineering reports indicated cooling system operations at 40 CoC and it has been reported that operations have been near 85 CoC (1.2 percent discharge). Although variations have been observed, on balance Microsoft's high-cycle operations proved to have low brine generation (less than 4 percent of the cooling demand). Nonetheless, the City's brine ponds have been recently observed approaching capacity and new ponds and brine management system improvements are becoming critical.

Water and Brine Management Effects of Microsoft's Conversion to Low-Cycle Operations

Microsoft is currently making a transition to 3 CoC operations. Under this condition, cooling system discharge will increase from 1.2 percent of the evaporation rate to 50 percent. If all this blowdown were sent to the brine ponds, they would be filled in a matter of days; thus, temporary discharge to the sanitary sewer was requested and allowed. It has been permitted to occur until December 31, 2016.

At 3 CoC, the TDS concentration in the cooling water is three times that which is in the water supply and groundwater. To control the flow rate of blowdown, higher CoC were considered, but the blowdown nitrate concentration would have caused the MWRF to exceed its limit for nitrate and other forms of nitrogen. Lower CoC were considered to reduce TDS and nitrate effects, but this would have created discharge volumes above the capacity of the MWRF.

Microsoft reported that operation at 3 CoC would not require use of the HES system. Thus, the 3 CoC systems will be fed non-softened potable water to eliminate unnecessary brine generation and salt consumption.

The CoC could be increased above 3, resulting in reduced TDS and nitrate concentrations in the discharge as well as reduced discharge volumes if the cooling tower makeup were treated by RO. It is conceivable that using nearly 100 percent RO permeate feed to cooling systems, moderate to high CoC (10 to 20 CoC) could be achieved, resulting in discharge rates at 5 to 10 percent of the evaporation rate. However, the RO system creates a waste stream, referred to as reject, which—at this stage of development—has been modeled at 11 percent of the permeate flow. Although "cycles of concentration" is not a common term for RO operations, this is equivalent to 9 CoC. The RO reject stream is classified as brine and cannot be discharged to the sewer.

The City's current plan is to feed the RO system with water softened by the HES system to protect the RO membranes from scaling. Thus, the HES system will continue to generate brine that, when combined with RO reject, will cause flow to brine ponds to increase by at least a factor of two compared to Microsoft's high-cycle operations. The immediate response to this can be the construction of ponds that will more than double the capacity and surface area of the existing pond system. Furthermore, evaporation enhancement systems in the ponds and brine-concentrating technologies between the RO system and pond system could be used and should be investigated.

The need for reject management and evaporation system improvements has been recognized as a part of the IRTWP for some time, but their implementation schedule would have been in relation to the IRWTP development. In the meantime, Microsoft's high-cycle operations would have allowed a steady increase in pond capacity buildout. Now, with Microsoft's sudden transition to low-cycle operations, the need for these improvements has been moved to the immediate future.

Interim Cooling Water and Wastewater Management

This section is based on a reasonable assumption that discharge from Microsoft cooling systems operated at 3 CoC cannot be reduced to a level that would allow discharge to the evaporation ponds. Thus, the discharge will need to be routed to another system. Discharge to the IWTP is still prohibited and discharge to the MWRF may not be preferred unless the effects can be significantly mitigated and allowed by Ecology. Eventually, after the IWTP discharge has ceased and the IRWTP is fully implemented, cooling tower blowdown can be discharged to the IWTP, but the required technologies will not be in place for at least a year (in October 2017). In addition, the required brine pond acreage cannot likely be in service until 2017 at the earliest. Fortunately, the expiration of the temporary permit occurs during the coldest time of year when cooling system demands are lowest.

Applying concepts that were used to develop temporary permit limits at 3 CoC, cooling system discharge scenarios were analyzed using partial and maximum RO permeate feed and supported by HES operation. The detailed model results are enclosed and summarized in the table below. The current 3 CoC operation is included as a baseline for comparison. The conditions are based on an estimate of 2017 annual average conditions for Microsoft's CO1, CO2, and MWH01, which together evaporate 350 gallons per minute (gpm) (508,000 gallons per day [gpd]) of cooling water on an annual average. The soon-to-be operating RO system has a firm capacity of 750 gpm (1.07 million gallons per day [mgd]) with n+1 redundancy and can almost support peak flows for the maximum RO condition in 2017.

For the analysis, it is assumed that the MWRF effluent TDS concentration is 600 milligrams per liter (mg/L) and the nitrogen concentration is 7 mg/L. The annual average MWRF effluent flow rate is assumed to be 1,100,000 gpd. Quincy Municipal Code establishes a surcharge fee basis for TDS as well as an enforcement limit (5,000 mg/L). It also establishes a limit of 250 mg/L of silica because of observed sewer pipe scaling from one discharger.

Hardness, TDS, nitrogen, and silica concentrations were modeled. Water hardness is not limited or monitored per code, but it can have observed effects such as accumulation on percolation bed soils. The MWRF permit does not have a TDS limit for its effluent reclaimed water, but the current permit requires a continuous TDS monitoring protocol in support of Ecology eventually establishing a limit. Although 600 mg/L may eventually be considered manageable with respect to aquifer anti-degradation, it is currently above the regulation-recommended limit of 500 mg/L.

Comparison of Cooling Systems Operations Scenarios Using RO and the Effects on MWRF Effluent Water Quality			
Parameter	3 CoC no RO	6 CoC partial RO	6 CoC maximum RO
Feed water TDS (mg/L)	475.0	200.0	79.2
Discharge TDS (mg/L)	1,425	1,200	475
RO permeate portion (%) [a]	0	65	93
Feed rate (gpd)	756,000	604,800	604,800
RO rate (gpd)	0	391,300	563,300
Cooling discharge (gpd)	252,000	100,800	100,800
RO reject (gpd)	0	43,500	62,600
HES regenerant (gpd)	0	9,700	13,900
Total to ponds (gpd)	0	53,100	66,500
Increases in MWRF Effluent			
TDS (mg/L)	266.0	101.0	40.0
Total hardness (mg/L as $CaCO_3$)	140.0	44.0	8.6
TN (mg/L)	3.9	1.2	0.2
Silica (as SiO_2 mg/L)	31.0	9.8	1.9

a. *% RO permeate represents the portion of feed water that is RO permeate, the rest is Quincy potable water.*

At 3 CoC in 2017 without RO treatment, the estimated TDS increase is 266 mg/L, representing a 43 percent increase above the current MWRF effluent TDS concentration. The cooling discharge of 252,000 gpd represents a 23 percent increase in MWRF flow. These values are essentially incompatible with the MWRF permit conditions. In addition, the total nitrogen (TN) increase of 3.9 mg/L would have a good probability of causing effluent TN permit violations.

For the partial RO example, the cooling makeup TDS of 200 mg/L is achieved by blending potable water with RO permeate. This could allow Microsoft to operate its systems at 6 CoC, thus reducing the discharge flow rate to 100,800 gpd. The MWRF effluent TDS concentration would increase by 101 mg/L, or 16 percent above the existing level, significantly less than in the 3 CoC operation.

For the maximum RO example using 6 CoC, the discharge flow would be the same as the partial RO example, but the effect on MWRF effluent TDS would be reduced to just 40 mg/L (a 6 percent increase).

If high-cycle operations were continued in 2017 at 508,000 gpd of evaporation, the average annual flow rate into the brine ponds would be on the order of 15,000 to 20,000 gpd. For the partial and maximum RO examples, the flow rate is estimated to be 53,000 and 66,000 gpd, respectively, or roughly three to four times higher than the high-cycle condition. There are currently four evaporation ponds in service that have a total of 3.2 acres of evaporative surface area with no evaporation enhancement. It is likely that evaporation from the existing ponds can be improved, or RO reject can be reduced, but more evaporation ponds will be needed soon after an RO permeate feed strategy is implemented.

The following values are presented as a rough correlation to understand the general magnitude of the low-cycle operating parameters—they are not the result from preliminary engineering:

- High-cycle: 15,000 to 20,000 gpd brine marginally supported by 3.2 acres
- Partial RO: 53,000 gpd brine requires 7 to 10 acres (4 to 7 more acres than exist)
- Maximum RO: 66,000 gpd brine requires 10 to 13 acres (7 to 10 more acres than exist)

Considering that RO capacity is adequate and assuming other infrastructure needs are minor, evaporation pond capacity is the primary limitation to achieving reasonable blowdown conditions to the MWRF. The IWTP property has enough room for the 13-acre worst-case pond requirement within the footprint of lagoon 6 (which is abandoned). The ponds could be built next to the two existing ponds at the IWTP. Maximum use of the lagoon 6 area now can mitigate current brine-reduction methods analyses, or brine-reduction methods can be studied to limit pond construction.

Included at the bottom of the enclosed RO model worksheet is a cost estimate for HES operation and brine management. For the maximum RO example, the salt use and brine salt production values are similar to the projected 2017 high-cycle operation scenario. At $2.65 per 100 cubic feet of feed water under the expiring agreement for salt and brine handling, Microsoft would have paid an estimated $666,100 for 508,000 gpd of cooling system evaporation. The estimate for the maximum RO example is $695,100 for salt and brine. This value is from a preliminary analysis only and other cost factors need to be considered.

Service Agreement Considerations

Once Microsoft fully eliminates its use of high-cycle operations, American Water Enterprises can terminate its service contract with Water Conservation Services for the operation of the HES system. After that, the operation of the HES for feed to RO will not be subject to the same requirements, because HES effluent will be used for RO feed, not cooling tower makeup. It may be possible to modify the HES operations to reduce salt consumption and regenerant volume production.

Overall, under the new low-cycle strategies, operations services for the HES and RO systems and the evaporation ponds will require evaluation.

Estimated Infrastructure Impacts

In addition to pond construction, the following is a list of currently known infrastructure improvements to support Microsoft's interim cooling system operations:

- Pumping: Current pumping systems include only the HES feed pumps, which provide enough pressure to convey softened HES effluent to Microsoft. When HES effluent is redirected to the RO, there will be insufficient pressure remaining downstream of the RO to send the water to Microsoft, so permeate pumps will be needed. To accomplish this, HES feed pumping will be provided by new pumps in the reuse filter building (RFB), drawing water from the new reuse water clearwell. The RO permeate pumps will be installed in the WSB. The RFB pumping system design is complete and ready for installation. The WSB RO permeate pump design is approximately 80 percent complete and requires review prior to design completion because its design basis may have changed since its design was initiated.

- HES modifications: The water quality from the HES units as specified by Water Conservation Technology International, Inc. (WCTI), was based on cooling water feed requirements. These requirements may change when the HES system is feeding RO. Modifications to the HES units might increase their capacity, improve monitoring and controls, and possibly reduce salt use and brine production.
- Existing HSW Pipe routes: As part of Microsoft's high-cycle infrastructure, the City installed redundant pipeline loops, radiating out from the WSB, for distribution of the highly softened water (HSW) produced by the HES system. Microsoft will need to consider its redundancy needs and how the Oxford and Columbia HSW routes/loops will be used to deliver RO permeate. The loops could require modifications.
- Controls: Primarily lacking is the method of controls for the RO system operation and the feed to the WSB RO permeate pumps. In addition, control strategies for the RFB and WSB pumps will need to be developed.
- RO building area piping: This area has been through three stages of development and has become overly complex. This area will need to be evaluated to determine which unused piping needs to be removed.
- Storage: Treated water storage may be required pending review of the above-listed infrastructure. At a minimum, storage can be used to address warm, mid-day peak loads to eliminate some future increases in HES and RO capacity.
- CO3/CO4 considerations: The CO3/CO4 wastewater needs that were considered critical in 2015 have not been resolved. At that time, one concept was to feed softened water to CO3/CO4 with discharge to CO1/CO2. This concept applies if 100 percent RO permeate is fed to CO3/CO4 and can be supported by appropriate storage design.

Considering the temporary permit expiration that will occur in 3 months, a preliminary design and cost estimation should be started soon. The predesign can also be used to establish inputs for water service agreement updates and improve negotiations between the City and Microsoft.

Please contact me if you have any questions.

Very truly yours,

Brown and Caldwell

Emil Voges
Program Manager

cc: A. Belino, City of Quincy
J. Favor, American Water

Attachment A: Microsoft Low Cycle Cooling System Operations Models

References

Brown and Caldwell (BC). 2009. Industrial Non-Contact Cooling Water Feasibility Study.

Environmental Management Corporation (EMC). 2010. High Efficiency Reverse Osmosis Feasibility Study.

Attachment A: Microsoft Low Cycle Cooling System Operations Models

2017 Microsoft Water and Wastewater - Partial RO

Possible Permit Limits

Permit Control Parameter

			Annual Average: Current Temp Permit	Annual Average: Partial RO	Max Month: Current Temp Permit	Max Month: Partial RO	Instantaneous: Current Temp Permit	Instantaneous: Partial RO
	CoC		3	6	3	6	3	6
	Evap	gpm	350	350	480	480	700	700
	Evap	gpd	504,000	504,000	691,200	691,200	1,008,000	1,008,000
This partial RO method cost is less than WCTI because approximately	BD TDS	mg/L	1,425	1,200	1,425	1,200	1,425	1,200
1/3 o f the TDS is being released to perc beds instead of capturec	Tower Feed TDS	mg/L	475.0	200.0	475.0	200.0	475.0	200.0
in ponds	Potable TDS	mg/L	475	475	475	475	475	475
	Permeate TDS	mg/L	50	50	50	50	50	50
	Feed Rate	gpd	756,000	604,800	1,036,800	829,440	1,512,000	1,209,600
	Blow down rate	gpd	252,000	100,800	345,600	138,240	504,000	201,600
	Permeate Percent		0%	65%	0%	65%	0%	65%
	Permeate Flow	gpd	-	391,341	-	536,696	-	782,682
	Potable Flow	gpd	756,000	213,459	1,036,800	292,744	1,512,000	426,918
	Recovery		90%	90%	90%	90%	90%	90%
	Reject % of Perm		11%	11%	11%	11%	11%	11%
	Reject flow	gpd	-	43,482	-	59,633	-	86,965
	HES Feed Flow	gpd	-	434,824	-	596,329	-	869,647
	HES salt rate	lb/ccf	3.3	3.3				
HES System Annual Ops Analysis Inputs	HES salt use	ppd	-	1,918				
60 mg/L Ca	Sodium Portion	ppd	-	761				
24 mg/L Mg	Sodium in RO feed	mg/L	115	115				
3.3 lb NaCl/ccf of softened water per 2015 data	Sodium in RO feed	ppd	-	416				
250 mg/L TH as CaCO3 = 2.5 mM divalents = 5.0 mEq	Regen Brine (Ca, Mg)	ppd	-	304				
5 mEq * 23 g/mole = 115 mg/L of Na exchanged into stream	Regen Brine (Na, Cl)	ppd	-	1,502				
	Total Regen Brine	ppd	-	1,806				
	Feed Flow to Regen ratio	ratio	45	45				
Reduce by extending regeneration cycle and divert rinse streams -->	Regen flow	gpd	-	9,663				
Reduce by extending regeneration cycle -->	Regen TDS	mg/L		22,467				
	Evap pond max concentration	mg/L	200,000	200,000				
	Evap Pond Haulout rate	gpd		1,085				
	Salt Cost	$/lb	0.12	0.12				
	Brine haul cost	$/gal	0.50	0.50				
	Annual Salt Cost	$/yr	-	$ 84,023				
	Annual Haul Cost	$/yr	-	$ 198,095				
	Total HES Salt Related Costs	$/yr	-	$ 282,118				
	MWRF Current Effluent	gpd	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
	MWRF Resultant Effluent	gpd	1,352,000	1,200,800	1,445,600	1,238,240	1,604,000	1,301,600
	TDS Mass to Perc	ppd	2988	1006	4097	1380	5975	2013
	Blow down TDS Increase	mg/L	265.6	100.7	340.7	134.0	447.8	185.9
	MWRF Effluent Current TDS	mg/L	600.0	600.0	600.0	600.0	600.0	600.0
	Blow down TDS Final	mg/L	865.6	700.7	940.7	734.0	1,047.8	785.9
	Source TH	mg/l CaCO3	250	250	250	250	250	250
TH = 0 in permeate yields reduced blend	Cooling Feed TH	mg/l CaCO3	250	88	250	88	250	88
	Blow down TH	mg/l CaCO3	750	529	750	529	750	529
	Blow down TH mass	ppd CaCO3	1572	444	2157	609	3145	888
	MWRF Current effluent TH	mg/l CaCO3	250	250	250	250	250	250
Does not take into account other TH effects.	Blow down TH increase MWRF	mg/l CaCO3	139.8	44.4	179.3	59.1	235.7	82.0
Intuit, Sabey and other effects probably make this value higher	Final TH	mg/l CaCO3	389.8	294.4	429.3	309.1	485.7	332.0
Nitrogen is biologically removed, thus	Source N	mg/L	7.0	7.0	7.0	7.0	7.0	7.0
MWRF effluent may have less N than groundwater source N	Feed N	mg/L	7	2	7	2	7	2
Blow down N is not removed because it doesn't go to MWRF SBRs	Blow down N	mg/L	21	14.8	21	14.8	21	14.8
	Blow down N mass	ppd	44	12	60	17	88	25
	Blow down N increase MWRF	mg/L	3.9	1.2	5.0	1.7	6.6	2.3
	Source Si	mg/L	55.0	55.0	55.0	55.0	55.0	55.0
	Feed Si	mg/L	55	19	55	19	55	19
	Blow down Si	mg/L	165	116	165	116	165	116
	Blow down Si mass	ppd	346	98	474	134	692	195
	Blow down Si increase MWRF	mg/L	30.8	9.8	39.4	13.0	51.8	18.0
	MWRF Effluent Current Si	mg/L	55.0	55.0	55.0	55.0	55.0	55.0
	Final Si	mg/L	85.8	64.8	94.4	68.0	106.8	73.0
Sodium added in the HES system is removed by RO	Sodium	N/A						

Reject Analysis - Annual Average Only

HES Feed TDS	mg/L	475
HES Na Increase	mg/L	115
HES Ca, Mg Decrease	mg/L	84
RO Feed TDS	mg/L	506
RO Reject TDS	mg/L	5060
RO Reject TDS	ppd	1,831
Brine Haul out concentration	mg/L	200,000
Brine Haul out volume	gpd	1,100
Brine haul cost, reject part	$/yr	$ 200,769
Total Salt/Brine O&M		$ 482,887
Total Brine Source flow	gpd	53,145

2017 Microsoft Water and Wastewater - Maximum RO

Possible Permit Limits

Permit Control Parameter

			Annual Average: Current Temp Permit	Annual Average: Maximum RO	Max Month: Current Temp Permit	Max Month: Maximum RO	Instantaneous: Current Temp Permit	Instantaneous: Maximum RO
	CoC		3	6	3	6	3	6
	Evap	gpm	350	350	480	480	700	700
	Evap	gpd	504,000	504,000	691,200	691,200	1,008,000	1,008,000
	BD TDS	mg/L	1,425	475	1,425	475	1,425	475
	Tower Feed TDS	mg/L	475.0	79.2	475.0	79.2	475.0	79.2
	Potable TDS	mg/L	475	475	475	475	475	475
	Permeate TDS	mg/L	50	50	50	50	50	50
	Feed Rate	gpd	756,000	604,800	1,036,800	829,440	1,512,000	1,209,600
	Blow down rate	gpd	252,000	100,800	345,600	138,240	504,000	201,600
	Permeate Percent		0%	93%	0%	93%	0%	93%
	Permeate Flow	gpd	-	563,294	-	772,518	-	1,126,588
	Potable Flow	gpd	756,000	41,506	1,036,800	56,922	1,512,000	83,012
	Recovery		90%	90%	90%	90%	90%	90%
	Reject % of Perm		11%	11%	11%	11%	11%	11%
	Reject flow	gpd	-	62,588	-	85,835	-	125,176
	HES Feed Flow	gpd	-	625,882	-	858,353	-	1,251,765
	HES salt rate	lb/ccf	3.3	3.3				
HES System Annual Ops Analysis Inputs	HES salt use	ppd	-	2,761				
60 mg/L Ca	Sodium Portion	ppd	-	1,095				
24 mg/L Mg	Sodium in RO feed	mg/L	115	115				
3.3 lb NaCl/ccf of softened water per 2015 data	Sodium in RO feed	ppd	-	599				
250 mg/L TH as CaCO3 = 2.5 mM divalents = 5.0 mEq	Regen Brine (Ca, Mg)	ppd	-	437				
5 mEq * 23 g/mole = 115 mg/L of Na exchanged into stream	Regen Brine (Na, Cl)	ppd	-	2,162				
	Total Regen Brine	ppd	-	2,600				
	Feed Flow to Regen ratio	ratio	45	45				
Reduce by extending regeneration cycle and divert rinse streams -->	Regen flow	gpd	-	13,908				
Reduce by extending regeneration cycle -->	Regen TDS	mg/L		22,467				
	Evap pond max concentration	mg/L	200,000	200,000				
	Evap Pond Haulout rate	gpd		1,562				
	Salt Cost	$/lb	0.12	0.12				
	Brine haul cost	$/gal	0.50	0.50				
	Annual Salt Cost	$/yr	-	$ 120,943				
	Annual Haul Cost	$/yr	-	$ 285,136				
	Total HES Salt Related Costs	$/yr	-	$ 406,079				
	MWRF Current Effluent	gpd	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
	MWRF Resultant Effluent	gpd	1,352,000	1,200,800	1,445,600	1,238,240	1,604,000	1,301,600
	TDS Mass to Perc	ppd	2988	398	4097	546	5975	797
	Blow down TDS Increase	mg/L	265.6	39.9	340.7	53.0	447.8	73.6
	MWRF Effluent Current TDS	mg/L	600.0	600.0	600.0	600.0	600.0	600.0
	Blow down TDS Final	mg/L	865.6	639.9	940.7	653.0	1,047.8	673.6
	Source TH	mg/l CaCO3	250	250	250	250	250	250
TH = 0 in permeate yields reduced blend	Cooling Feed TH	mg/l CaCO3	250	17	250	17	250	17
	Blow down TH	mg/l CaCO3	750	103	750	103	750	103
	Blow down TH mass	ppd CaCO3	1572	86	2157	118	3145	173
	MWRF Current effluent TH	mg/l CaCO3	250	250	250	250	250	250
Does not take into account other TH effects.	Blow down TH increase MWRF	mg/l CaCO3	139.8	8.6	179.3	11.5	235.7	15.9
Intuit, Sabey and other effects probably make this value higher	Final TH	mg/l CaCO3	389.8	258.6	429.3	261.5	485.7	265.9
Nitrogen is biologically removed, thus	Source N	mg/L	7.0	7.0	7.0	7.0	7.0	7.0
MWRF effluent may have less N than groundwater source N	Feed N	mg/L	7	0	7	0	7	0
Blow down N is not removed because it doesn't go to MWRF SBRs	Blow down N	mg/L	21	2.9	21	2.9	21	2.9
	Blow down N mass	ppd	44	2	60	3	88	5
	Blow down N increase MWRF	mg/L	3.9	0.2	5.0	0.3	6.6	0.4
	Source Si	mg/L	55.0	55.0	55.0	55.0	55.0	55.0
	Feed Si	mg/L	55	4	55	4	55	4
	Blow down Si	mg/L	165	23	165	23	165	23
	Blow down Si mass	ppd	346	19	474	26	692	38
	Blow down Si increase MWRF	mg/L	30.8	1.9	39.4	2.5	51.8	3.5
	MWRF Effluent Current Si	mg/L	55.0	55.0	55.0	55.0	55.0	55.0
	Final Si	mg/L	85.8	56.9	94.4	57.5	106.8	58.5
Sodium added in the HES system is removed by RO	Sodium	N/A						

Reject Analysis - Annual Average Only

HES Feed TDS	mg/L	475
HES Na Increase	mg/L	115
HES Ca, Mg Decrease	mg/L	84
RO Feed TDS	mg/L	506
RO Reject TDS	mg/L	5060
RO Reject TDS	ppd	2,635
Brine Haul out concentration	mg/L	200,000
Brine Haul out volume	gpd	1,583
Brine haul cost, reject part	$/yr	$ 288,986
Total Salt/Brine O&M		$ 695,064
Total Brine Source flow	gpd	76,497

Appendix D: Technical Memorandum Process Design Parameters

Dated October 12, 2016

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Brown AND Caldwell

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Technical Memorandum

Prepared for: City of Quincy

Project Title: IRWTP Coagulation-Sedimentation Predesign Report

Project No.: 149252.330

Technical Memorandum

Subject: Process Design Parameters

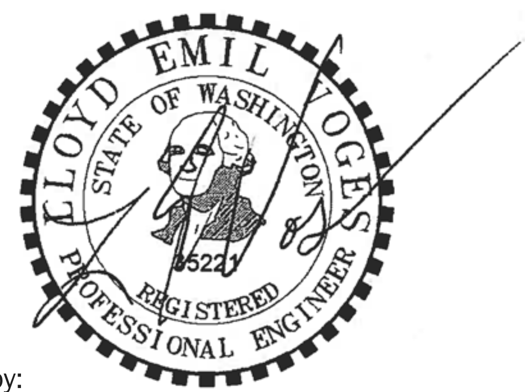
Date: October 12, 2016

To: Ariel Belino, City of Quincy

From: L. Emil Voges, P.E.

Prepared by: Matthew B. Gerhardt, Ph.D.

Ben Watson, E.I.T.



Approved by:

L. Emil Voges, P.E.
Washington License 35321

Limitations:

This document was prepared solely for City of Quincy in accordance with professional standards at the time the services were performed and in accordance with the contract between City of Quincy and Brown and Caldwell dated April 5, 2016. This document is governed by the specific scope of work authorized by City of Quincy; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by City of Quincy and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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List of Abbreviations

BOD	basis of design
CaO	calcium oxide
$CaOH_2$	calcium hydroxide
CIEPS	Clarified Industrial Effluent Pump Station
City	City of Quincy
lime-coag-sed	coagulation-sedimentation
CoC	cycles of concentration
d	day(s)
ft^2	square foot/feet
ft^3	cubic foot/feet
gpd	gallon(s) per day
gpm	gallon(s) per minute
H_2SO_4	sulfuric acid
hr	hour(s)
hp	horsepower
BODR	separate TM to be prepared on the basis of mechanical, civil, structural, architectural, electrical, and controls infrastructure design
IRWTP	Industrial Reuse Water Treatment Plant
IWTP	Industrial Wastewater Treatment Plant
IX	ion exchange
lb	pound(s)
meq/L	milliequivalent(s) per liter
mg/L	milligram(s) per liter
mgd	million gallons per day
MWRF	Municipal Wastewater Reclamation Facility
N	normal
N/A	not applicable
P	phosphorus
PFD	process flow diagram
Process BOD	basis of design for the process parameters of the lime-coag-sed system
RO	reverse osmosis
SBR	sequencing batch reactor
SLR	solids loading rate
SOR	surface overflow rate
TDS	total dissolved solids
TM	technical memorandum
TSS	total suspended solids
UF	ultrafiltration

Section 1: Introduction

This process design technical memorandum (Process TM) presents the basis of design (BOD) for the process parameters of the lime softening-coagulation-sedimentation (lime-coag-sed) system that is part of the Quincy Industrial Reuse Water Treatment Plant (IRWTP). It describes the lime-coag-sed process and design capacities based on the treatment of Quincy Industrial Wastewater Treatment Plant's (IWTP) existing secondary effluent stream. A separate basis of design report (BODR) will be prepared on the basis of mechanical, civil, structural, architectural, electrical, and controls infrastructure design.

The IRWTP will serve the following functions.

- It will ultimately provide a discharge route for all IWTP effluent so that the current discharge outfall may be eliminated, and will provide a higher water quality than that for the current outfall
- In the interim, it can supplement Quincy's industrial (i.e., non-potable) water supply, for use in primarily industrial cooling systems
- In the interim and ultimately, it will allow increased flow through the IWTP, which is currently hydraulically limited at its outfall

Effluent from the lime-coag-sed system will be pumped to the IRWTP ultrafiltration (UF) system by the Clarified Industrial Effluent Pump Station (CIEPS) for further treatment. Some UF effluent will be treated further by ion exchange (IX) and reverse osmosis (RO) and blended to meet user water quality requirements. The lime-coag-sed system will treat the effluent from IWTP sequencing batch reactors (SBRs) to improve operations of the UF and RO systems.

The lime-coag-sed system must meet the following objectives:

- Reduce concentrations of silica, phosphate, hardness, and suspended and colloidal material in water to be sent to the IRWTP to protect the UF, IX, and RO systems. Hardness does not need to be completely removed by this system because there is an IX system downstream, but removing the bulk of it here reduces the IX regeneration frequency and associated brine generation.
- Operate on demand to provide water as needed for the IRWTP.

Section 2: Basis of Design and Treatment Goals

Historical data and projections were used to prepare a BOD. User requirements were used to establish treatment goals.

2.1 Basis of Process Design

Historically, the IWTP effluent flow rate averaged around approximately 2.00 million gallons per day (mgd) from January 2011 through June 2016. The rate ranged between 0.00 and 3.44 mgd during that period. As additional industrial dischargers connect to the system, the average is expected to increase. In the short term, some SBR effluent will continue to be discharged to the surface water outfall while the rest is diverted to the lime-coag-sed system to meet reuse demands.

The lime-coag-sed system will be constructed in two or more stages. Stage 1, planned to be operational in late 2017, will produce enough water to supply the UF, IX, and RO systems so that the RO system can meet the Microsoft cooling water systems' peak demand. When the cooling towers require less water, the balance of produced RO water can be used for other purposes such as total dissolved solids (TDS) control at the Municipal Wastewater Reclamation Facility (MWRF) percolation beds. The second stage will be constructed several years later to accommodate the need to reuse all IWTP effluent and cease discharge to surface water. There may be additional stages if the supply of wastewater and the demand for reuse water increase.

2.1.1 Peak Flows

The following peak flows were estimated for Stage 1 and Stage 2. Stage 1 peak flows, and the resultant design capacity, are considered “demand-based.” That is, the design capacity is controlled by the demand for reuse water produced by the IRWTP. The Stage 2 capacity is considered “supply-based,” meaning that 100 percent of the SBR effluent supply has to be diverted from the current outfall to cooling systems and other uses. Stage 2 is described first to establish the buildout conditions. Stage 1 is then described to demonstrate that the incremental capacity installation can meet Stage 1 demand.

Estimated Stage 2 Lime-coag-sed System Flow Rate. Stage 2 capacity is projected to be required around 2022-25. The peak 2022 IWTP effluent flow is projected to include the following components:

- Existing peak IWTP effluent rate of 3.5 mgd[1] (rounded)
- 0.5 mgd of new industrial wastewater flow to allow for growth
- IRWTP internal return streams (UF backwash, dewatering from sludge beds discussed below)
- 0.6 mgd cooling tower blowdown (allowing for growth), which will be routed to the IWTP headworks once Stage 2 is operational

Using these Stage 2 values, the internal return’s stream flow is estimated to be 0.34 mgd and the peak SBR effluent flow is anticipated to be 4.80 to 5.00 mgd. Based on this analysis, and assuming continued use of Lagoon 5 for peak flow control management, 4.80 mgd is the selected lime-coag-sed system Stage 2 design basis flow rate.

Estimated Stage 1 Lime-coag-sed System Flow Rate (2017). In engineering reports submitted to the City of Quincy in 2014 and updated in 2016, Microsoft provided a peak 2017 estimated evaporation rate of 1.1 mgd in its cooling systems in Quincy. This includes Microsoft CO1, CO2, CO3/4/5 and MWH01 cooling systems. This is based on operation at 6 cycles of concentration (CoC), except for CO3/4/5 systems, which operate in a once-through mode of 2 CoC or less. Thus, there will be up to 0.5 mgd of blowdown and a makeup demand of up to 1.7 mgd.

In addition to the users’ water demand the lime-coag-sed system must also treat sufficient water to account for the losses in the UF, IX, and RO systems. IX system losses are assumed to be negligible. RO will recover 90 percent of its feed flow as permeate and have 10 percent loss as reject. This equates to the reject flow being 11.1 percent (10.0 percent ÷ 90.0 percent) of the RO permeate flow. The IX and RO systems are estimated to need to treat 75 percent of the produced UF water.

At 1.23 mgd permeate flow (or 75 percent of 1.70 mgd flow to Microsoft), RO reject flow will be 0.14 mgd. The total UF filtrate production rate requirement is:

$$1.70 \text{ mgd} + 0.14 \text{ mgd} = 1.84 \text{ mgd}$$

The UF system will produce approximately 95 percent of its feed flow as filtrate and have 5 percent loss as backwash. This equates to the backwash flow being 5.3 percent (5.0 percent ÷ 95.0 percent) of the UF permeate flow, or 0.1 mgd. The UF feed (or lime-coag-sed production rate) is therefore:

$$1.84 \text{ mgd} + 0.10 \text{ mgd} = 1.94 \text{ mgd}$$

The estimated total flow that must be treated by the Stage 1 lime-coag-sed system is less than 2 mgd.

[1] Currently the IWTP instantaneous discharge rate is limited to 5 cubic feet per second (3.23 mgd), and excess is stored in Lagoon 5. In the future, when SBR effluent is sent to the lime-coag-sed system, little or no water will be discharged, so the 3.23 mgd limit will always be met. Lagoon 5 will still be available for use in equalizing peak SBR effluent flows. Therefore, the lime-coag-sed system does not have to be large enough to treat the instantaneous peak SBR effluent flow.

Using half the Stage 2 value, the Stage 1 design basis flow rate for clarifier sizing is 2.4 mgd, which is conservatively higher than the projected demands for the next several years, allowing incremental expansion with equal equipment sizing.

Allowance for Non-Forecasted Growth. The design basis values are based on current reasonable values of industrial growth, but they do not establish hard constraints should unforeseen increases in demand-based or supply-based flow scenarios occur. As described in the BODR, the selected lime-coag-sed site can support greater than 4.8 mgd capacity. The existing conveyance piping can support greater than 4.8 mgd as well. Previous analysis of the IWTP's current installed capacity indicates that it can support greater than 4.8 mgd and the UF and RO systems capacities can be expanded modularly.

During the estimated Stage 1 period, if a new industry causes a significant step increase in reuse water demand, the 4.8 mgd design basis capacity can be installed in advance of the projected Stage 2 date.

2.1.2 Average Flows

Projected average flow rates are shown in Table 1.

Table 1. Estimated Average Lime-coag-sed Feed Rate

Year	Flow (mgd)			
	Microsoft cooling water makeup [a, b]	Water to percolation [c]	RO feed rate [d]	Lime-coag-sed feed rate [e]
2016 [f]	0.59	0.10	0.58	0.79
2018	1.02	0.10	0.84	1.14
2020	1.34	0.10	1.08	1.47
2022	1.66	0.10	1.32	1.79
Average	1.16	0.10	0.95	1.29

a. *2016 value shown is annual average evaporation rates for CO1/2 (0.293 mgd) and MWH (0.182 mgd), multiplied by 1.25 to represent makeup demand in future operation at six cycles of concentration.*

b. *Increase in Microsoft cooling water makeup based on addition of three data center phases, one phase every 2 years, each with a demand equal to that of MWH (0.182 mgd * 1.25 = 0.228 mgd).*

c. *Estimated annual average flow rate of industrial reuse water to percolation ponds.*

d. *Flow to RO, assuming that 75% of industrial reuse water is RO-treated, and RO recovery is 90%.*

e. *Sum of water to RO and water bypassed for blending.*

f. *UF backwash assumed to be 5% of UF feed.*

2.2 Feedwater Quality

Table 2 below presents the BOD for feed flow rate and feedwater quality. It is based on flow data presented above and historical IWTP effluent water quality data.

Table 2. Lime-coag-sed System Feedwater BOD			
Parameter	Unit	Design quantity	
		Peak	Average
Influent flow rate:	mgd		
Stage 1		2.4	1.2 [a]
Stage 2		4.8 [b]	2.8 [c]
TSS	mg/L	60	25
pH	N/A	7.5	7.5
Total alkalinity	mg/L as $CaCO_3$	300	300
Phosphate	mg/L as P	30	30
Silica	mg/L as SiO_2	52	52

a. *Average of values shown in Table 1 for 2016 and 2018.*

b. *Existing peak flow rate (3.86 mgd) + new industrial discharge (0.20 mgd) + UF backwash (0.24 mgd) + cooling tower blowdown (0.40 mgd).*

c. *Existing average flow rate (2.24 mgd) + new industrial discharge (0.20 mgd) + UF backwash (0.14 mgd) + cooling tower blowdown (0.20 mgd).*

N/A = not applicable.

P = phosphorus.

2.3 Treatment Goals

The UF and RO systems remove constituents through physical separation from the influent water. These processes produce a cleaner effluent while concentrating constituents retained by the membrane. This concentrating effect can cause membrane fouling, especially by organic colloids, and membrane scaling by precipitation of inorganics. In addition to improving water quality for the ultimate use of the water, the lime-coag-sed system treats IWTP effluent to protect the UF and RO from fouling and scaling. Table 3 presents the water quality treatment goals for the lime-coag-sed system.

Table 3. Lime-coag-sed System Treatment Goals			
Parameter	Unit	Goal	Basis
Silica	mg/L as SiO_2	< 30.0	To increase recovery in RO.
Phosphate	mg/L as P	< 1.5	To increase recovery in RO.
Hardness	mg/L as $CaCO_3$	< 150.0	No absolute limit, as the IX system will remove excess, but this goal minimizes the load to the IX system.
TSS	mg/L	< 30.0	Minimizes load to the UF system.
Colloidal material	N/A	Coagulated	Qualitative goal.
pH	N/A	pH <9, not less than 7	Minimizes scaling and corrosion in piping to UF. Needs to be lower than operating point of lime-coag-sed system. Actual value depends on UF requirements

Section 3: Process Description

The lime-coag-sed system removes silica, phosphate, hardness, suspended solids, and colloids from the IWTP effluent. Lime chemically removes phosphorus, hardness, and silica. Coagulation of suspended solids and colloids is caused by removing the stabilizing effects of surface charge on suspended particles. The resulting precipitated and coagulated solids are removed in the clarification step. The pH of the clarified water is neutralized and pumped to the UF system. The settled solids form sludge at up to 10 percent (100,000 milligrams per liter [mg/L]) solids in the bottom of the clarifier, and the sludge is pumped to the dewatering system.

3.1 Process Chemistry

The lime-coag-sed process can be divided into three distinct phases. Chemical treatment of hardness, phosphorus, and silica is initiated in the clarifier influent line and continues throughout the reactor clarifier process. The process of physical separation relies on particulate settling and occurs in the clarifier section of the reactor clarifier. The final step is pH adjustment which occurs in a mixing well upstream of the effluent wetwell.

3.1.1 Reactions: Precipitation, Adsorption, Coagulation, Flocculation

Lime (calcium hydroxide [$CaOH_2$]) and ferric chloride are added to the treatment stream in the reactor. Most of the solids are created as lime raises the pH to a point at which the bicarbonate in the water is converted to carbonate, allowing the formation of calcium carbonate, which precipitates from the dissolved phase. Calcium phosphate and ferric hydroxide also precipitate. Elevated pH also induces magnesium hydroxide precipitation. Silica adsorbs onto the magnesium hydroxide or forms magnesium silicates. Other minor precipitation and adsorption reactions may occur. The silica adsorption and precipitation reactions are slow—thus a design basis residence time of 1 hour at design basis flow is provided.

3.1.2 Clarification: Settling

Clarification is a principally physical means for separation; however, it can be severely impeded by charged molecules in the water. Ferric chloride used in this application serves as a coagulant by neutralizing the charges on particles allowing the small particles to flocculate and become larger, better-settling flocs.

3.1.3 Adjustment of pH

Effluent from the reactor clarifier will contain dissolved calcium and magnesium salts, which may continue to precipitate in downstream systems. To protect these systems from the possibility of plating and scaling by the precipitates, the pH will be reduced to less the 9, but not less than 7. Sulfuric acid, a common and considered economical means to neutralize high pH water, will be used.

3.2 Process Narrative

IWTP effluent will be evenly distributed to each clarifier. The process flow diagram (PFD) in Figure 1 below is for one typical clarifier system. Ferric chloride is added to the influent stream and is then dispersed through the flow in the pipe using a static mixer. Clarifier feed flow enters the reactor zone of the clarifier via the draft tube, where it is mixed with the lime slurry feed line. After mixing, the solids will settle out to be pumped to a solids-handling system, while the effluent flows by gravity to a pH adjustment contact chamber. After pH adjustment, effluent enters a clear well to be pumped to upstream systems.

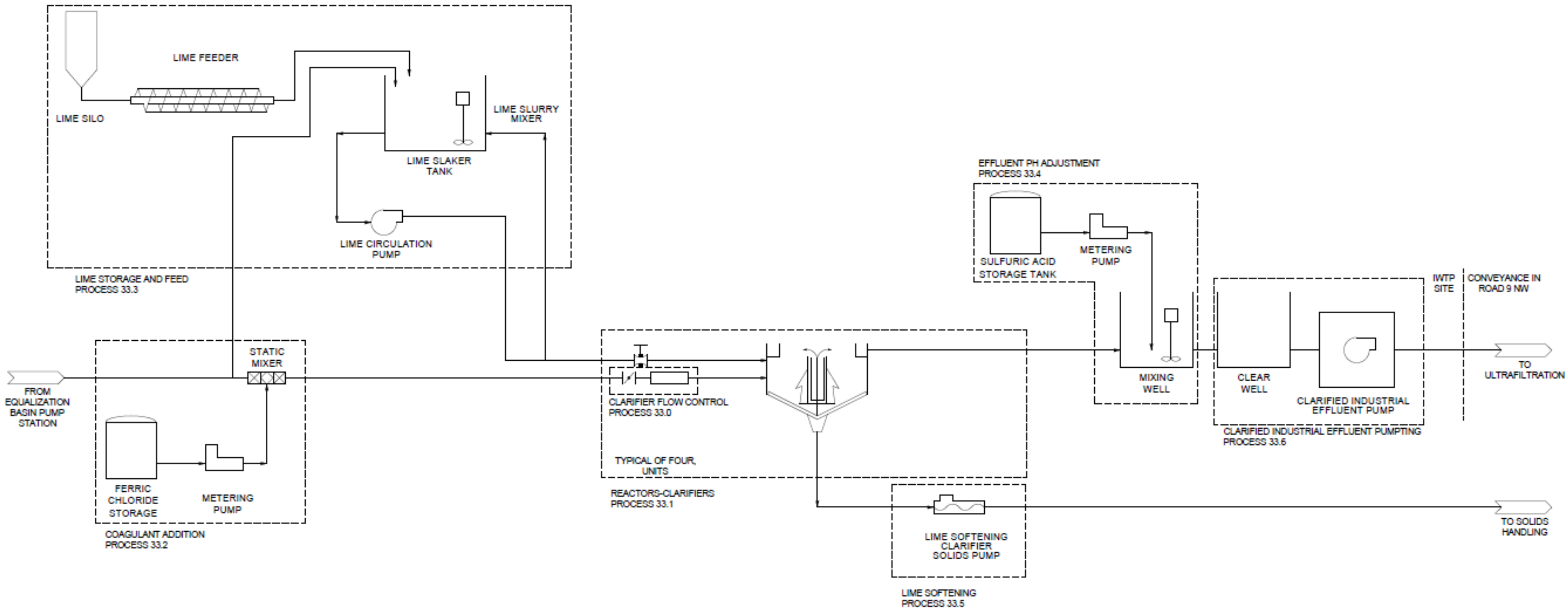

Figure 1. Lime-coag-sed system PFD

3.2.1 Lime-coag-sed System Influent

SBR effluent is fed to the lime-coag-sed system from the SBR effluent equalization system basin. The basin is currently open to the atmosphere and subject to water quality changes from exposure to dust, dirt, and algae growth. The basin will be covered so that the SBR effluent water quality does not change between the SBRs and lime-coag-sed system inlet. The equalization basin pump station will be upgraded to support higher total dynamic head and higher flow. A circulation line will be branched off the pump station discharge pipe to feed back into the basin and mitigate the stagnant water conditions that currently exist in the basin.

3.2.2 Lime Feed

The lime dose required to remove silica was assessed using bench-scale tests. The tests were performed in 2013 and again in 2014 (Figure 2, below). The recommended dose is driven by the 30 mg/L silica limit which, in bench-scale tests, required a lime dose of 1,000 mg/L as calcium oxide (CaO). This is considered to be an unusually high dose. The full-scale system will be designed to deliver this dose; however, during startup of the system the dose will be optimized, and a reduction is anticipated. Bench-scale tests showed that phosphorus concentrations of less than 2 mg/L can be achieved when the lime dose exceeds 300 mg/L as CaO.

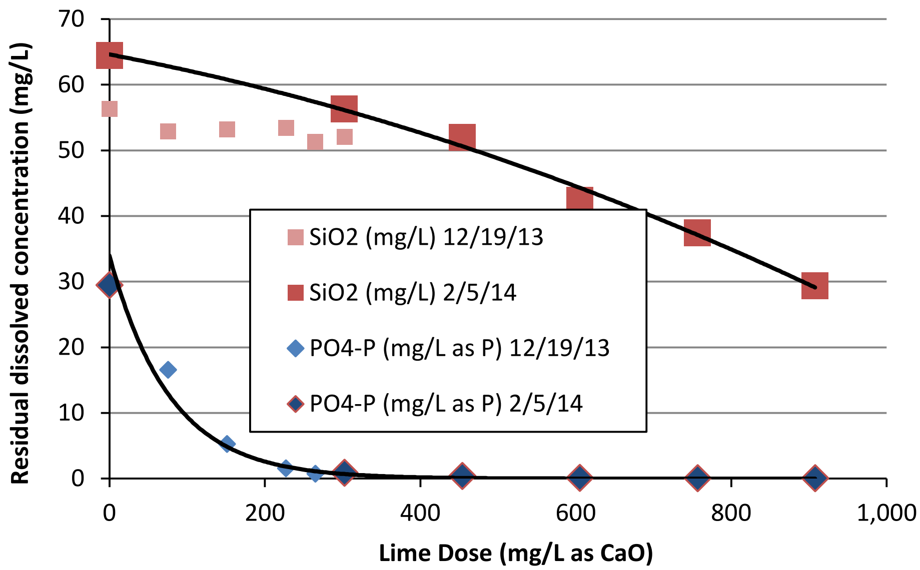

Figure 2. Bench-scale treatability results

3.2.3 Ferric Chloride Feed

Ferric chloride will be added to improve the removal of organic matter in the clarifier. Typical doses range from 15 to 40 mg/L for ferric chloride coagulation. The design will be based on a 40 mg/L dose; however, the final dose will be optimized during startup and may change during the course of operation depending on the concentration of colloidal organic matter in the SBR effluent.

3.2.4 Reactor-Clarifiers

The lime reactions and clarification will be performed in circular reactor-clarifiers. Combining these eliminates the need for separate reaction tanks and simplifies sludge recycling, which is designed and provided by the clarifier vendor.

Figure 3 below shows a typical reactor-clarifier cross section. Within the tank, internal baffles create a completely mixed reaction zone and a quiescent clarification zone. Influent is routed to the center of the reaction well draft tube. Sludge from the bottom of the reactor is drawn up the tube and mixed with influent by a single impeller mixer. The particulate suspension is gently mixed by the fluid exiting the draft tube, creating conditions ideal for flocculation. An underflow baffle contains the mixing zone and separates the suspended particle solution from the clarification zone.

The reactor zone will have a minimum residence time of 1 hour. An impeller mixer prevents sedimentation of flocculated particulates in the reactor.

Clarification requires quiescent conditions to allow the large flocculated particles created by the reactor to settle out and be collected by a scraping mechanism. Material from the bottom of the clarifiers will be collected and pumped to the sludge beds for dewatering before reuse. At the clarifier surface, effluent overflows via a perimeter weir plate and into a launder. Flow leaves the launder in the clarifier wall to a single outlet pipe. The outlets from the multiple clarifiers are combined into one larger pipe that routes flow to the CIEPS.

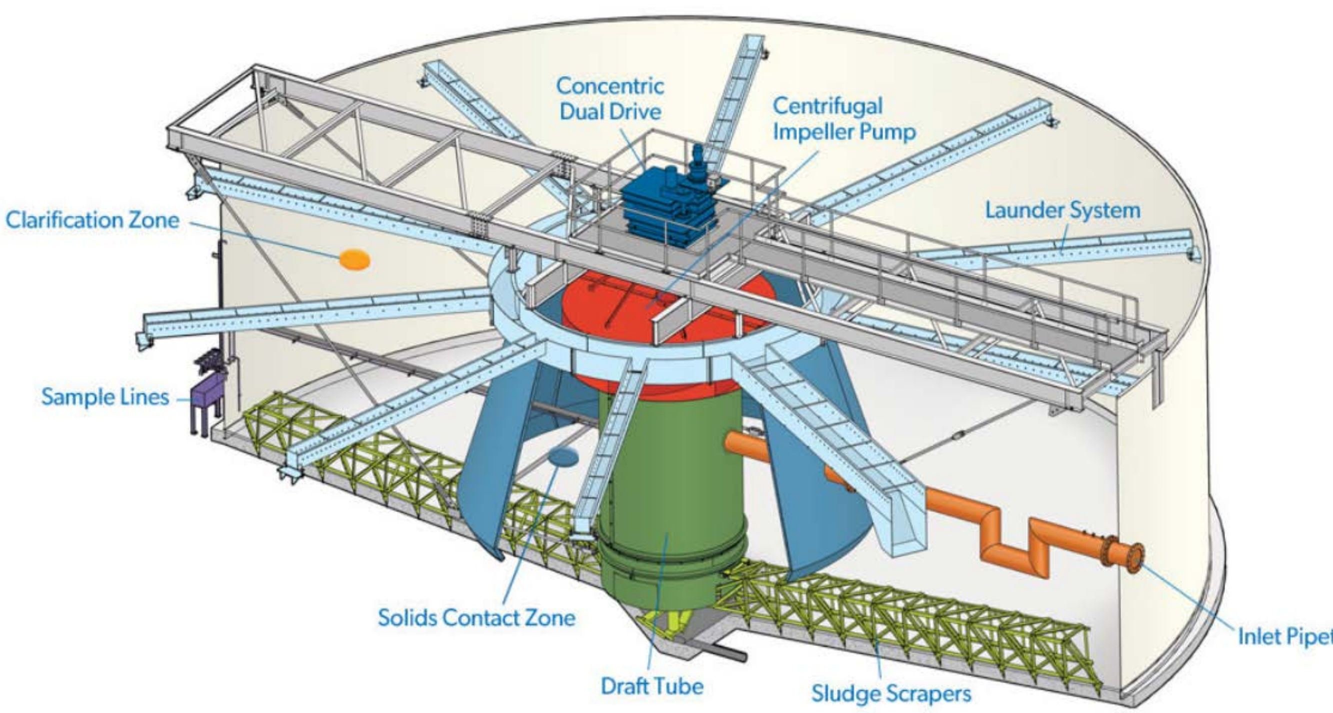

Figure 3. Example reactor-clarifier

Reactor clarifier diagram shows a WesTech Contact Clarifier™. Image was provided by WesTech in an informational brochure.

The clarifier size is governed by one of two criteria, the surface overflow rate (SOR) and the solids loading rate (SLR). To ensure quiescent conditions the velocity of water up and over the effluent weirs must be low; therefore, a maximum SOR (gallon[s] per day [gpd] per square foot [ft^2]) is selected based on the manufacturer's recommendation based on the type of suspended solids, in this case, lime-softening solids. To prevent a buildup of sludge in the clarifier the SLR limit (pound[s] [lb] of solids per day [d] per ft^2) is also selected per the manufacturer's recommendation. The criterion that results in the larger clarifier size (volume and diameter) controls the dimensions of the clarifiers. Design SOR and SLR are reported in Table 4, below.

3.2.5 Effluent pH Adjustment

The chemical process of lime treatment that includes the precipitation and removal of magnesium (as $Mg[OH]_2$) and silica, raises the pH of the water to 10.5 or higher. The clarified effluent retains some soluble calcium carbonate and magnesium hydroxide. To cause the calcium and magnesium to dissociate to their divalent element form, the pH is reduced to less than 10. This helps protect the downstream piping and UF systems from scaling and fouling. Operation at less than pH 9 is selected. Refined control around neutral pH (pH 7) is not required, would consume slightly more acid and would be more difficult to control than targeted only 9 or less. The pH adjustment will be achieved by injecting sulfuric acid (H_2SO_4) into a mixing well integrated into the CIEPS clear well.

3.2.6 Sludge Management

The sludge produced in the lime-coag-sed system will be conveyed by a combination of existing and new buried piping to existing sand beds (former reed beds) located southwest of the proposed lime-coag-sed site. These beds have been abandoned for several years and will be rehabilitated and modified as needed to support repurposing for the dewatering and drying of solids. The existing beds have the fundamental infrastructure, piping, distribution system, and drainage and pumping systems to allow for feasible conversion. Further evaluation and predesign efforts are required before confirming this dewatering process.

Section 4: Process Design Criteria

The following design criteria apply for the design of all equipment.

4.1 Redundancy

Equipment is sized to treat the peak flow with one unit out of service to allow for equipment repair and preventive maintenance. Piping and electrical components will be designed to handle the flows and loads at the future buildout. Chemical storage facilities will be sized to hold a minimum of a 7-day supply at maximum conditions or a 30-day supply at average conditions.

4.2 Reactor-Clarifier

Stage 1 will require only one reactor-clarifier to supply the demand for industrial reuse water, thus, two are required to provide redundancy. For Stage 2, the two units will be capable of treating all IWTP effluent flow—a third unit will be necessary for redundancy. Table 4 lists the design criteria for the clarifier.

The reactor zone in the reactor-clarifier will be designed to provide a completely mixed environment with a minimum 1-hour retention time at the design flow rate. The reactor will be constructed of materials that are resistant to corrosion with operation at pH 11 and to degradation at sustained exposure to abrasive particles and environmental conditions. The reactor zone is mixed with a 15-horsepower (hp) motor-driven impeller. The impeller location is optimized to maximize the suspension of reactor particles in the reactor zone, to entrain the feed streams as they enter the zone, and to provide a velocity gradient that is most effective for the flocculation of suspended particles.

4.3 Sludge Production and Removal

A model based on lime-softening reaction stoichiometry, predicted total suspended solids (TSS) removal, and a mass balance on the influent and return flows was used to estimate lime-coag-sed sludge production. The model-estimated solids content in the reactor is approximately 2,000 mg/L. The model was based on an assumed dose of 1,000 mg/L as CaO and typical return flow rates.

The SOR and SLR analysis indicated that clarifier size (height and diameter) was selected based on the minimum 1-hour retention time within the reactor zone. Clarifier height was limited to improve accessibility and appearance, thus the volume for the selected SLR resulted in a diameter and SOR that are larger than required. Should system testing indicate that the SLR can be reduced, the clarifier can later be rated for a higher flow rate. The recommended maximum SOR is 1,440 gpd/ft^2, and the maximum SLR is 31.8 lb/d/ft^2.

Table 4. Reactor-Clarifier Equipment Design Criteria (per unit)

Parameter	Unit	Design data
Design flow rate	mgd	2.4
Estimated reactor TSS	mg/L	2,000
Reactor-clarifier diameter	ft	70
Estimated mixing energy	hp	15
Solids rake power	hp	1.5
Design SOR	gpd/ft^2	692
Design SLR	lb/d/ft^2	11.5

4.4 Lime Systems

The lime storage system will contain the larger of a 30-day supply of lime at average conditions or a 7-day supply at peak conditions. The slurry slaker unit will maintain lime slurry at 10 percent as $CaOH_2$ solid, resulting in a 24-gallon per minute (gpm) slurry production rate. A typical slaker system will require an estimated 3 hp to operate the mixer motor and grit-removal motor. Table 5 shows the lime system design criteria. Because of the potential for clogs in the lime supply line the system will be designed as a circulating loop of 4-inch-diameter pipe with spurs to each clarifier. The velocity in the lime loop should remain in excess of 4 feet per second, resulting in a minimum flow of 185 gpm through the recirculation loop.

Table 5. Lime System Equipment Design Criteria

Parameter	Unit	Design data
Design dose	mg/L	1,000
Total lime storage capacity	ft^3	10,000
Quantity of Storage Silo's		4
Design slaker slurry	wt/wt	10% $CaOH_2$ solids
Design slaking rate	lb CaO/hr	2,000 [a]
Design slaker flow rate	gpm	30 [a]
Estimated power	hp	3

a. Includes additional 20% capacity

ft^3 = cubic foot/feet.

hr = hour(s).

wt/wt = wet ton(s) per wet ton.

4.5 Ferric Chloride System

The ferric chloride system will contain the larger of a 30-day supply of ferric chloride at average treatment flow rates or a 7-day supply of ferric chloride at peak conditions. The Table 6 data are based on a supply of 38 percent ferric chloride and a design dose of 40 mg/L. This dose is conservatively selected at twice what was used in bench-scale tests. To provide consistency of the metering pumps with others, a hydraulically actuated diaphragm chemical feed pump was selected for this application. The pump will be flow-paced to maintain a constant dose to the clarifier.

Table 6. Ferric Chloride System Equipment Design Criteria		
Parameter	Unit	Design data
Design dose	mg/L	40
Total storage capacity	Gallons	6,400
Quantity of Tanks		2
Max Feed rate	gph	18 [a]

a. Includes additional 20% capacity.

gph = gallon(s) per hour.

4.6 Sulfuric Acid System

Sulfuric acid will be dosed into the clarifier effluent as it flows through a mixed contact basin that is integrated into the clarifier effluent clear well. The dose will be controlled to maintain a set point within a dead band and based on feedback from a signal from the pH probe and using proportional feedback control. The storage requirements and estimated peak feed rate listed in Table 7 are based on typical industrial concentrated acid (93 percent H_2SO_4 solution or 34 normal [N]). Spill containment will be provided by placing the tanks within a concrete wall. Hydraulic diaphragm pumps are recommended because of the minimal maintenance requirements limiting potential operator exposure during routine maintenance.

Table 7. Sulfuric Acid System Equipment Design Criteria		
Parameter	Unit	Design data
Design dose	meq/L	3.05
Total storage capacity	Gallons	6,000
Quantity of Tanks		2
Max Feed rate	gph	21 [a]

a. Includes additional 20% capacity.

meq/L = milliequivalent(s) per liter.

4.7 Pumping Systems

The lime-coag-sed system will include the CIEPS and the Lime Softening Sludge Pump Station. The CIEPS will be designed to supply adequate flow and pressure to the UF system in the reuse filter building and to control water level in the CIEPS clearwell. The design flow rate is 4.8 mgd plus reserve capacity.

The lime-coag-sed sludge pumps will remove excess sludge from the bottom of the reactor-clarifiers and pump it to the existing reed bed distribution system. Each clarifier will have two sludge pumps, one duty and one standby. The sludge flow rate will be approximately 5 percent of the influent flow rate and will contain an estimated 10 percent solids. The preliminary pump design criteria are presented in Table 8.

Table 8. Lime-coag-sed Sludge Pump Design Data (per reactor-clarifier)

Parameter	Unit	Design criterion
Number of pumps	(Duty + standby)	2 + 1
Approximate head	ft (psig)	400 (173)
Approximate flow (each pump)	gpm	80
Approximate power (each pump)	hp	15

4.8 Solids Dewatering

Solids dewatering predesign is not provided for in this TM. However, to estimate the sludge pumping requirements, it is assumed that sludge will be pumped to the repurposed reed beds. The lime-coag-sed system sludge pumps will convey clarifier sludge via a 6-inch-diameter pipeline. An existing 10-inch-diamter line—called the dredge discharge line on the reed bed drawings—connects the SBRs and the reed beds. The existing pipeline's diameter is larger than needed. The 6-inch-diameter pipe will be slip-lined inside the existing pipe. The existing distribution piping at the reed beds may be able to distribute the solids to individual beds. Lime-coag-sed sludge will be pumped to the beds continuously.

Appendix E: Process Diagrams

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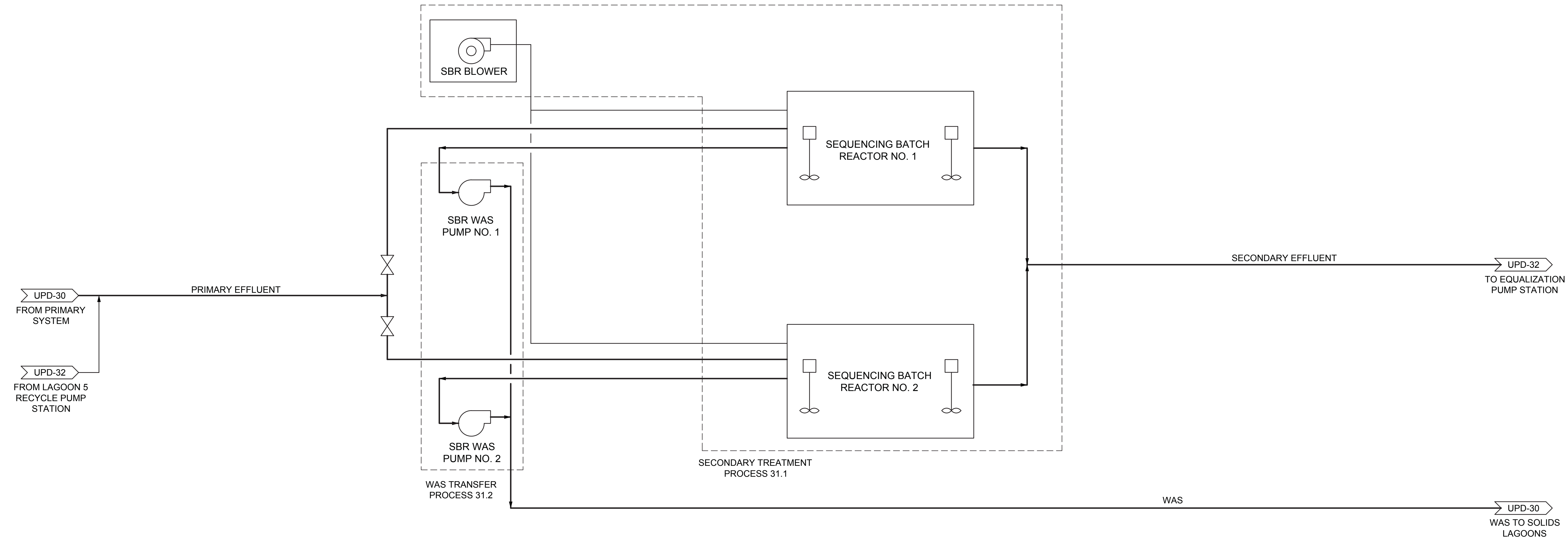


Brown AND Caldwell

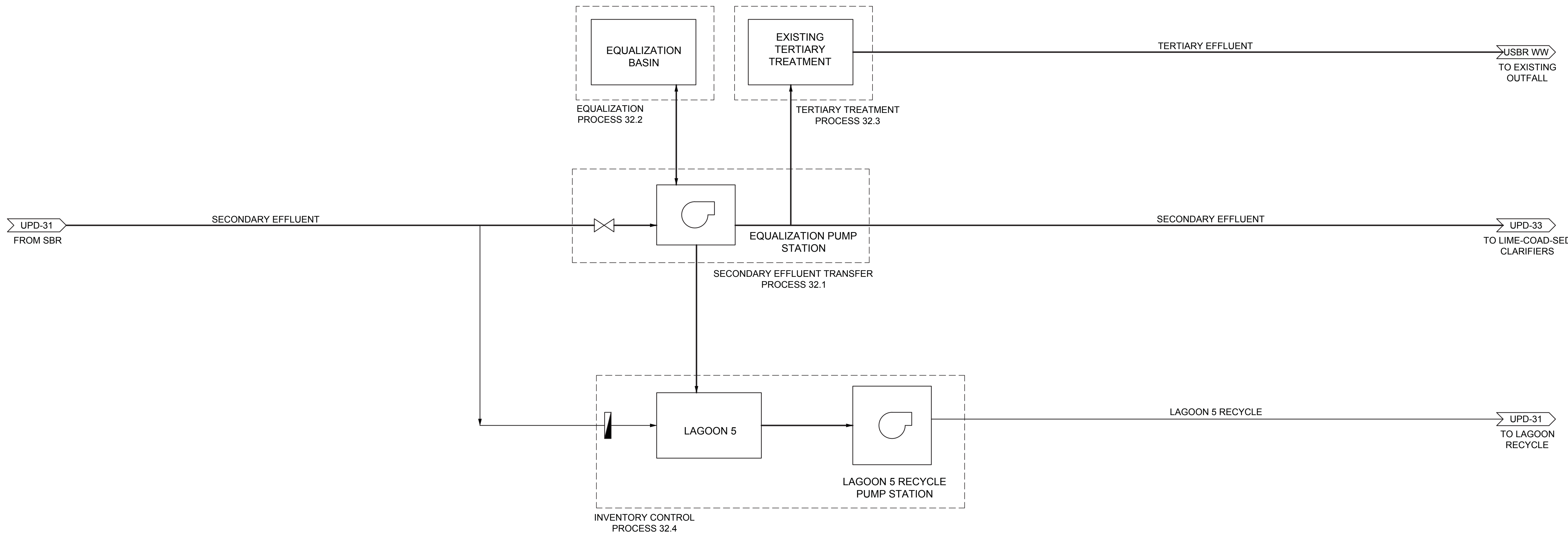
QUINCY

DATE: October 31, 2016

QUINCY INDUSTIRAL REUSE WATER TREATMENT PLANT
UNIT PROCESS DIAGRAM: EXISTING SECONDARY TREATMENT

FIGURE

UPD-31



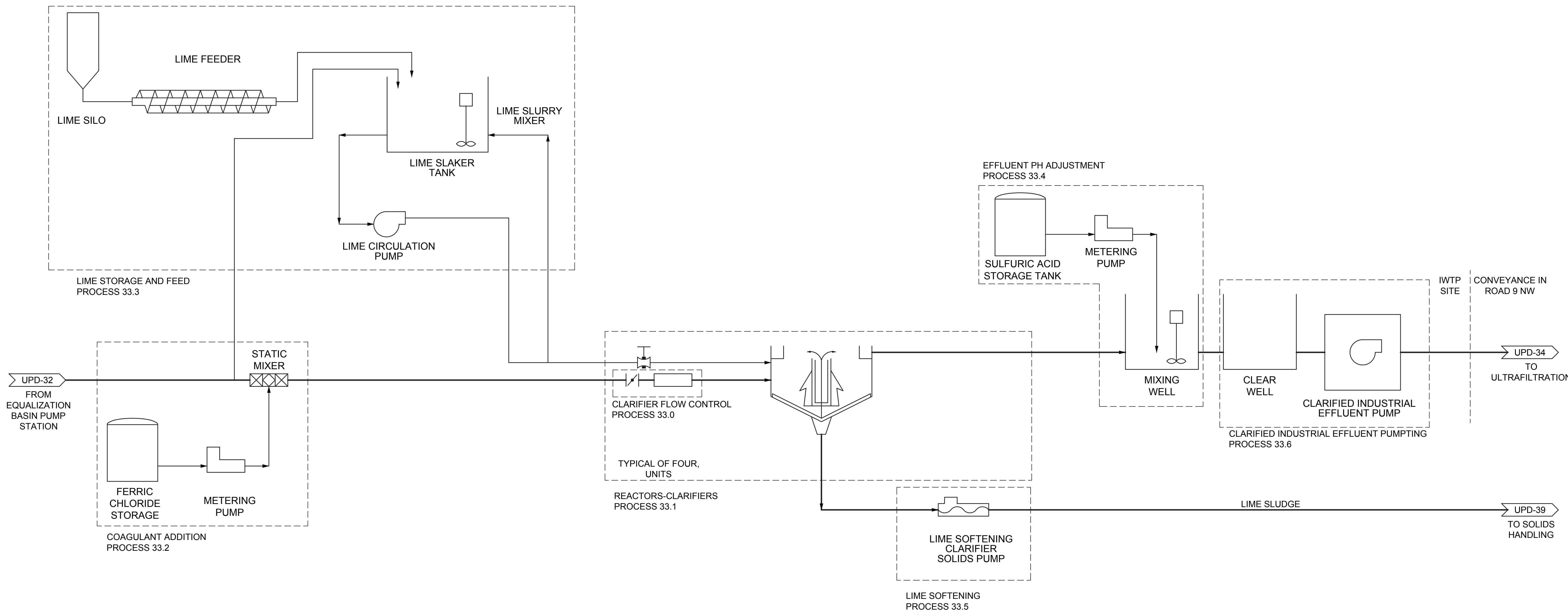
Brown AND Caldwell

QUINCY

DATE: October 31, 2016

QUINCY INDUSTIRAL REUSE WATER TREATMENT PLANT
UNIT PROCESS DIAGRAM: EFFLUENT EQUILIZATION AND EXISTING TERTIARY TREATMENT

FIGURE
UPD-32



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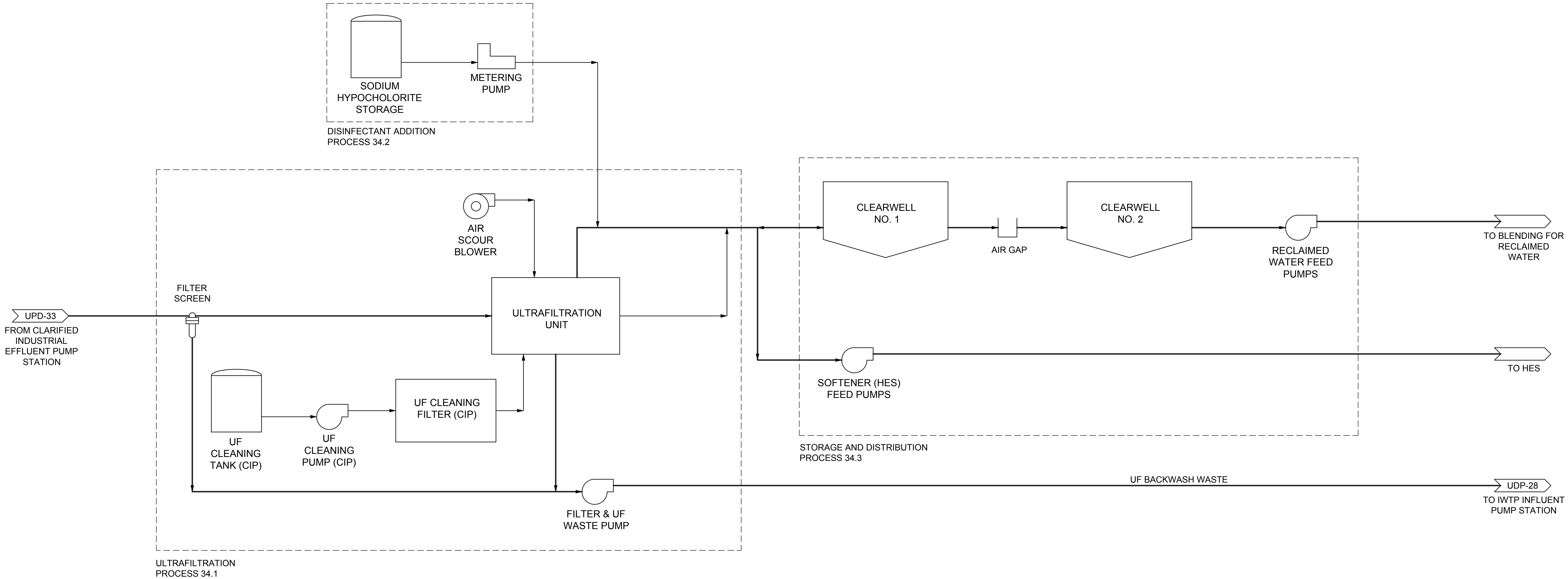
Brown AND Caldwell

QUINCY

DATE: October 31, 2016

QUINCY INDUSTIRAL REUSE WATER TREATMENT PLANT
UNIT PROCESS DIAGRAM: LIME-COAG-SED SYSTEM

FIGURE
UPD-33



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QUINCY

DATE: October 31, 2016

QUINCY INDUSTIRAL REUSE WATER TREATMENT PLANT
UNIT PROCESS DIAGRAM: ULTRAFILTRATION SYSTEM (PRELIMINARY)

FIGURE
UPD-34

FUNCTIONAL IDENTIFICATION

MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A ANALYTICAL OR AUTO		ALARM		
B BURNER, COMBUSTION				
C CONDUCTIVITY			CONTROL	CLOSE
D DENSITY, SPECIFIC GRAVITY	DIFFERENTIAL			
E RUNNING		PRIMARY ELEMENT		
F FLOW RATE	RATIO			
G FIRE, SMOKE		GLASS		
H HAND				HIGH OR OPEN
I CURRENT (ELEC)		INDICATE		
J POWER	SCAN			
K TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L LEVEL		LIGHT		LOW OR CLOSED
M MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N NETWORK				
O OFF		ORIFICE		OPEN
P PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q QUANTITY	INTEGRATE, TOTALIZE			
R RADIATION		RECORD		
S SPEED, FREQUENCY	SAFETY		SWITCH	
T TEMPERATURE			TRANSMIT	
U MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W WEIGHT, FORCE, TORQUE		WELL		
X UNCLASSIFIED	X AXIS		INTERFACE	
Y ALARM OR CALL	Y AXIS		RELAY, COMPUTE, CONVERT	
Z POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, FINAL CONTROL ELEMENT	

TYPICAL INSTRUMENT IDENTIFICATION

- FIELD MOUNTED INSTRUMENT
- FACE MOUNTED INSTRUMENT ON MAIN PANEL, OPERATOR ACCESSIBLE
- INSTRUMENT MOUNTED ON/IN MAIN PANEL, OPERATOR INACCESSIBLE
- FACE MOUNTED INSTRUMENT ON FIELD PANEL, OPERATOR ACCESSIBLE
- INSTRUMENT MOUNTED ON/IN FIELD PANEL, OPERATOR INACCESSIBLE
- FIELD MOUNTED MULTIFUNCTION INSTRUMENT WITH SHARED HARDWARE (USED FOR "DISTRIBUTED CONTROL SYSTEMS")
- FACE MOUNTED MULTIFUNCTION INSTRUMENT WITH SHARED HARDWARE (USED FOR "DISTRIBUTED CONTROL SYSTEMS")
- COMPUTER FUNCTION
- INTERLOCKING OR SEQUENTIAL CONTROL FUNCTION (I OR I)
- PROGRAMMABLE LOGIC CONTROL FUNCTION
- ANALOG INPUT
- ANALOG OUTPUT
- DISCRETE INPUT
- DISCRETE OUTPUT

FI 904 / SC 904 — TYPICAL ANALOG HARDWIRED I/O GROUPING

FAL 904 / EI 904 — TYPICAL DISCRETE HARDWIRED I/O GROUPING

NETWORK I/O LEGEND

NX 100A E — SUFFIX; PANEL NUMBER

NETWORK TYPE
E ETHERNET

PIPE LINE SYMBOLS

- QUICK CONNECTOR
- CAP OR PLUG
- BLIND FLANGE
- FLEX CONNECTIONS
- VENT
- REDUCER
- SUBMERSIBLE LEVEL TRANSMITTER
- FLOAT LEVEL ELEMENT
- ULTRASONIC FLOW ELEMENT
- SILENCER
- CALIBRATION CHAMBER
- PULSATION DAMPENER
- COUPLING
- STATIC MIXER
- THERMAL WELL
- CHEMICAL SEAL
- SIZE REDUCTION
- INSULATION
- HEAT TRACE
- MAGNETIC FLOWMETER
- SONIC FLOWMETER (DOPPLER OR TRANSIT TIME)
- POSITIVE DISPLACEMENT METER
- THERMAL FLOW ELEMENT
- VORTEX FLOW ELEMENT
- CORIOLIS FLOW ELEMENT
- RADAR OR ULTRASONIC LEVEL ELEMENT
- ANNUBAR
- BUBBLER LEVEL TUBE
- COMPENSATED FLOW METER
- PIPING SPEC CHANGE (SS / PVC)

INSTRUMENT SIGNAL SYMBOLS

- INSTRUMENT SUPPLY, PROCESS TAPS
- PNEUMATIC SIGNAL (ANALOG)
- ELECTRIC SIGNAL
- FIELDBUS (DEVICENET OR FOUNDATION)
- PNEUMATIC SIGNAL (DISCRETE)
- CAPILLARY TUBE OR FILLED SYSTEM
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
- SOFTWARE OR DATA LINK
- MECHANICAL LINK
- HYDRAULIC
- ES — ELECTRIC POWER SUPPLY 120 VAC 60 HZ U.O.N.
- SA — SERVICE AIR SUPPLY
- IA — INSTRUMENT QUALITY AIR SUPPLY
- W — WATER SUPPLY

UON = UNLESS OTHERWISE NOTED

INSTRUMENT TAG NUMBERS

P D IT 11 64 A

- SUFFIX - USED ONLY WHEN TWO OR MORE INSTRUMENTS WOULD OTHERWISE HAVE THE SAME TAG NUMBER
- LOOP NUMBER
- PLANT AREA
- SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION AND/OR OUTPUT FUNCTION WITH MODIFIER WHEN REQUIRED
- MODIFIER LETTER, WHEN REQUIRED
- MEASURED OR INITIATING VARIABLE LETTER

FUNCTIONAL IDENTIFICATION SEE TABLE THIS DRAWING

EXAMPLE: PDIT 1164

INSTRUMENT LOOP IDENTIFICATION

IL 09 04 A

- SUFFIX
- LOOP NUMBER
- PLANT AREA
- INSTRUMENT LOOP

*UNIQUE NUMBER FOR EACH LOOP

TYPICAL INSTRUMENT IDENTIFICATION

PI 1005

- FUNCTIONAL IDENTIFICATION
- BASIC INSTRUMENT
- SUFFIX - USED WHEN REQUIRED
- VENDOR PROVIDED
- NUMBER
- AREA CODE OPTIONAL

MISCELLANEOUS SYMBOLS

- M — MCC (MOTOR CONTROL/STARTER)
- P — PURGE OR FLUSHING DEVICE
- R — RESET FOR LATCH-TYPE OPERATOR
- C — SEAL WATER CONTROL UNIT

VALVES

NORMALLY OPEN / NORMALLY CLOSED

- GATE VALVE
- PLUG VALVE
- BALL VALVE
- GLOBE VALVE
- DIAPHRAGM VALVE
- ANGLE VALVE
- BUTTERFLY VALVE
- NEEDLE VALVE
- THREE WAY VALVE
- CHECK VALVE
- PRESSURE RELIEF VALVE
- MOTOR OPERATED VALVE
- PISTON OPERATED VALVE
- BALL CHECK VALVE
- PRESSURE REGULATING VALVE (SELF-CONTAINED)
- BACK PRESSURE REGULATING VALVE (SELF-CONTAINED)
- SOLENOID OPERATED VALVE
- DIAPHRAGM OPERATED VALVE

EQUIPMENT

- PUMP, CENTRIFUGAL
- PUMP, METERING
- PUMP, SUBMERSIBLE
- VFD — VARIABLE FREQUENCY DRIVE (AC)
- D — DRAIN
- CD — CHEMICAL DRAIN
- BLOWER OR CENTRIFUGAL FAN
- BLOWER, ROTARY LOBE

Brown AND Caldwell
SEATTLE, WASHINGTON

SUBMITTED: ____ PROJECT MANAGER DATE: ____
APPROVED: ____ BROWN AND CALDWELL DATE: ____

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: JNH
DRAWN: JHM
CHECKED: TJT
CHECKED: JNH LSL
APPROVED: JNH

EXTERNAL REFERENCE FILES

RECORD DRAWING

THIS RECORD DRAWING HAS BEEN PREPARED BY BROWN AND CALDWELL (BC) BASED ON CONSTRUCTION RECORDS AND INFORMATION FURNISHED BY OTHERS. BC HAS REVIEWED THIS INFORMATION FOR ACCURACY IN A MANNER CONSISTENT WITH ITS CONTRACTED SCOPE OF WORK, BUT CANNOT REPRESENT THE ACCURACY OF ALL ELEMENTS REFLECTED HEREIN. THOSE RELYING ON THIS RECORD DOCUMENT ARE ADVISED TO VERIFY ITS ACCURACY.

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	0	ISSUE FOR RECORD	JH	1/8/16	LEV

AMERICAN WATER

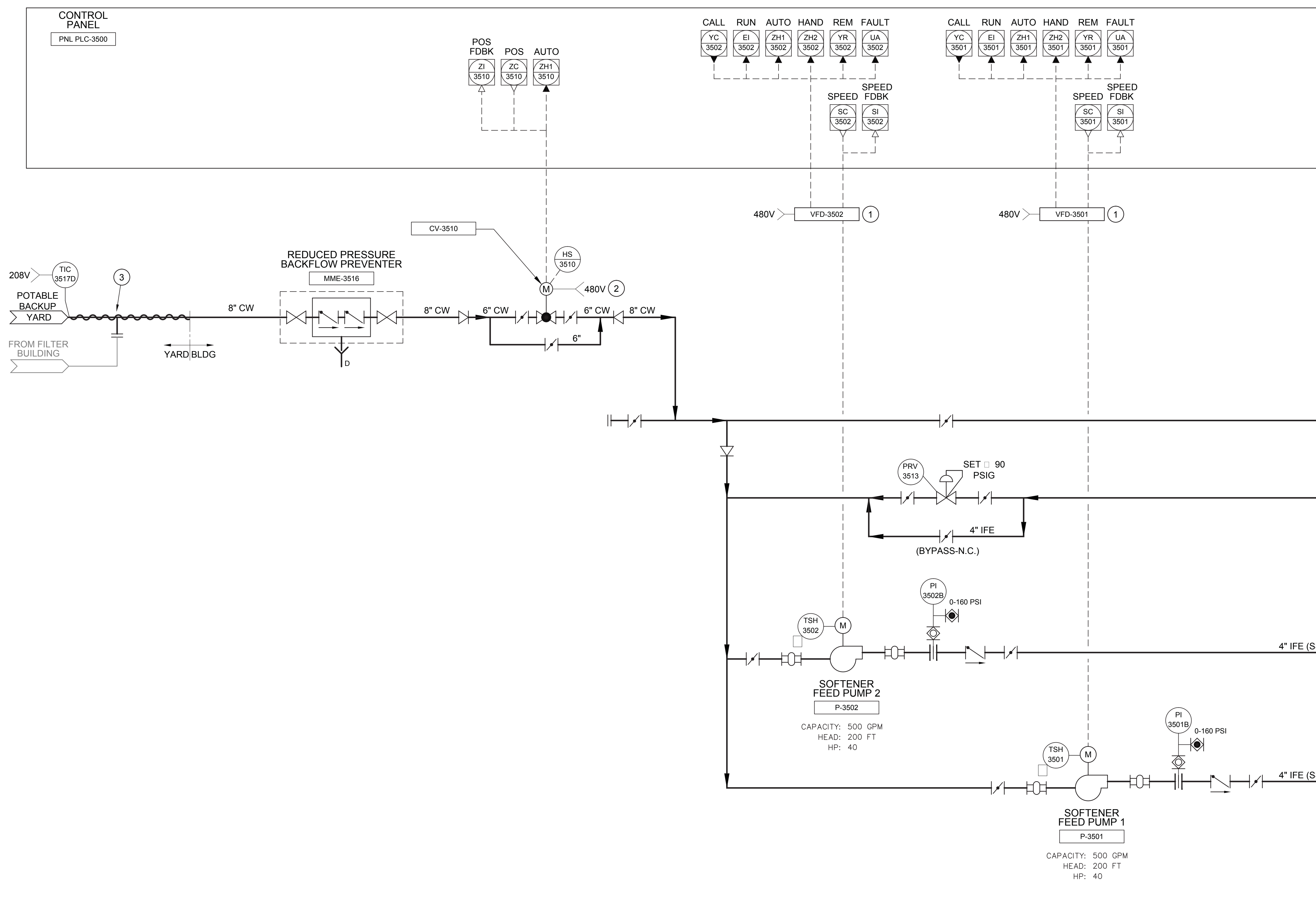
CITY OF QUINCY — Opportunities Unlimited!

WATER REUSE UTILITY - PHASE 3B
HIGH EFFICIENCY WATER SOFTENER BUILDING
PROCESS AND INSTRUMENTATION DIAGRAM

PROCESS SYMBOLS LEGEND

FILENAME 000-P-001.dwg
BC PROJECT NUMBER 145617
CLIENT PROJECT NUMBER
DRAWING NUMBER 000-P-001
SHEET NUMBER OF

Jan 07, 2016 - 4:21pm P:\076656 - Quincy, City of (WA)\145617_Water Softener DB_CAD\2-Sheets\P-Process\000-P-001.dwg
allambert
American Water.png City of Quincy Logo.JPG
SEPTEMBER 2011



GENERAL NOTES:

1. PNL-3500 SHALL BE PROVIDED BY A CERTIFIED UL508 PANEL SHOP. ELECTRICAL CONTRACTOR PROVIDE ALL CONDUIT, WIRE, CONNECTORS, SUPPORTS AND OTHER APPURTENANCES TO INTERCONNECT MOTOR CONTROL CENTERS, VFDS, CONTROL PANELS, AND INSTRUMENTS.
2. ITEMS MARKED WITH AN ASTERISK ( ) ARE TO BE PROVIDED WITH MOTOR AND INTERLOCKED AT VFD TO STOP PUMP.

KEY NOTES:

1. LOCATED IN MCC-35831.
2. ACTUATOR's MANUFACTURER REMOTE DISPLAY MODULE (RDM) WHICH REPEATS THE SAME CONTROL ALARMS MONITORING AS THE INTEGRAL LOCAL DISPLAY MODULE (LDM). NETWORK RDM TO LDM VIA RS-485 AND POWER RDM VIA LDM INTERNAL 24 V.
3. POTABLE WATER TO BE DISCONNECTED WHEN PIPE CONNECTION FROM FILTER BUILDING IS COMPLETED.

Brown AND Caldwell
SEATTLE, WASHINGTON

SUBMITTED: ________ DATE: ________
PROJECT MANAGER
APPROVED: ________ DATE: ________
BROWN AND CALDWELL

LINE IS 2 INCHES AT FULL SIZE
(IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: LEV
DRAWN: KEW
CHECKED: TJT
CHECKED: LEV LSL
APPROVED: LEV

EXTERNAL REFERENCE FILES

RECORD DRAWING

THIS RECORD DRAWING HAS BEEN PREPARED BY BROWN AND CALDWELL (BC) BASED ON CONSTRUCTION RECORDS AND INFORMATION FURNISHED BY OTHERS. BC HAS REVIEWED THIS INFORMATION FOR ACCURACY IN A MANNER CONSISTENT WITH ITS CONTRACTED SCOPE OF WORK, BUT CANNOT REPRESENT THE ACCURACY OF ALL ELEMENTS REFLECTED HEREIN. THOSE RELYING ON THIS RECORD DOCUMENT ARE ADVISED TO VERIFY ITS ACCURACY.

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	0	ISSUE FOR RECORD	JH	4/4/16	LEV

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WATER REUSE UTILITY - PHASE 3B
HIGH EFFICIENCY WATER SOFTENER BUILDING
PROCESS AND INSTRUMENTATION DIAGRAM

SOFTENER FEED PUMPS

FILENAME: 350-P-001.dwg
BC PROJECT NUMBER: 145617
CLIENT PROJECT NUMBER:
DRAWING NUMBER: 350-P-001
SHEET NUMBER OF

JANUARY 27, 2016

Apr 01, 2016 - 11:32am
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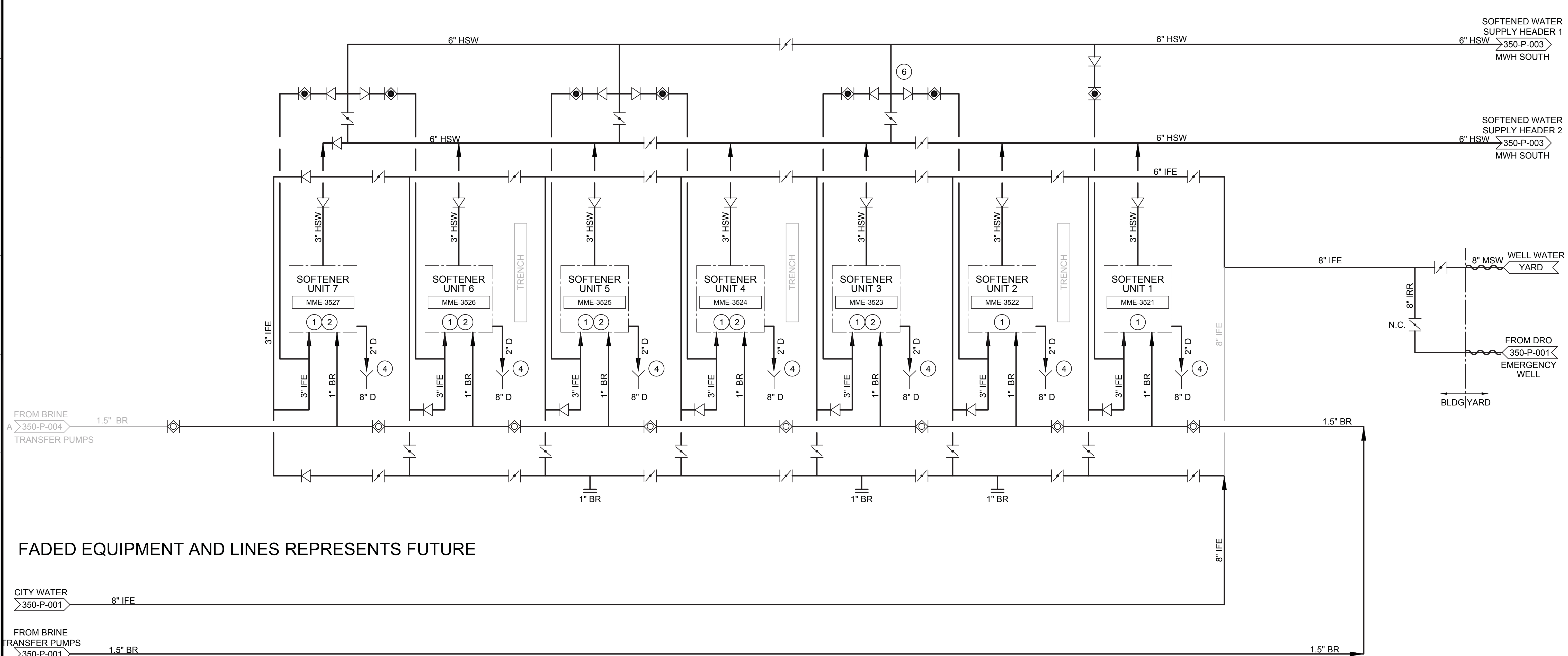
llemon
American Water.png
City of Quincy Logo.JPG

KEY NOTES:

1. VENDOR PACKAGE. SEE 350-P-005.
2. EXISTING OWNER PROVIDED EQUIPMENT. SOFTENERS AND ANCILLARY EQUIPMENT TO BE RELOCATED TO NEW FACILITY.
3. NOT USED.
4. FOR CONTINUATION SEE DRAWING 350-P-004 (TYPICAL OF 7).
5. AIR RELEASE VACUUM BREAK VALVE, SEE 000-M-001 GENERAL NOTE 10.
6. 6" SKID CROSSOVER TYP OF 3.



Brown AND Caldwell SEATTLE, WASHINGTON	
SUBMITTED: PROJECT MANAGER	DATE:
APPROVED: BROWN AND CALDWELL	DATE:

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:	LEV
DRAWN:	KEW
CHECKED:	TJT
CHECKED:	LEV LSL
APPROVED:	LEV

EXTERNAL REFERENCE FILES

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WATER REUSE UTILITY - PHASE 3B
HIGH EFFICIENCY WATER SOFTENER BUILDING
PROCESS AND INSTRUMENTATION DIAGRAM

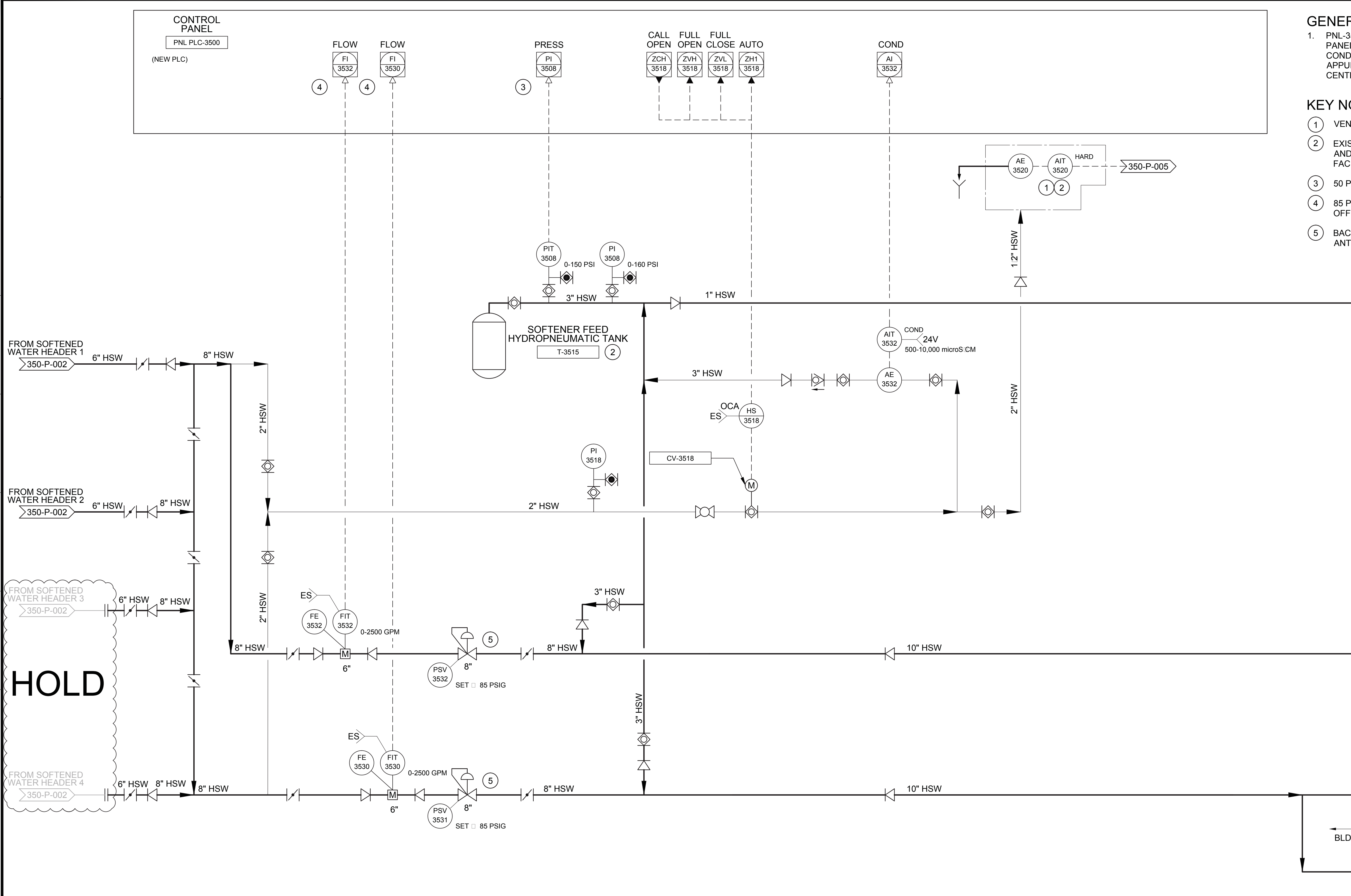
SOFTENERS

FILENAME	350-P-002.dwg
BC PROJECT NUMBER	145617
CLIENT PROJECT NUMBER	
DRAWING NUMBER	350-P-002
SHEET NUMBER	OF

JANUARY 27, 2017

Jan 07, 2016 - 4:18pm P:\076656 - Quincy, City of (WA)\145617_Water Softener DB_CAD\2-Sheets\P-Process\350-P-002.dwg alambert

American Water.png City of Quincy Logo.JPG



GENERAL NOTES:

1. PNL-3500 SHALL BE PROVIDED BY A CERTIFIED UL508 PANEL SHOP. ELECTRICAL CONTRACTOR PROVIDE ALL CONDUIT, WIRE, CONNECTORS, SUPPORTS AND OTHER APPURTENANCES TO INTERCONNECT MOTOR CONTROL CENTERS, VFDS, CONTROL PANELS, AND INSTRUMENTS.

KEY NOTES:

1. VENDOR PACKAGE. SEE 350-P-005.
2. EXISTING OWNER PROVIDED EQUIPMENT. SOFTENERS AND ANCILLARY EQUIPMENT TO BE RELOCATED TO NEW FACILITY.
3. 50 PSI OR LESS TURNS ON FEED PUMP.
4. 85 PSI AND LESS THAN 200 GPM TOTAL FLOW, PUMPS OFF.
5. BACK PRESSURE SUSTAINING VALVE WITH ANTICAVITATION DEVICE.

Brown AND Caldwell
SEATTLE, WASHINGTON

SUBMITTED: PROJECT MANAGER DATE:
APPROVED: BROWN AND CALDWELL DATE:

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: LEV
DRAWN: KEW
CHECKED: TJT
CHECKED: LEV LSL
APPROVED: LEV

EXTERNAL REFERENCE FILES

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ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	0	ISSUE FOR RECORD	JH	1/8/16	LEV

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WATER REUSE UTILITY - PHASE 3B
HIGH EFFICIENCY WATER SOFTENER BUILDING
PROCESS AND INSTRUMENTATION DIAGRAM

SOFTENERS

FILENAME 350-P-003.dwg
BC PROJECT NUMBER 145617
CLIENT PROJECT NUMBER
DRAWING NUMBER 350-P-003
SHEET NUMBER OF

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Jan 07, 2016 - 4:20pm
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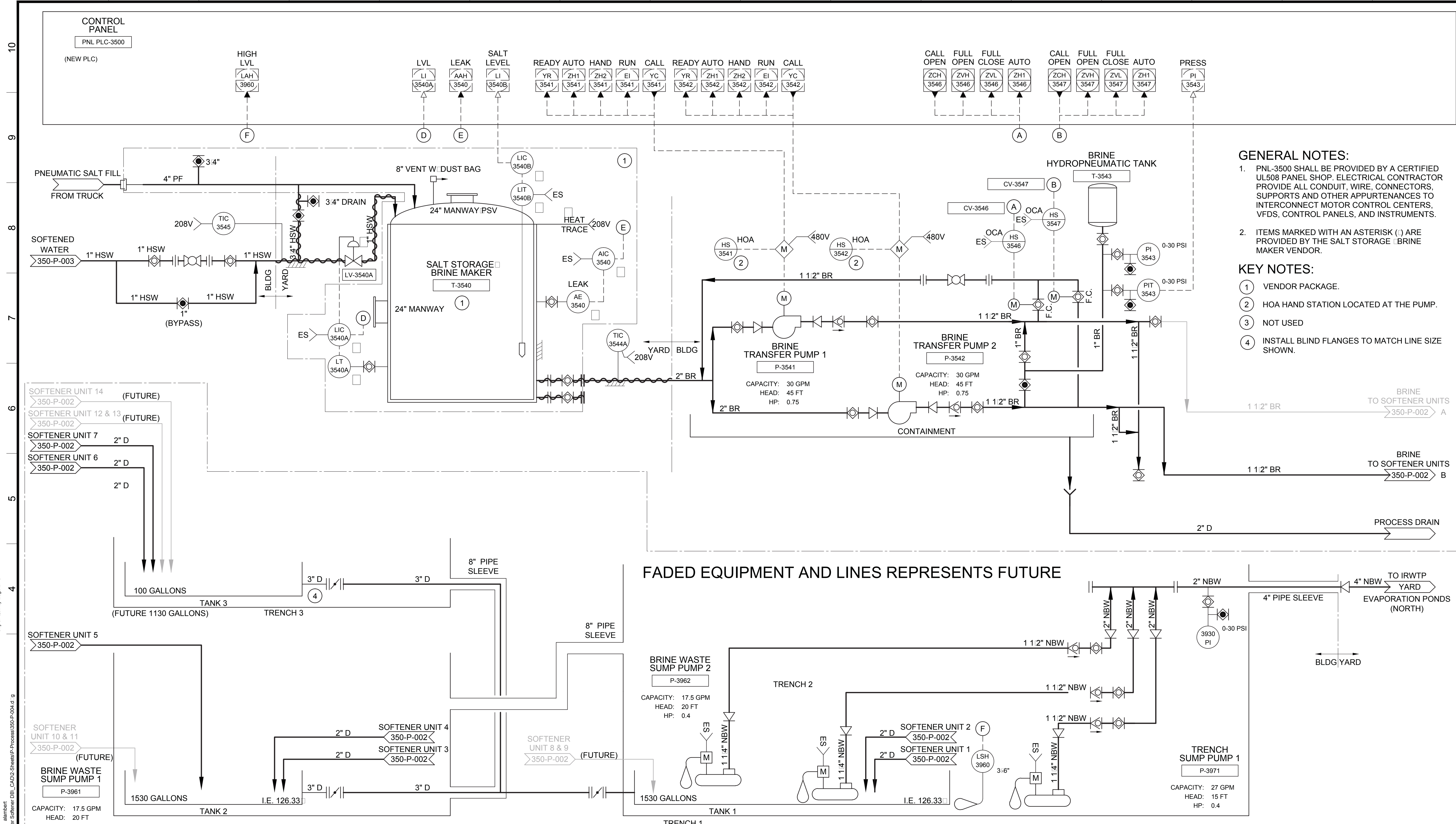
City of Quincy Logo.JPG
JANUARY 27, 2017



GENERAL NOTES:

1. PNL-3500 SHALL BE PROVIDED BY A CERTIFIED UL508 PANEL SHOP. ELECTRICAL CONTRACTOR PROVIDE ALL CONDUIT, WIRE, CONNECTORS, SUPPORTS AND OTHER APPURTENANCES TO INTERCONNECT MOTOR CONTROL CENTERS, VFDS, CONTROL PANELS, AND INSTRUMENTS.
2. ITEMS MARKED WITH AN ASTERISK (*) ARE PROVIDED BY THE SALT STORAGE/BRINE MAKER VENDOR.

KEY NOTES:

1. VENDOR PACKAGE.
2. HOA HAND STATION LOCATED AT THE PUMP.
3. NOT USED
4. INSTALL BLIND FLANGES TO MATCH LINE SIZE SHOWN.

Brown AND Caldwell
SEATTLE, WASHINGTON

SUBMITTED: ____ PROJECT MANAGER DATE: ____
APPROVED: ____ BROWN AND CALDWELL DATE: ____

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: LEV
DRAWN: KEW
CHECKED: TJT
CHECKED: LEV LSL
APPROVED: LEV

EXTERNAL REFERENCE FILES

RECORD DRAWING

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REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	0	ISSUE FOR RECORD	JH	1/8/16	LEV

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WATER REUSE UTILITY - PHASE 3B
HIGH EFFICIENCY WATER SOFTENER BUILDING
PROCESS AND INSTRUMENTATION DIAGRAM
LIFT STATION
BULK BRINE AND DISTRIBUTION

FILENAME 350-P-004.dwg
BC PROJECT NUMBER 145617
CLIENT PROJECT NUMBER
DRAWING NUMBER 350-P-004
SHEET NUMBER OF

Jan 07, 2016 - 4:20pm
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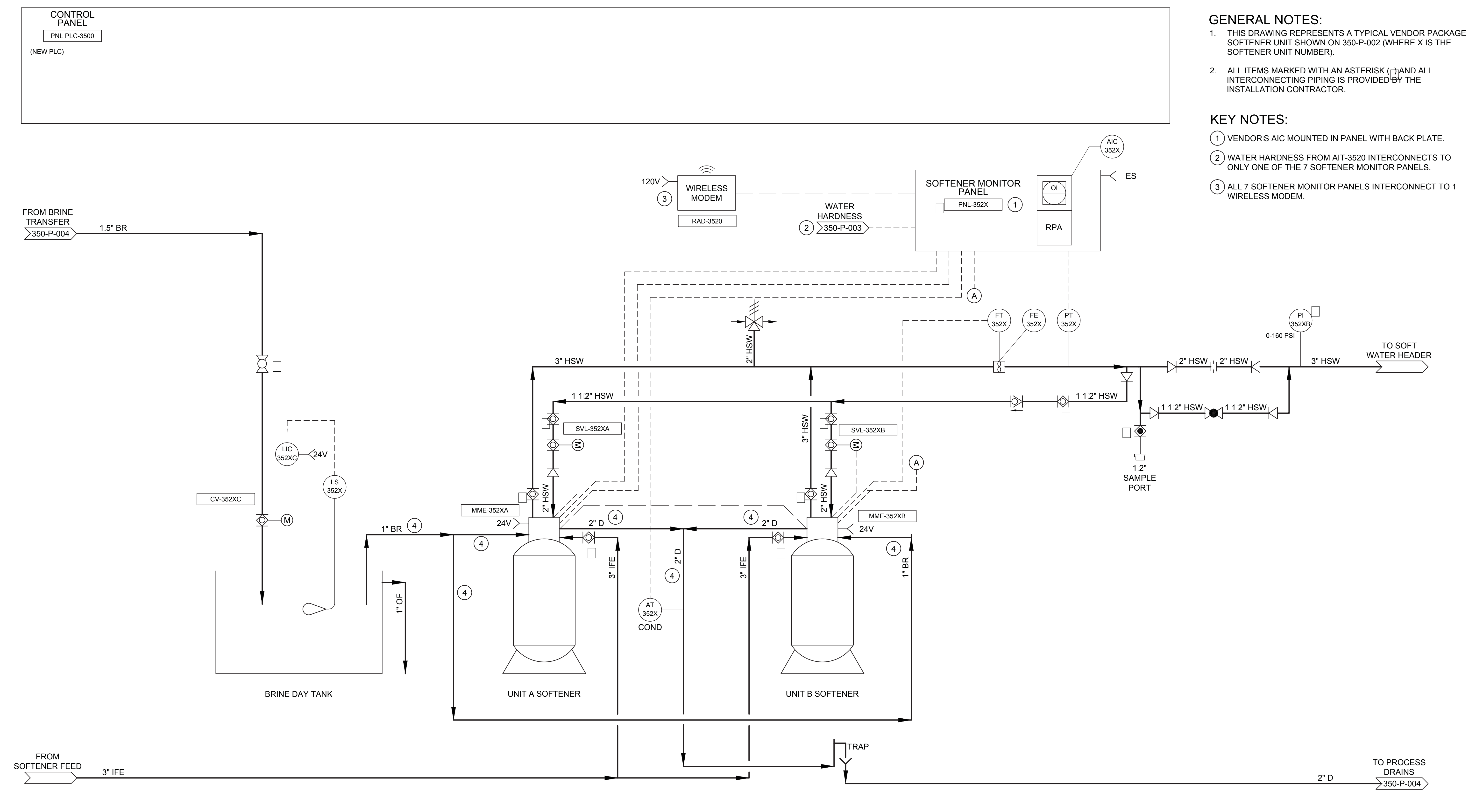
American Water.png
City of Quincy Logo.JPG
JANUARY 27, 2014



GENERAL NOTES:

1. THIS DRAWING REPRESENTS A TYPICAL VENDOR PACKAGE SOFTENER UNIT SHOWN ON 350-P-002 (WHERE X IS THE SOFTENER UNIT NUMBER).
2. ALL ITEMS MARKED WITH AN ASTERISK ( ) AND ALL INTERCONNECTING PIPING IS PROVIDED BY THE INSTALLATION CONTRACTOR.

KEY NOTES:

1. VENDOR'S AIC MOUNTED IN PANEL WITH BACK PLATE.
2. WATER HARDNESS FROM AIT-3520 INTERCONNECTS TO ONLY ONE OF THE 7 SOFTENER MONITOR PANELS.
3. ALL 7 SOFTENER MONITOR PANELS INTERCONNECT TO 1 WIRELESS MODEM.

Brown AND Caldwell
SEATTLE, WASHINGTON

SUBMITTED: ____ PROJECT MANAGER DATE: ____
APPROVED: ____ BROWN AND CALDWELL DATE: ____

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)
DESIGNED: LEV
DRAWN: KEW
CHECKED: TJT
CHECKED: LEV LSL
APPROVED: LEV

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REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
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WATER REUSE UTILITY - PHASE 3B
HIGH EFFICIENCY WATER SOFTENER BUILDING
PROCESS AND INSTRUMENTATION DIAGRAM

VENDOR PACKAGE (TYPICAL)

FILENAME 350-P-005.dwg
BC PROJECT NUMBER 145617
CLIENT PROJECT NUMBER
DRAWING NUMBER 350-P-005
SHEET NUMBER OF

JANUARY 27, 2017

Jan 07, 2016 - 4:20pm
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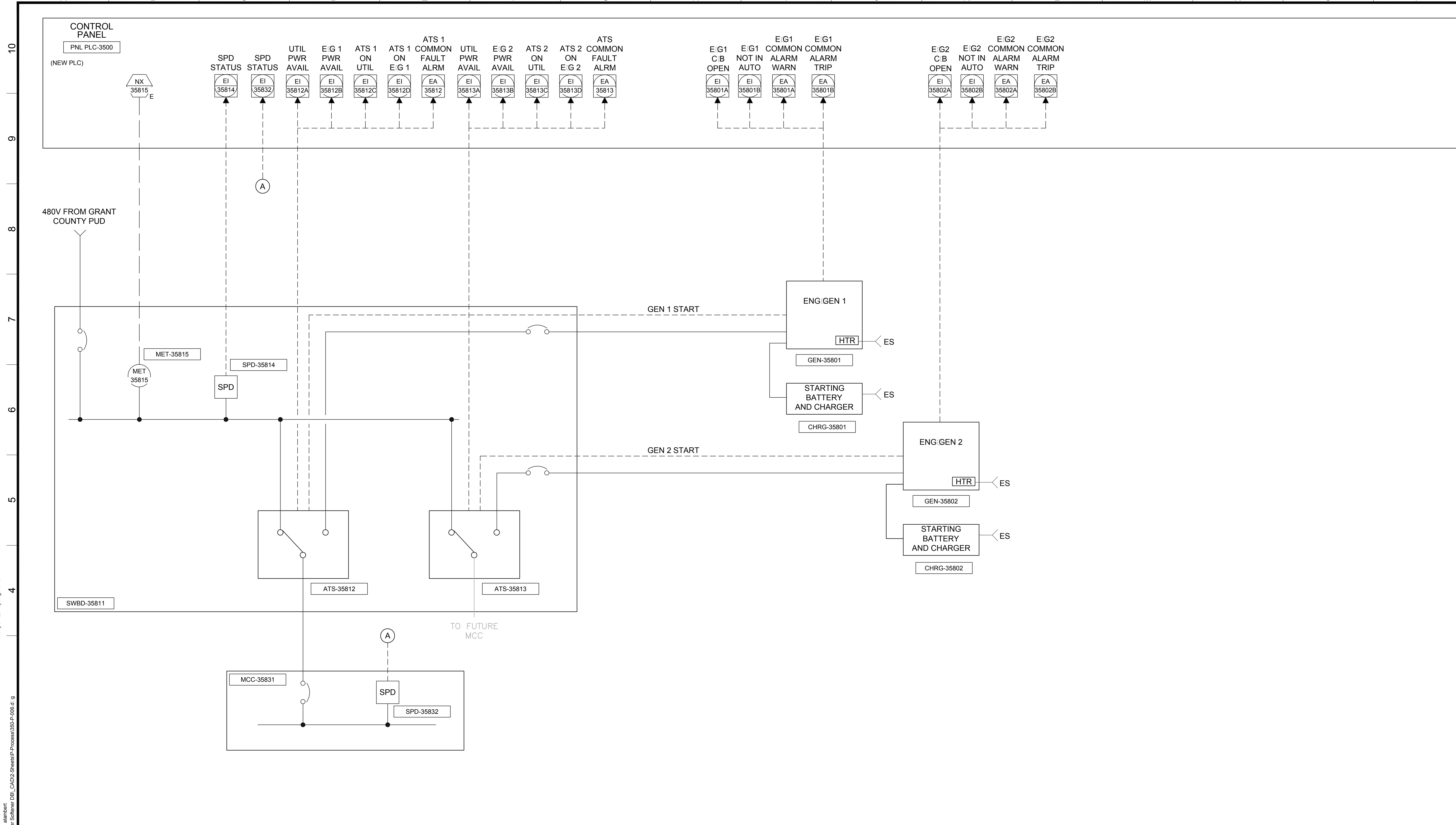
American Water.png
City of Quincy Logo.JPG



Brown AND Caldwell SEATTLE, WASHINGTON	LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)	EXTERNAL REFERENCE FILES	RECORD DRAWING
SUBMITTED: ____ PROJECT MANAGER DATE: ____	DESIGNED: XX		THIS RECORD DRAWING HAS BEEN PREPARED BY BROWN AND CALDWELL (BC) BASED ON CONSTRUCTION RECORDS AND INFORMATION FURNISHED BY OTHERS. BC HAS REVIEWED THIS INFORMATION FOR ACCURACY IN A MANNER CONSISTENT WITH ITS CONTRACTED SCOPE OF WORK, BUT CANNOT REPRESENT THE ACCURACY OF ALL ELEMENTS REFLECTED HEREIN. THOSE RELYING ON THIS RECORD DOCUMENT ARE ADVISED TO VERIFY ITS ACCURACY.
APPROVED: ____ BROWN AND CALDWELL DATE: ____	DRAWN: XX		
	CHECKED: XX		
	CHECKED: XX		
	APPROVED: XX		

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	0	ISSUE FOR RECORD	JH	1/8/16	LEV

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WATER REUSE UTILITY - PHASE 3B
HIGH EFFICIENCY WATER SOFTENER BUILDING
PROCESS AND INSTRUMENTATION DIAGRAM

POWER DISTRIBUTION EQUIPMENT

FILENAME	350-P-006.d□g
BC PROJECT NUMBER	145617
CLIENT PROJECT NUMBER	
DRAWING NUMBER	350-P-006
SHEET NUMBER	OF

JANUARY 27, 2013

Jan 07, 2016 - 4:21pm alambert
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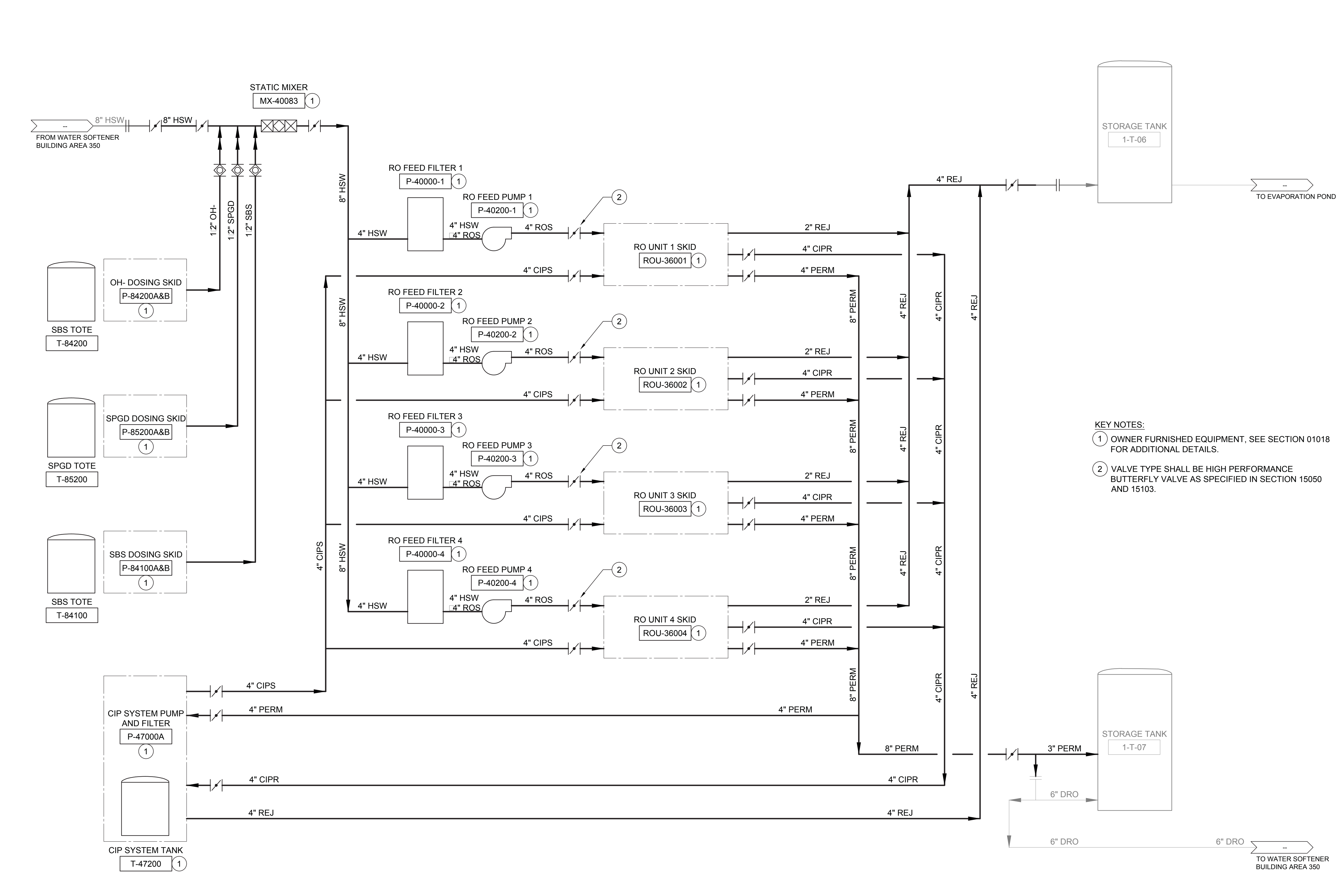
American Water.png
City of Quincy Logo.JPG



KEY NOTES:

1. OWNER FURNISHED EQUIPMENT, SEE SECTION 01018 FOR ADDITIONAL DETAILS.
2. VALVE TYPE SHALL BE HIGH PERFORMANCE BUTTERFLY VALVE AS SPECIFIED IN SECTION 15050 AND 15103.

GENERAL NOTES:

1. ALL VALVES SHOWN ON THIS DRAWING ARE TO BE ADDITIONAL TO THOSE SHOWN ON DRAWINGS I-360-0720 THRU I-360-0726.

Brown AND Caldwell
Seattle, Washington

CITY OF QUINCY
Opportunities Unlimited !

NOT FOR CONSTRUCTION

CITY OF QUINCY
1WATER IRWTP
REVERSE OSMOSIS SYSTEM
DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	--	--

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: J. NOVAK
DRAWN: T.LEMON
CHECKED: T. GATLIN
CHECKED: J. HOLLINGSWORTH
APPROVED: E. VOGES

FILENAME 36-06-36-P-0705-DP4.DWG
BC PROJECT NUMBER 148860
QUINCY PROJECT NUMBER

PROCESS
RO BUILDING PROCESS FLOW DIAGRAM

DRAWING NUMBER
360-P-0705

SHEET NUMBER 35 OF 69

Appendix F: Draft Technical Memorandum Design Basis Summary

Dated May 20, 2016

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701 Pike Street, Suite 1200
Seattle, WA 98104

T: 206.624.0100
F: 206.749.2200

Technical Memorandum

Prepared for: City of Quincy

Project Title: TO22 Q1W Reuse Pumping Systems

Project No.: 148621.052

Technical Memorandum

Subject: Design Basis Summary

Date: May 20, 2016

To: Ariel Belino, City of Quincy

From: L. Emil Voges, P.E.

Copy to: Jami Favor, American Water

Prepared by: ___________________________________
L. Emil Voges, P.E., Washington License 35221, expires November 13, 2016

Reviewed by: ___________________________________
Jaimie Hennessy

Limitations:

This is a draft memorandum and is not intended to be a final representation of the work done or recommendations made by Brown and Caldwell. It should not be relied upon; consult the final report.

This document was prepared solely for the City of Quincy, WA in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Quincy, WA and Brown and Caldwell dated November 17, 2015. This document is governed by the specific scope of work authorized by the City of Quincy, WA; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Quincy, WA and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

A	ampere(s)
ASR	aquifer storage and recovery
BODR	basis of design report
DP 4	Design Phase 4
EQ Basin	equalization basin
GE	General Electric
gpm	gallons per minute
HDPE	high-density polyethylene
HES	high-efficiency softening
HMI	human-machine interface
hp	horsepower
I&C	instrumentation and controls
I/O	input/output
IFE	industrial filtered effluent
IRW	industrial reuse water
IRWTP	Industrial Reuse Water Treatment Plant
ISA	International Society of Automation
IWTP	Industrial Wastewater Treatment Plant
MCC	motor control center
mg/L	milligram(s) per liter
MWRF	Municipal Water Reclamation Facility
NEC	National Electric Code
NFPA	National Fire Protection Association
P&ID	process and instrumentation drawing
PLC	programmable logic controller
Q1W	Quincy 1Water Utility
RFB	reuse filter building
RO	reverse osmosis
RW	Washington Class A reclaimed water
SCADA	supervisory control and data acquisition
TDH	total dynamic head
TDS	total dissolved solids
UF	ultrafiltration
UL	Underwriters Laboratories
V	volt(s)
VFD	variable-frequency drive
WSB	water softener building

Section 1: Design Objectives and Control Narrative

The Quincy 1Water Utility (Q1W) Reuse Water Distribution System will convey Municipal Water Reclamation Facility (MWRF) Class A reclaimed water (RW) and Industrial Reuse Water Treatment Plant (IRWTP) industrial reuse water (IRW) to multiple beneficial uses. RW is already being generated and a RW pump station is already functional at the MWRF. This basis of design report (BODR) describes the parameters for the design of new pump stations to complete the Q1W Reuse Water Distribution System.

1.1 Basic Function

The IRWTP will produce IRW using an ultrafiltration (UF) system to be installed at the reuse filter building (RFB). To reduce total dissolved solids (TDS), the IRWTP also includes reverse osmosis (RO) treatment produced at the RO building. As described in this BODR, RW, ultrafiltered IRW, and RO-treated water will be conveyed to a central reuse water pump station to be installed at the water softener building (WSB). New pumps are needed to convey water from the RFB to the WSB. Conveyance from the RO building to the WSB is not included in this BODR, and that conveyance system is not expected to require pumps.

RW is reserved for use for crop production and will be pumped to an equalization basin (EQ Basin) for distribution to fields by the growers. During the peak crop production season the flow will be supplemented by the industrial filtered effluent (IFE) supply produced by the UF system and pumped by a dedicated pump station. RO-treated IRW will be blended with RW to control TDS to meet crop production requirements.

Via a second pump station in the RFB, IRW IFE will be conveyed to the WSB, where water is softened for use by Microsoft and for feeding to the RO system. IFE can bypass the water softening and RO treatment steps, allowing control of the IRW TDS via RO water blending. IRW will be used by industrial customers or transported to an aquifer storage and recovery (ASR) system.

1.2 System Basic Description

The Q1W Reuse Water Distribution System main flow diagram and primary components are shown on Figure 1-1. Note that the controls for the system shown in Figure 1-1 will also include a regional wireless communications network to control function between the pump stations.

Figure 1-2 shows an overall vicinity map and Figures 1-3 and 1-4 show major conveyance system components of the RFB and WSB areas, respectively. The separate RW and IRW conveyance system layouts are described below.

1.2.1 RW Conveyance System Layout

The RW conveyance system layout includes the following main components:

- Existing RW Pump Station: Existing at the MWRF with piping to the RFB. (Note that these pumps are not shown on Figure 1-1).
- Existing RW Clearwell: Existing abandoned clarifier, rehabilitated to serve as a clearwell that will be filled via overflow (i.e., air gap) from the adjacent existing IRW Clearwell (see below). New feed piping from the clearwell to the reclaimed water IFE pumps.
- New RW IFE pumps to pump via existing piping to the WSB.
- New RW booster pump at the WSB: This pump station includes a pressurized bladder tank to prevent vacuum conditions on the suction side of the pumps.
- New reclaimed water RO air gap tank.

- New RW RO blending pumps at the WSB.
- New connections to existing irrigation pipelines that will be extended to the irrigation pond under a future project.
- Programmable logic controllers (PLCs) and supervisory control and data acquisition (SCADA) systems for controlling the pump operations and level of irrigation pond, and RO blending based on measured TDS concentrations.

1.2.2 IRW Conveyance System Layout

The industrial reuse water conveyance system includes:

- Existing reuse clearwell filled by the future UF system
- Reuse water IFE pumps to pump from the RFB to WSB via existing pipelines
- Potable water backup valve and back flow preventer for the reuse water system at the RFB
- New reuse water booster pumps at the WSB
- New reuse water RO tank
- New reuse water RO blending pumps at the WSB with connections set for future piping to end users
- Automated control of RO blending based on measured TDS concentrations
- PLC and SCADA control system shared with (and with the same function as) the reclaimed water system:
  - The RFB, PLC, and SCADA are new under this BODR
  - The WSB, PLC, and SCADA are existing at the WSB

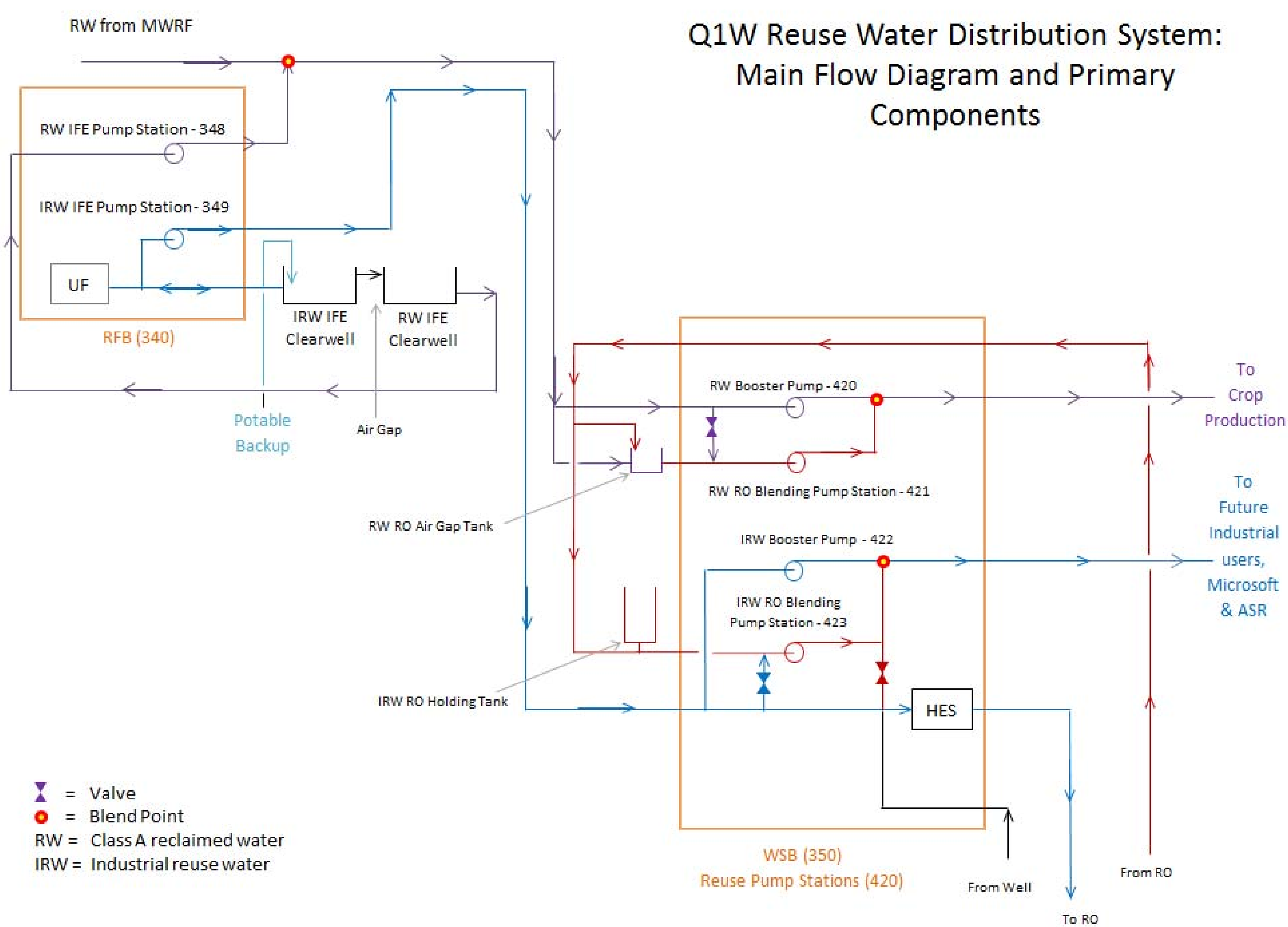

Figure 1-1. Q1W Reuse Water Distribution System conveyance system layout

Brown AND Caldwell

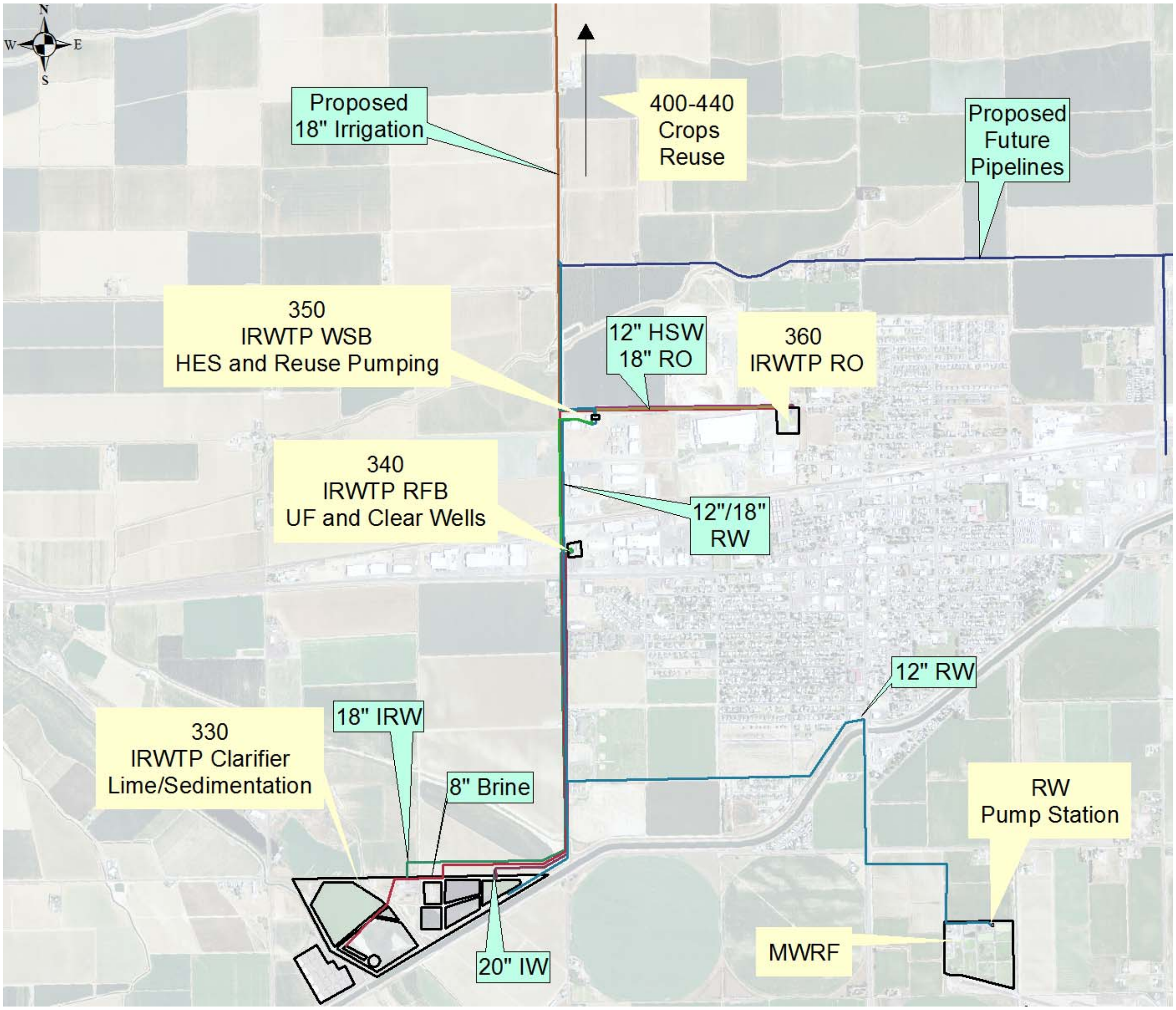

Figure 1-2. Overall vicinity map

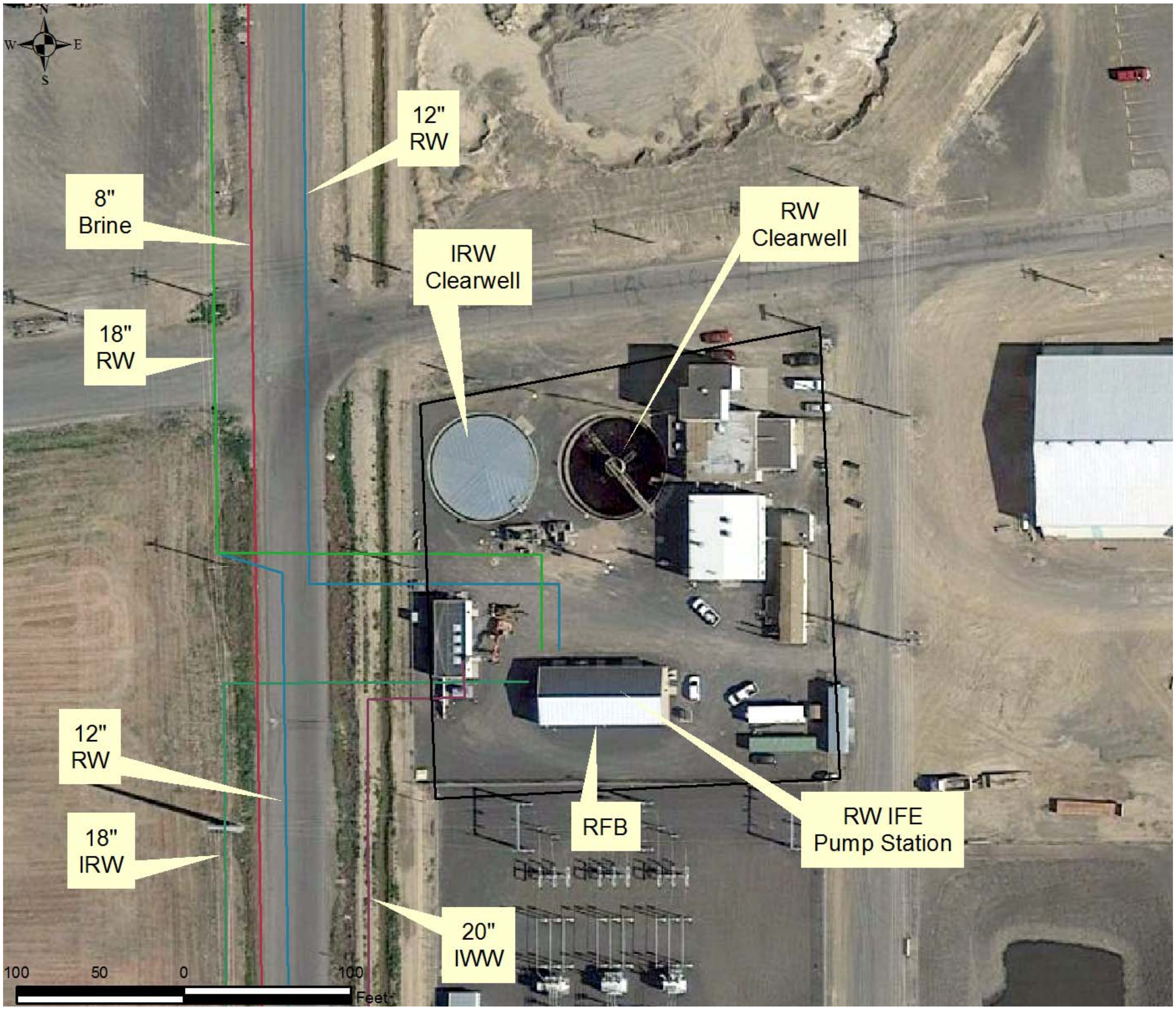

Figure 1-3. RFB (Area 340) map

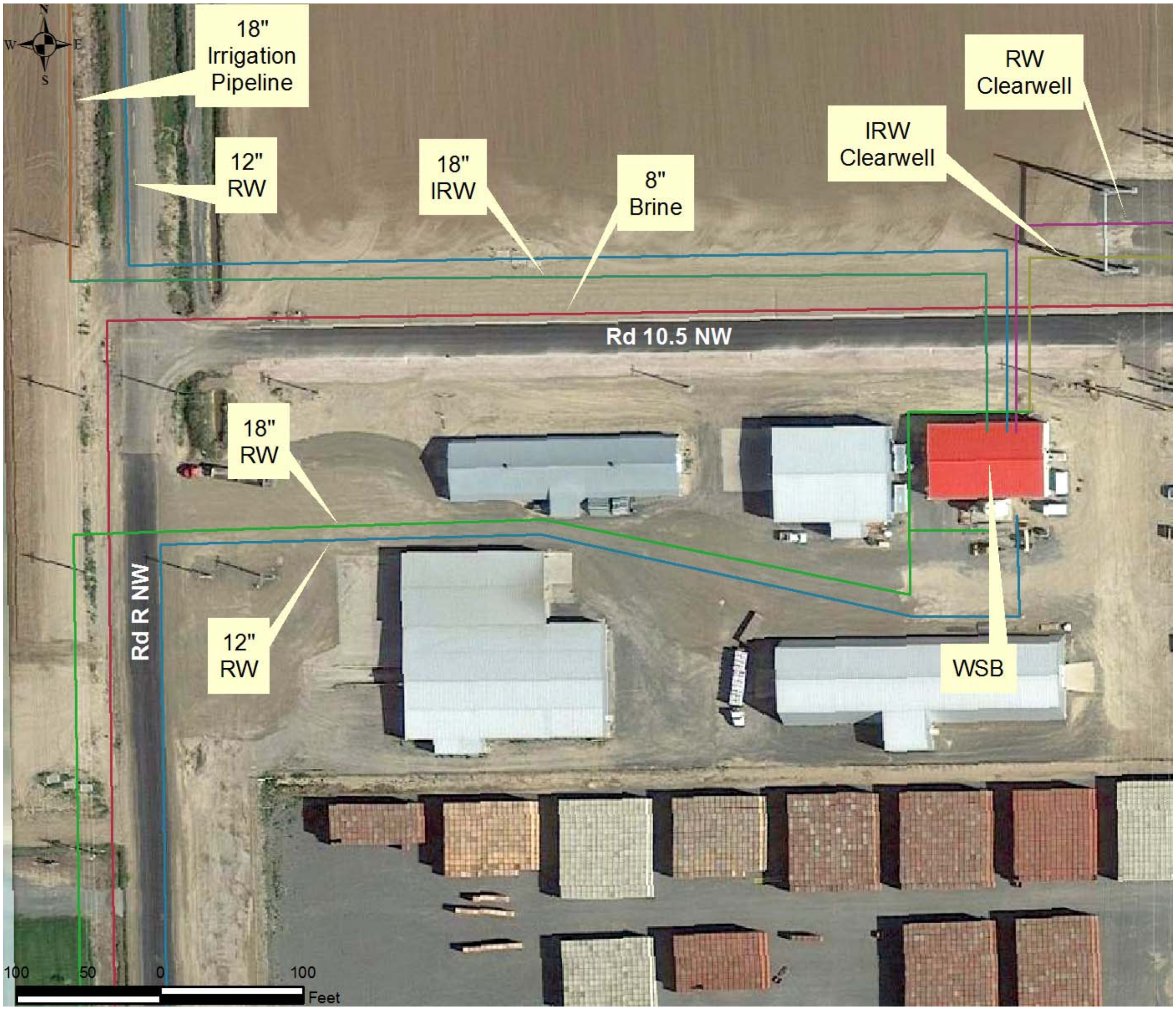

Figure 1-4. WSB (Area 350) map

1.3 RW System Components and Layout

The following subsections describe the main RW components and layout.

1.3.1 Existing RW Pump Station & RW Clearwell

Effluent from the MWRF is coagulated, filtered, and disinfected to meet Washington Class A RW standards and is suitable for crop production. During crop growing periods, the pump station will be automatically controlled to deliver as much RW to the crop production area as is demanded. If demand is low, excess RW will flow to the existing MWRF percolation beds. The pumps will turn off based on lack of demand in the crop production system. When the crop production demand, as determined by EQ Basin decreasing level, exceeds the available flow of RW, supplemental flow will be provided from the RW IFE Clearwell and its associated pump stations. The RW supply pump station at the MWRF is currently available and operational for service. It has four pumps, each with a capacity of 350 gallons per minute (gpm) at a total of head of 330 feet. As required pumping head increases with increasing crop production flows, head will be boosted by the new RW booster pump station at the WSB.

1.3.2 RW Conveyance Piping

The existing conveyance pipe from the MWRF to the RFB is 12-inch-diameter high-density polyethylene (HDPE) pipe approximately 3.1 miles long. Roughly 100 feet north of the RFB, an 8-inch-diameter pipe ties from the RW IFE Pump Station. The pipeline continues approximately 2,850 feet to the WSB.

Immediately adjacent to and southwest of the RFB site, the 12-inch-diameter pipe is currently connected to the 18-inch-diameter IRW HDPE pipe. This connection will be eliminated and the originally installed continuous 12-inch-diameter RW pipeline route will be restored.

1.3.3 RW IFE Pump Station

The RW IFE Pump Station will be located at the RFB, and will be used to meet peak flow crop production demands. The supply reservoir will be the abandoned east primary clarifier located near the RFB, converted to be a clearwell, hereinafter referred to as the RW IFE Clearwell. IFE will be supplied to the RW IFE Clearwell via the clearwell overflow from the adjacent reuse water clearwell, hereinafter referred to as the IRW IFE Clearwell. Separation between the two liquid streams will be maintained by an air gap between the overflow pipe and the RW IFE Clearwell. The RW IFE Pump Station consists of three, single-speed, 40-horsepower (hp) pumps with a capacity of 417 gpm each at 240 feet of head. This RW IFE Pump Station will be controlled by the EQ Basin levels and the operating state of the RW supply pump station located at the MWRF.

1.3.4 RW Booster Pump

The RW Booster Pump will be located at the WSB and will be required when flow rates to the crop production area create pipe head loss conditions that prevent further increase in flow from the upstream RW system pump stations (either the RW IFE Pump Station or the supply pump station at the MWRF). The RW Booster Pump will be controlled by pressure sensors located on the suction side of the pump, and flow conditions will be monitored on the crop production supply flow meter. The RW Booster Pump is a single pump with a rating of 40 hp and has been designed for approximately 1,600 gpm at 80 feet of total dynamic head (TDH).

To account for possible flow and pressure fluctuations that can occur in pipeline-feeding the WSB, a 1,000-gallon pressurized water tank will be connected to the suction side of the IRW Booster Pump. The tank will be designed to stabilize pressure at that point in the pipeline. The tank will be located outside the west end of the WSB and will be insulated and heated.

To account for possible transient conditions in the crop production supply pipeline, a 1,000-gallon pressurized bladder tank will be connected downstream of the RO blend point. The tank will be designed to absorb pressure spikes that can occur on the loss of pump operation.

1.3.5 RW RO Blending

Blending of RO-treated RW is necessary to maintain TDS concentrations less than the regulated value. The value is still yet to be determined but it is estimated to be around 500 milligrams per liter (mg/L). RW coming from the MWRF has an estimated TDS of 500 to 600 mg/L. The RW IFE will have a TDS ranging from 1,200 to 1,400 mg/L, and the RO-treated RW TDS will be less than 100 mg/L. TDS will be controlled based on a conductivity meter installed downstream of the point where RW and RO water are blended.

1.3.6 RW RO Blending Pump Station

The RW RO Blending Pump Station will draw from the RW RO Air Gap Tank, which is fed from the IRW RO Holding Tank via an air gap to prevent cross-contamination between the RW and IRW systems.

The pumps will pump to the RW RO blending point. The RW RO Blending Pump Station will have three 40 hp pumps, each with a capacity of 417 gpm at a TDH of 280 feet. The pumps are identical to the RW IFE Pump Station pumps in the RFB and one or more will operate at variable speed using 50 hp variable-frequency drives (VFDs).

1.4 IRW System Components and Layout

The following subsections describe the main IRW components and layout.

1.4.1 Clarified Industrial Effluent Pump Station

The Clarified Industrial Effluent Pump Station will be described under a future BODR. It will supply water to the UF system housed in the RFB. These pumps will be controlled in response to the Industrial Wastewater Treatment Plant's (IWTP) effluent production rate.

1.4.2 IRW Conveyance Piping

The 18-inch-diameter HDPE IRW pipe begins at the IWTP approximately 1.5 miles south of the RFB. A future Clarified Industrial Effluent Pump Station will pump to the RFB, and then to where effluent is filtered by the UF system. Leaving the RFB, a 14-inch-diameter IRW pipe travels 265 feet and crosses Road 13, where it connects to an 18-inch-diameter HDPE pipe. The 18-inch-diameter pipe continues 1,500 feet north to the intersection of Road R NW and Port Industrial Parkway, where it reduces to 12 inches in diameter, and then continues to the WSB. Leaving the WSB, a portion of the flow is supplied to Microsoft, a portion feeds the RO system, and a portion is blended with RO-treated water to supply future industrial users or the ASR system.

As noted above, the 12- to 18-inch-diameter pipe connection southwest of the RFB will need to be eliminated to allow the 18-inch-diameter pipeline to be used for reuse water conveyance.

1.4.3 IRW IFE Pump Station

The IRW IFE Pump Station will be supplied from the IRW IFE Clearwell. The IRW IFE Pump Station will have four pumps, each rated at 50 hp, and each with a total capacity of 2,080 gpm and 280 feet of TDH.

At the WSB, a portion of the IRW will feed the high-efficiency softening (HES) units. Water from the IRW RO Holding Tank will be pumped into either the IRW bypass system or the RW systems for TDS control. Flow from this IRW RO Holding Tank will be controlled by the RO blending pumps, which in turn are controlled by upstream TDS probes on a supervisory control and data acquisition (SCADA) feedback loop.

1.4.4 IRW Booster Pump

The IRW Booster Pump will be located in the WSB and will be required when head loss created by the flow rates to the HES units and users prevent a further increase in flow from the upstream IRW system pump stations. The IRW Booster Pump will be controlled by pressure sensors located on the suction side of the pump and flow conditions will be monitored on the IRW supply flow meter. The IRW Booster Pump is a single pump with a rating of 40 hp, and has been designed for approximately 1,600 gpm at 80 feet of TDH. It is identical to the RW Booster Pump.

1.4.5 IRW RO Blending

Blending of RO-treated IRW is necessary to maintain TDS concentrations less compatible with the end user needs and the regulated value for ASR. The values are still yet to be determined but they are estimated to be around 500 mg/L. The IRW IFE will have a TDS ranging from 1,200 to 1,400 mg/L, and the RO-treated IRW TDS will be less than 100 mg/L. TDS will be controlled based on a conductivity meter installed downstream of the point where IRW and RO water are blended.

1.4.6 IRW RO Blending Pump Station

The IRW RO Blending Pump Station will draw from the IRW RO Holding Tank. The IRW RO Holding Tank will receive RO-treated IRW via gravity flow from an existing 30,000-gallon RO permeate tank at the IRWTP RO building.

The IRW RO Blending Pump Station will pump to the IRW RO blending point. The IRW RO Blending Pump Station will have three 40 hp pumps, each with a capacity of 417 gpm at a TDH of 280 feet. The pumps are identical to the RW Blending pumps in the RFB and one or more will operate at variable speed using 50 hp VFDs.

1.5 Preliminary Design Data

Refer to Attachment A for drawings including the building layouts, process and instrumentation drawings (P&IDs), and electrical fundamental element drawings. Refer to Attachment B for the equipment and instrument list.

Section 2: Electrical and Instrumentation and Controls Requirements

This section describes the suitability of existing electrical service, electrical equipment standards, existing instrumentation and controls (I&C) service, and I&C standards.

2.1 Suitability of Existing Electrical Service

This section describes the existing electrical service at the RFB (Area 340) and WSB (Area 350).

2.1.1 RFB (Area 340)

The existing 1,200-ampere (A) service and distribution equipment are suitable for adding new pump loads. Detailed design will include extending existing motor control center (MCC) 34830. MCC sections will be used for new pump starters. New pump motor feeders are planned to feed pumps through the floor to space below the electrical room.

The existing General Electric (GE) MCC is planned to be extended by at least one vertical section. The electrical room includes adequate space for MCC extension.

It is assumed that:

- No lighting changes will be needed in the building for this work
- Service is adequately sized for planned expansion; no interaction with the utility is required
- Fire alarm/smoke detection, security, telephone/cable, and other auxiliary systems not specifically identified in the attached drawings will not be required
- Standby power is not required for this facility
- Required low-voltage (120-volt [V]/208 V) circuits will not exceed existing spare capacity
- Existing sump pump and ancillary systems will be integrated into the programmable logic controller (PLC) monitoring systems

Refer to attached drawings.

2.1.2 WSB (Area 350)

The existing 600 A service is suitable for adding new pump loads. The existing Eaton MCC-35831 will be used to feed new pumps, as well as the addition of a new MCC-35852. The new MCC and existing MCC will be connected in a main-tie-tie-main configuration; the kirk-key configuration will be revised to prevent closing four breakers at one time. Existing distribution equipment is adequate for new loads. New pump motors are planned to be fed using the existing overhead cable tray.

The new MCC will be installed in the existing electrical room.

It is assumed that:

- No lighting changes will be needed in the building for this work
- Service is adequately sized for planned expansion; no interaction with the utility is required
- Fire alarm/smoke detection, security, telephone/cable, and other auxiliary systems not specifically identified in the attached drawings will not be required
- Required low-voltage (120 V/208 V) circuits will not exceed existing spare capacity

Refer to attached drawings.

2.2 Electrical Equipment Standards

Detailed design will include the following specification sections:

16000	General Requirements for Electrical Work
16030	Electrical Testing
16110	Raceways, Boxes and Supports
16120	600 Volt Conductors, Wire, and Cable
16140	Wiring Devices
16175	Miscellaneous Electrical Devices
16176	Local Control Panels
16431	Arc Flash Analysis, Short Circuit Study, and Protective Device Coordination Report
16440	Instrument Transformers, Meters, Switches and Accessories
16450	Grounding System
16754	480 V Service Entrance Section
16920	600 V Motor Control Centers

2.3 Suitability of Existing Instrumentation and Control Service

The following subsections describe the existing I&C service for the RFB (Area 340) and WSB (Area 350).

2.3.1 RFB (Area 340)

Detailed design will be adding a new PLC panel (PNL 34900) in the existing building 340; the location will be next to the existing electrical room as shown on the electrical plan drawings.

2.3.2 WSB (Area 350)

Brown and Caldwell has determined that there is sufficient available input/output (I/O) in the existing PLC panel (PNL-3500) in the WSB (Area 350) for the additional control and monitoring required in Design Package 4 (DP 4).

2.4 Instrumentation and Control Standards

The following subsections describe the specification sections, describe I&C per manufacturer standardization, list the I&C manufacturers, and outline quality assurance standards.

2.4.1 Specification Sections

Detailed design will include the following Brown and Caldwell standard Division 17 specification sections used in prior City of Quincy designs:

17000	General Requirements for Instrumentation and Control
17030	Process Instrumentation and Control System Testing
17110	Instrument and Control Panels
17200	Instrument Index
17211	Process Taps and Primary Elements

17212	Process Transmitter
17216	Process Switches
17310	Programmable Logic Controllers (PLC)
17801	Operator Interface System
17815	Network Equipment
17900	Control Strategy

2.4.2 Instrumentation and Controls Manufacturers Standardization

Detailed design for the RFB (Area 340) and WSB (Area 350) will be based on existing I&C manufacturers in the WSB (Area 350) to simplify operation and maintenance, and to ensure compatibility for controls.

2.4.3 Instrumentation Manufacturers

Design will be based on the following instrument manufacturers:

Magnetic flow transmitters/meters	Endress+Hauser 10W
Pressure transmitters	Endress+Hauser PMP71
Level transmitters	Endress+Hauser FMD77
Pressure gauges	Ashcroft 45-1279
Float level switches	Anchor Scientific

2.4.4 Control Manufacturers

Design will be based on the following control system for the RFB (Area 340):

PLC enclosure	Hoffman A903636FS
PLC central processing unit	Allen-Bradley ControlLogix 1756-L61
PLC communication	Allen-Bradley ControlLogix 1756-EN2T
PLC I/O	Allen-Bradley ControlLogix 1756-Modules
PLC human-machine interface (HMI)	Allen-Bradley 2711 PanelView Plus 6
Ethernet switch	Phoenix SFN 8TX
Radio modem	Data-Linc FLC830E
Uninterruptible power supply	APC SMT3000

2.4.5 I&C Quality Assurance

The following subsections describe the national codes and standards and qualifications for conducting quality assurance.

2.4.5.1 National Codes and Standards

Standards and codes will include:

National Fire Protection Association (NFPA) 70	National Electric Code (NEC)
NFPA 79	Electrical Standard for Industrial Machinery
Underwriters Laboratories (UL) 508A	Standard for Industrial Control Panels

Electronic I&C will be marked, installed, and wired per NFPA 70 requirements. Control panels will be fabricated per NFPA 79 and UL 508A; the more stringent standard will be followed.

2.4.5.2 Qualifications

Detailed design will require an International Society of Automation (ISA)-certified or equivalent I&C system integrator with a minimum of 5 years of experience in industrial automation to implement the work specified in Division 17, which will include:

- Submittal of documentation including bill of materials, product literature, layout drawings, wiring diagrams, and testing procedure
- Furnishing of instrumentation
- Custom fabrication of control panels
- Factory testing including basic application programming for testing PLC and human-machine interface (HMI) communication and ability to read/write with field I/Os
- Delivery and installation
- Calibration
- Testing including integration of final application programming

Brown and Caldwell will provide the final application programming, which will be defined in Specification Section 17900.

2.4.6 Instrumentation and Control Design Fundamentals

Detailed design will be based on process equipment having both local and automatic control as shown on the P&IDs. Automatic control will be implemented through the building's PLC and will be able to operate as a standalone system. The exception is automation through the building's PLC, which may be vendor equipment, and will have its own factory-integrated control system for automatic operation.

Detailed design will provide both local and remote access to the building's PLC control system for SCADA as shown on the Communication Block Diagrams.

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Attachment A: Drawings List

*Note that the existing RW pumps at the MWRF and the existing piping from the MWRF to the RFB are not shown on P&IDs.

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Attachment A Drawing List		
Drawing no.	**Revision**	**Title**
Process		
P-000-0001	A	PROCESS LEGEND AND SYMBOLS 1
P-000-0002	A	PROCESS LEGEND AND SYMBOLS 2
P-000-0003	A	PROCESS LEGEND AND SYMBOLS 3
P-340-0006	A	EMERGENCY EYEWASH/SHOWERS SUMP PUMPS & POWER DISTRIBUTION REUSE FILTER BUILDING
P-340-0021	A	CLEARWELLS
P-340-0022	A	REUSE FILTER DISTRIBUTION REUSE FILTER BUILDING
P-340-0023	A	REUSE FILTER WATER PUMPS REUSE FILTER BUILDING
P-420-0001	A	FILTERED REUSE DISTRIBUTION TANKS
P-420-0002	A	BLENDED RECLAIMED WATER BOOSTER PUMP WATER SOFTENER BUILDING
P-420-0003	A	BLENDED RECLAIMED WATER RO BLEND PUMPS WATER SOFTENER BUILDING
P-420-0004	A	BLENDED INDUSTRIAL REUSE BOOSTER PUMP WATER SOFTENER BUILDING
P-420-0005	A	BLENDED INDUSTRIAL REUSE RO BLEND PUMPS WATER SOFTENER BUILDING
Mechanical		
M-000-0001	A	PROCESS MECHANICAL SYMBOLS
M-340-0001	A	REUSE FILTER BUILDING BASEMENT GENERAL ARRANGEMENT
M-350-0001	A	WATER SOFTENER BUILDING GENERAL ARRANGEMENT PLAN
Electrical		
E-340-0001	A	REUSE FILTER BUILDING SITE PLAN
E-340-0101	A	REUSE FILTER BUILDING LOWER LEVEL POWER, CONTROL, AND SIGNAL PLAN
E-340-0111	A	REUSE FILTER BUILDING MAIN FLOOR POWER, CONTROL, AND SIGNAL PLAN
E-340-0501	A	REUSE FILTER BUILDING ONE LINE DIAGRAM
E-350-0501	A	WATER SOFTENER BUILDING ONE LINE DIAGRAM 1
E-350-0502	A	WATER SOFTENER BUILDING ONE LINE DIAGRAM 2
E-350-0504	A	MCC 35831 ELEVATION AND LOAD SCHEDULE
E-350-0505	A	MCC 35851 ELEVATION AND LOAD SCHEDULE
Instrumentation		
I-340-0001	A	REUSE FILTER BUILDING COMMUNICATION BLOCK DIAGRAM
I-350-0001	A	WATER SOFTENER BUILDING COMMUNICATION BLOCK DIAGRAM

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PUMPS

- PUMP, CENTRIFUGAL
- PUMP, DIAGHRAGM
- PUMP, GEAR
- PUMP, METERING
- PUMP, PERISTALTIC
- PUMP, PROGRESSING CAVITY
- PUMP, ROTARY LOBE
- PUMP, SUBMERSIBLE
- PUMP, JET
- PUMP, VERTICAL
- AXIAL FLOW PUMP, SUBMERSIBLE (M)

BLOWERS/COMPRESSORS

- BLOWER OR CENTRIFUGAL FAN
- BLOWER OR COMPRESSOR, LIQUID RING
- BLOWER OR COMPRESSOR, ROTARY LOBE
- COMPRESSOR, ROTARY SCREW
- COMPRESSOR, ROTARY SLIDING VANE
- COMPRESSOR, PISTON

PIPE LINE DEVICES

- TRAP (T)
- SEDIMENT TRAP
- GAS DRIP TRAP (DT)
- SEPARATOR/ DRYER
- PIPELINE FILTER
- RUPTURE DISK (VACUUM RELIEF)
- RUPTURE DISK (PRESSURE RELIEF)
- CONNECTION BETWEEN NEW AND EXISTING PIPING
- UNION
- SAMPLING AND FLUSHING CONNECTIONS
- CAP OR PLUG
- BLIND FLANGE
- FLEX CONNECTOR
- VENT TO ROOF
- VENT
- STEAM VENT
- AUTOMATIC VENT
- MANUAL VENT
- STRAINERS
- FOOT VALVE
- AIR SEPARATOR
- DRAIN (D)
- DRAIN VALVE (DV)
- CALIBRATION CHAMBER
- PULSATION DAMPENER
- INJECTOR
- FLAME TRAP
- FLAME CHECK
- QUICK CONNECTOR
- SUCTION DIFFUSER
- TEMPERATURE WELL
- FLOW STRAIGHTENING VANES
- PRESSURE REDUCING ASSEMBLY (PRA)
- DAMPER
- SIGHT GLASS
- PIG LAUNCHER/ RECEIVER
- REDUCER

HVAC RELATED

- FAN, INLINE
- CHILLER
- FILTER OR FILTER-SILENCER INLET AIR
- BOILER
- CHILLER

MIXERS

- MIXER
- DRAFT TUBE MIXER
- MIXER, INLINE STATIC

HEAT EXCHANGERS

- SHELL AND TUBE HEAT EXCHANGER
- HEAT EXCHANGER PLATE TYPE
- HEAT EXCHANGER SPIRAL TYPE
- HEAT EXCHANGER STRAIGHT TUBE TYPE
- HEAT EXCHANGER U-TUBE TYPE

GENERAL NOTES:

1. THIS DRAWING IS GENERAL IN NATURE. SOME SYMBOLS AND IDENTIFICATIONS SHOWN HEREON MAY NOT BE USED ON THE CONTRACT DRAWINGS.

Brown AND Caldwell
Seattle, Washington

CITY OF QUINCY
Opportunities Unlimited !

QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME P-000-0001-DP4-BC.DWG
BC PROJECT NUMBER 148860
QUINCY PROJECT NUMBER

PROCESS LEGEND AND SYMBOLS 1

DRAWING NUMBER
P-000-0001
SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4_5-I-P&IDS FILENAME: P-000-0001-DP4-BC.DWG PLOT DATE: 5/9/2016 8:55 AM CAD USER: KEN WESTERBERG
City of Quincy Logo.JPG

MISCELLANEOUS SYMBOLS

- M — MCC (MOTOR CONTROL/STARTER)
- P — PURGE OR FLUSHING DEVICE
- R — RESET FOR LATCH-TYPE OPERATOR
- C — SEAL WATER CONTROL UNIT
- E — ETHERNET COMMUNICATIONS
- I — INTERLOCKING OR CONTROL FUNCTION
- IS — INTRINSIC SAFETY BARRIER
- D — MOTOR DISCONNECT
- ANALOG INPUT
- ANALOG OUTPUT
- DISCRETE INPUT
- DISCRETE OUTPUT
- CAMERA (CCTV)
- VFD — VARIABLE FREQUENCY DRIVE
- SPD — SURGE PROTECTION DEVICE

ACTUATORS/MOTORS/POWER

- ASD — ADJUSTABLE SPEED DRIVE (MECHANICAL)
- ROTARY PISTON ACTUATORS, VALVE OR GATE
- LINEAR PISTON ACTUATORS, VALVE OR GATE
- S — SOLENOID ACTUATOR, VALVE
- MANUAL OR HAND ACTUATOR, VALVE OR GATE (OR BLANK)
- M — MOTOR (ACTUATOR, VALVE , GATE OR EQUIPMENT)
- ENGINE
- EJECTOR, PNEUMATIC
- GENERATOR

PRIMARY ELEMENT SYMBOLS

- ORIFICE PLATE/FLANGE
- VENTURI OR FLOW TUBE
- NOZZLE FLOW
- PITOT TUBE
- PROPELLER OR TURBINE METER
- FLUME
- WEIR
- VARIABLE AREA FLOW INDICATOR (ROTAMETER) (FI) — OR
- DIAPHRAGM SEAL
- IN-LINE ANNULAR SEAL
- M — MAGNETIC FLOWMETER
- SONIC FLOWMETER (DOPPLER OR TRANSIT TIME)
- POSITIVE DISPLACEMENT METER
- ΔT — THERMAL FLOW ELEMENT
- VORTEX FLOW ELEMENT
- CORIOLIS FLOW ELEMENT
- FLOAT LEVEL ELEMENT
- ULTRASONIC LEVEL ELEMENT
- BUBBLER LEVEL TUBE
- SUBMERSIBLE LEVEL TRANSMITTER
- HYDROSTATIC LEVEL PROBE
- RADAR LEVEL ELEMENT
- ANNUBAR, PITOT TUBE
- AVERAGING PITOT TUBE

VALVES

NORMALLY OPEN / NORMALLY CLOSED

- GATE VALVE
- PLUG VALVE
- BALL VALVE
- GLOBE VALVE
- NEEDLE VALVE
- KNIFE GATE VALVE
- DIAPHRAGM VALVE
- BUTTERFLY VALVE
- ANGLE VALVE
- THREE WAY VALVE
- FOUR WAY VALVE
- FLOAT VALVE
- PINCH VALVE
- BALANCING COCK
- THERMOSTATICALLY CONTROLLED VALVE
- DOUBLE LEAF CHECK VALVE
- CHECK VALVE
- BALL CHECK VALVE
- PUMP DISCHARGE VALVE
- GAUGE OR ROOT VALVE
- PRESSURE AND VACUUM RELIEF VALVE
- VACUUM RELIEF VALVE
- PRESSURE RELIEF VALVE
- IN-LINE SPRING LOADED RELIEF VALVE
- PRESSURE REGULATING VALVE (SELF-CONTAINED)
- BACK PRESSURE REGULATING VALVE (SELF-CONTAINED)
- FUSIBLE LINK
- S — SOLENOID VALVE
- DIAPHRAGM OPERATED VALVE
- PRESSURE BALANCE OPERATED VALVE
- M — MOTOR OPERATED VALVE
- M — MOTOR OPERATED VALVE, MODULATING

NOTE: USE VALVE BODY SYMBOL TO MATCH TYPE OF VALVE.

- PISTON OPERATED VALVE
- TELESCOPING VALVE
- MUD VALVE
- ANTI SIPHON VALVE
- LIFT CHECK VALVE

FUNCTION SYMBOLS

- SHARED DISPLAY, PROCESS CONTROL SYSTEM
- SOFTWARE FUNCTIONALITY
- FIELD OR PANEL DEVICE

LOCATION AND ACCESSIBILITY MODIFIERS FOR FUNCTION SYMBOLS

- STAND ALONE DEVICE, OPERATOR ACCESSIBLE
- LOCATED ON FRONT OF PANEL OR CONSOLE, OPERATOR ACCESSIBLE
- LOCATED IN REAR OF PANEL OR CONSOLE, OPERATOR INACCESSIBLE

INSTRUMENTATION SYMBOLS

- XXX XXX — INTEGRAL INSTRUMENT — PRIMARY ELEMENT SYMBOL
- XXX XXX — CLOSE COUPLED INSTRUMENT — PRIMARY ELEMENT SYMBOL
- XXX XXX — SEPARATE OR REMOTE MOUNTED INSTRUMENT — PRIMARY ELEMENT SYMBOL
- XXX XXX / XXX XXX / XXX XXX — MULTI VARIABLE INSTRUMENT
- XXX XXX — SEPARATE OR REMOTE MOUNTED INSTRUMENT — PRIMARY ELEMENT SYMBOL — FLANGE OR ELEMENT TAPS
- XXX XXX — SEPARATE OR REMOTE MOUNTED INSTRUMENT — PRIMARY ELEMENT SYMBOL — PIPE TAPS
- XXX XXX — SEPARATE OR REMOTE MOUNTED INSTRUMENT — PRIMARY ELEMENT SYMBOL — COMBINATION TAPS
- XXX XXX — SINGLE VARIABLE INSTRUMENT

SLIDE AND SLUICE GATES

NORMALLY OPEN / NORMALLY CLOSED

- FLAP GATE
- BUTTERFLY GATE (NO / NC)
- STOP GATE
- SLIDE GATE
- SLUICE GATE

GENERAL NOTES:

1. THIS DRAWING IS GENERAL IN NATURE. SOME SYMBOLS AND IDENTIFICATIONS SHOWN HEREON MAY NOT BE USED ON THE CONTRACT DRAWINGS.

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:	E. Voges
DRAWN:	K. Westerberg
CHECKED:	J. Thomas
CHECKED:	L. Lubke
APPROVED:	

FILENAME
P-000-0002-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

PROCESS LEGEND AND SYMBOLS 2

DRAWING NUMBER
P-000-0002

SHEET NUMBER
OF

FUNCTIONAL IDENTIFICATION

VARIABLE	MEASURED OR INITIATING VARIABLE DESCRIPTION	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION				
C	CONDUCTIVITY			CONTROL	CLOSE
D	DENSITY, SPECIFIC GRAVITY	DIFFERENTIAL			DEVIATION
E	VOLTAGE, SOLENOID		PRIMARY ELEMENT		
F	FLOW, FLOW RATE	RATIO			
G	FIRE, SMOKE		GLASS		
H	HAND				HIGH
I	CURRENT		INDICATE		
J	POWER		SCAN		
K	TIME, SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE, HUMIDITY, MOTION	MOMENTARY			MIDDLE, INTERMEDIATE
N	EQUIPMENT STATUS				
O	DISSOLVED OXYGEN		ORIFICE		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		RUN
S	SPEED, FREQUENCY	SAFETY		SWITCH	STOP
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE, TORQUE		WELL, PROBE		
X	UNCLASSIFIED	X AXIS			
Y	EVENT, STATE OR PRESENCE	Y AXIS		AUXILIARY DEVICES	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, FINAL CONTROL ELEMENT	

INSTRUMENT TAG AND LOOP IDENTIFICATION

P D I T — 1 2 3 4 5 A

- MEASURED OR INITIATING VARIABLE
- # MODIFIER WHEN REQUIRED
- SUCCEEDING LETTERS, - READOUT OR PASSIVE FUNCTION, OUTPUT FUNCTION, OR MODIFIER
- INSTRUMENT FUNCTIONAL IDENTIFICATION PER TABLE THIS SHEET
- UNIQUE LOOP NUMBER PER INSTRUMENT (# = OPTIONAL)
- # - ALPHABETICAL IDENTIFIER FOR LIKE INSTRUMENTS IN SAME LOOP
- LOOP IDENTIFIER ON SHEET
- NUMERIC IDENTIFIER FOR SIMILAR INSTRUMENTS IN RELATED PROCESSES OR LOOP
- AREA CODE TO WHICH LOOP BELONGS

EXAMPLE: PDIT 12345A # OPTIONAL

EQUIPMENT IDENTIFICATION SYSTEM

	AERATION BLOWER	EQUIPMENT NAME
	P XXXXX	EQUIPMENT NUMBER
OPTIONAL PER PROJECT	SPEC: 11486	SPECIFICATION REFERENCE
	TYPE: MULTIPLE STAGE CENTRIFUGAL	EQUIPMENT TYPE
	Q: 1500 SCFM	CAPACITY RATING
	HEAD: 5.5 PSIG	DISCHARGE PRESSURE RATING
	HP: 50	MOTOR POWER

INSTRUMENT SIGNAL LINES

- INSTRUMENT SUPPLY, PROCESS TAPS
- PNEUMATIC SIGNAL
- ELECTRICAL SIGNAL (ANALOG OR DISCRETE)
- FIELDBUS (DEVICENET OR FOUNDATION)
- CAPILLARY TUBE OR FILLED SYSTEM
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (UNGUIDED)
- SOFTWARE OR DATA LINK
- MECHANICAL LINK
- HYDRAULIC
- ES — ELECTRIC POWER SUPPLY 120 VAC 60 HZ UNLESS OTHERWISE NOTED. (e.g. 480V)
- SA — SERVICE AIR SUPPLY
- IA — INSTRUMENT QUALITY AIR SUPPLY
- C2 — WATER SUPPLY C1, C2, C3 ETC.

TYPICAL INSTRUMENT IDENTIFICATION

LP2 AIT 12345A DO F

- PANEL LOCATION #
- FUNCTIONAL IDENTIFICATION
- CONTROL AND MEASUREMENT NOTATIONS #
- FUNCTION SYMBOL
- LOOP NUMBER

= OPTIONAL

NETWORK TYPE	
F	FOUNDATION FIELDBUS
D	DEVICENET
E	ETHERNET
P	PROFIBUS
PN	PROFINET
M-RTU	MODBUS RTU
M-TCP	MODBUS TCP
CIP	CONTROL INDUSTRIAL PROTOCOL
E-SNMP	SIMPLE NETWORK MANAGEMENT PROTOCOL

PROCESS AND SIGNAL CROSS REFERENCE SYSTEM

WHEN A PROCESS LINE CROSSES FROM DRAWING TO DRAWING. THE P&ID DRAWING NUMBERS NEED TO BE REFERENCED. IN THIS EXAMPLE; PRIMARY EFFLUENT IS FLOWING FROM THE CLARIFIER TO THE AERATION BASIN ON A SEPARATE P&ID, SEE BELOW.

__" PE — P-350-0001 C — a — TO AERATION BASINS 5-8 — P&ID I-260-0001

C — P-260-0001 a — __" PE — FROM PRIMARY CLARIFIER 6 — P&ID I-350-0001

SHEET WHERE LINE CONTINUES TO/FROM

PROCESS DESCRIPTION OF WHERE LINE GOES TO/FROM

PROCESS DESCRIPTION OF WHERE LINE GOES TO/FROM

IF THERE ARE MULTIPLE LINES CROSSING THE SAME TWO P&ID DRAWINGS. IT IS ACCEPTABLE TO ADD A LETTER FOR CLARITY

A — P-XXX-XXXX b — a

Two-Way Arrow

PROCESS LINES

- NEW PRIMARY PROCESS FLOW
- NEW SECONDARY PROCESS FLOW
- NEW UTILITY PROCESS FLOW
- FUTURE
- EXISTING PROCESS FLOW, EQUIPMENT, OR SIGNAL PATH (SCREENED)
- NEW/EXISTING CONNECTIONS
- TEMPORARY PIPING
- PROCESS AREA
- VENDOR PACKAGE BOUNDARY

CONTROL AND MEASUREMENT NOTATIONS

ACK	ACKNOWLEDGE
AM	AUTO/MAN
BYP	BYPASS
CL	CLOSE
CL2	CHLORINE
CMAT	COMPUTER/MANUAL/AUTO/TRACKING
COMB	COMBUSTIBLE GAS
CP	CONTROL POWER
COND	CONDUCTIVITY
DEC	DECREASE
DO	DISSOLVED OXYGEN
ESP	EMERGENCY STOP
FWD	FORWARD
F/R	FORWARD/REVERSE
F/S	FAST/SLOW
HLOA	HIGH/LOW/OFF/AUTO
HOA	HAND/OFF/AUTO
HOAL	HAND/OFF/AUTO/LOCAL
HOR	HAND/OFF/REMOTE
INC	INCREASE
JOA	JOG/OFF/AUTO
LL	LEAD/LAG
LOR	LOCAL/OFF/REMOTE
LOS	LOCKOUT STOP
L/R	LOCAL/REMOTE
M/A LS	MAN/AUTO LOADING STATION
OCA	OPEN/CLOSE/AUTO
OCP	PURGE VALVE OP/CL/PC
OL	OVERLOAD
OP	OPEN
OSC/LR	OPEN/STOP/CLOSE WITH LOCAL/REMOTE SELECT
PA	PAUSE
PAL	LOW PRESSURE
PB	PUSH BUTTON
pH	pH
POT	POTENTIOMETER
RDY	READY
REV	REVERSE
RNG	RUNNING
ROF	REVERSE/OFF/FORWARD
RST	RESET
SO2	SULFUR DIOXIDE
SP	STOP
ST	START
TCP	TEST/CLOSE/PC
T/S	TEST/NORMAL/SILENCE
TBL	TROUBLE
TSS	TOTAL SUSPENDED SOLIDS

GENERAL NOTES:

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Seattle, Washington

CITY OF QUINCY
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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

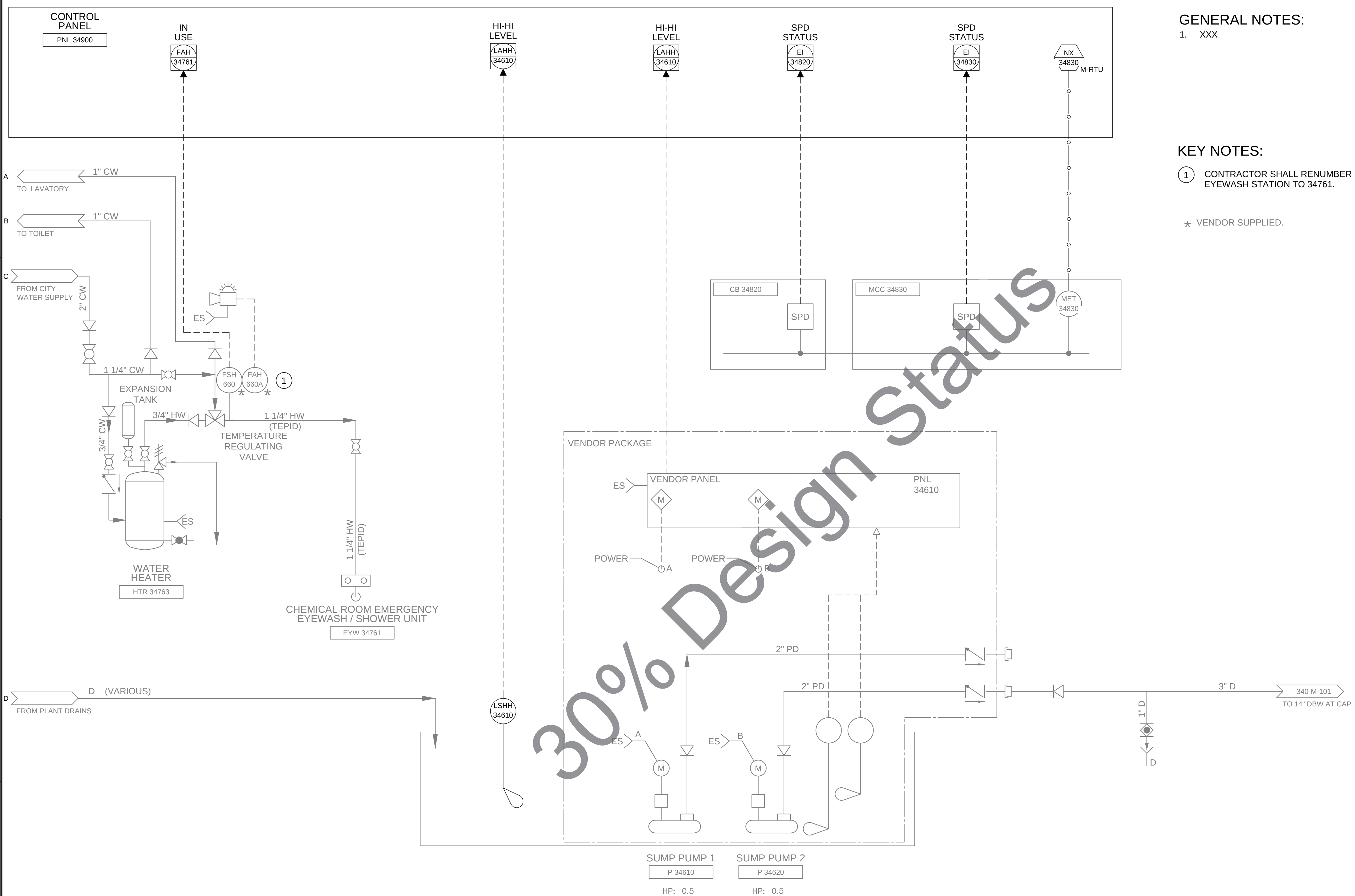
DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME P-000-0003-DP4-BC.DWG
BC PROJECT NUMBER 148860
QUINCY PROJECT NUMBER

PROCESS
LEGEND AND SYMBOLS 3

DRAWING NUMBER
P-000-0003
SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\6-P-PROC FILENAME: P-000-0003-DP4-BC.DWG PLOT DATE: 5/12/2016 8:18 AM CAD USER: KEN WESTERBERG
City of Quincy Logo.JPG



GENERAL NOTES:

1. XXX

KEY NOTES:

(1) CONTRACTOR SHALL RENUMBER EXISTING SWITCH BY EYEWASH STATION TO 34761.

* VENDOR SUPPLIED.

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

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LINE IS 2 INCHES AT FULL SIZE

DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME
P-340-0006-DP4-BC.DWG

BC PROJECT NUMBER
148860

QUINCY PROJECT NUMBER

PROCESS

EMERGENCY EYEWASH / SHOWERS SUMP PUMPS & POWER DISTRIBUTION REUSE FILTER BUILDING

DRAWING NUMBER
P-340-0006

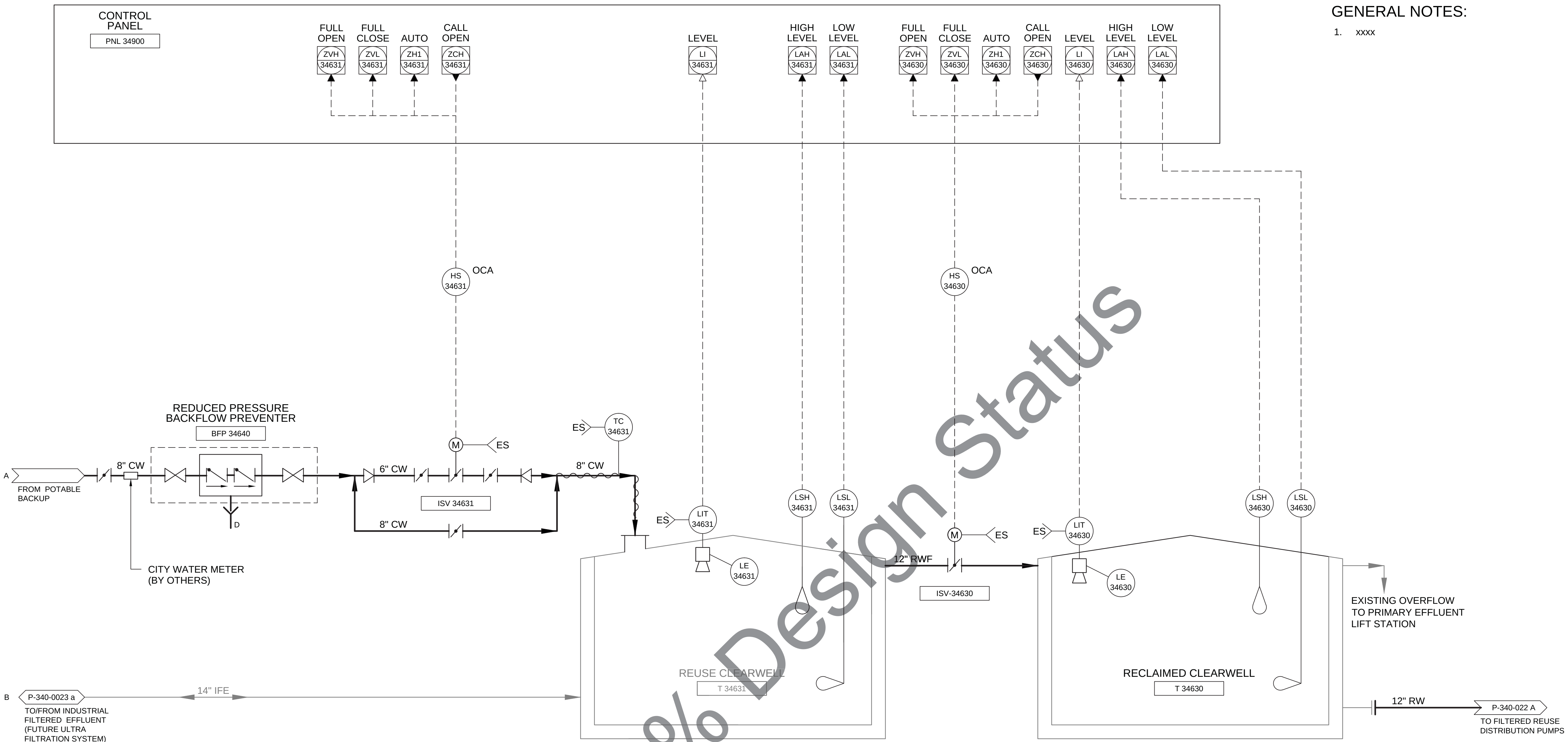
SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4_5-I-P&IDS FILENAME: P-340-0006-DP4-BC.DWG PLOT DATE: 5/10/2016 10:36 AM CAD USER: KEN WESTERBERG

City of Quincy Logo.JPG

GENERAL NOTES:

1. xxxx



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QUINCY 1WATER
IRWTP REVERSE
OSMOSIS SYSTEM
DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME
P-340-0021-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

PROCESS
CLEARWELLS

DRAWING NUMBER
P-340-0021

SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\07656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4_5-I-P&IDS FILENAME: P-340-0021-DP4-BC.DWG PLOT DATE: 5/10/2016 10:47 AM CAD USER: KEN WESTERBERG

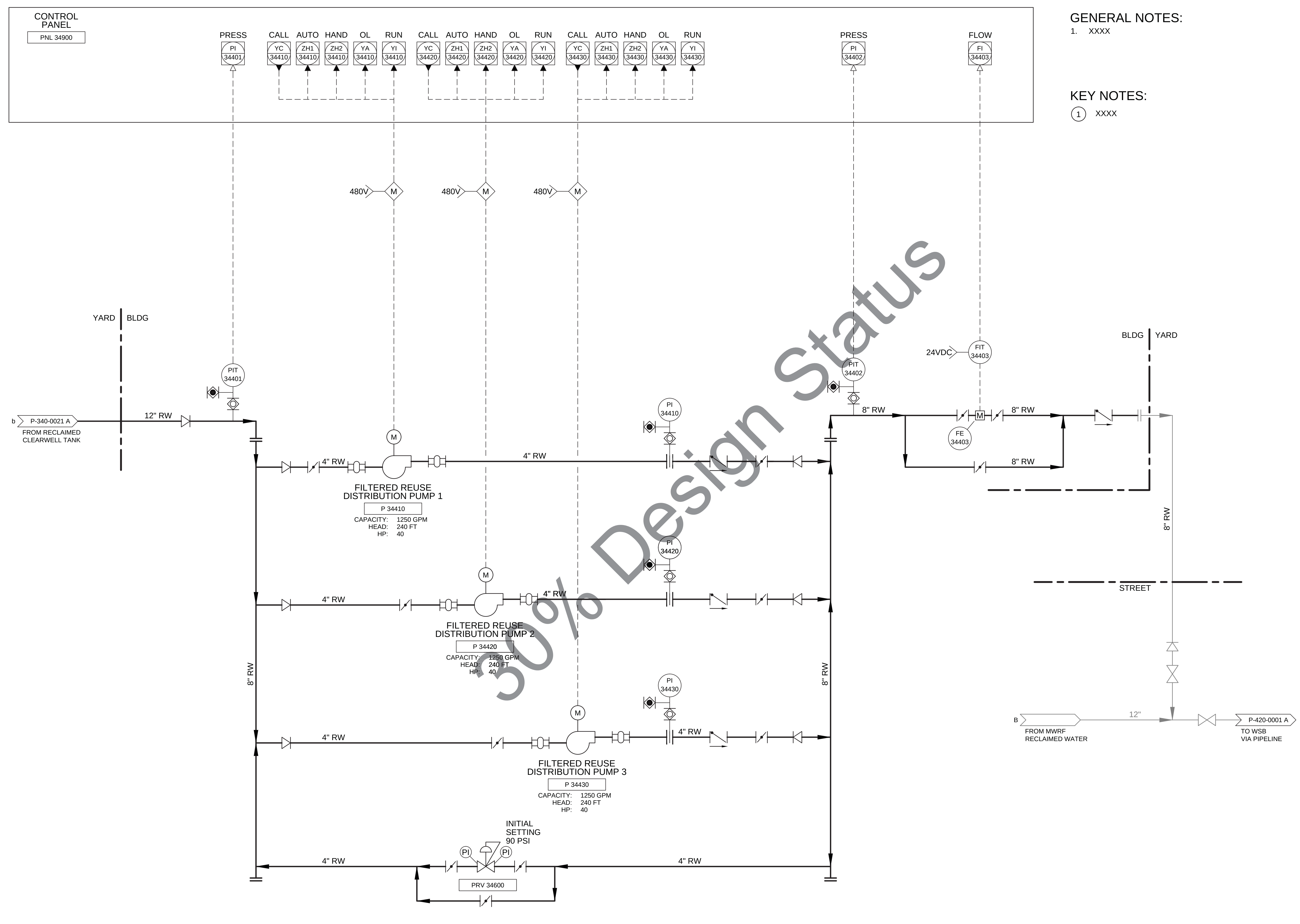
City of Quincy Logo.JPG

GENERAL NOTES:

1. XXXX

KEY NOTES:

(1) XXXX



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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS		
REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

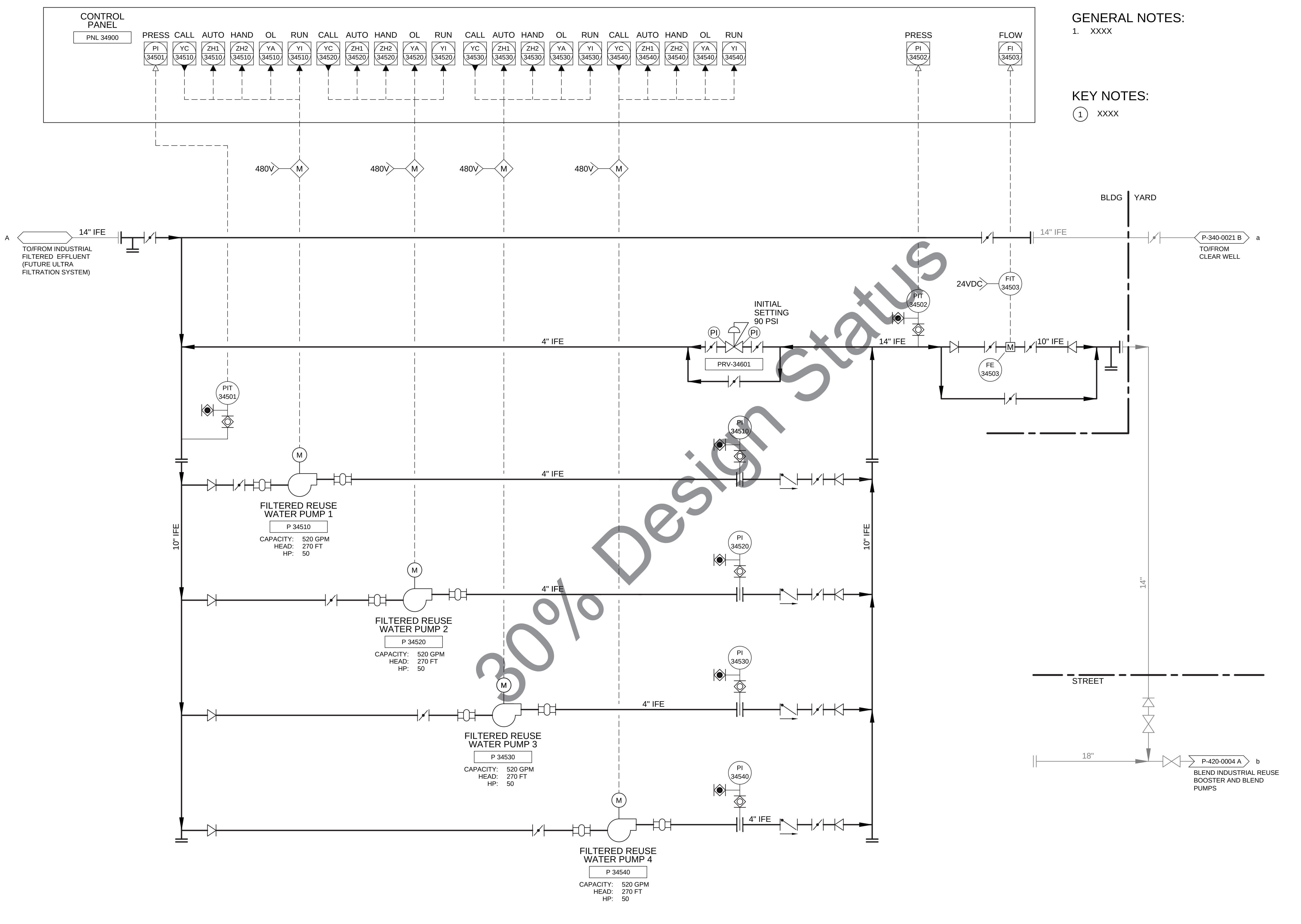
FILENAME
P-340-0022-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

PROCESS

REUSE FILTER DISTRIBUTION PUMPS
REUSE FILTER BUILDING

DRAWING NUMBER
P-340-0022

SHEET NUMBER
OF



GENERAL NOTES:

1. XXXX

KEY NOTES:

(1) XXXX

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Seattle, Washington

CITY OF QUINCY
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QUINCY 1WATER
IRWTP REVERSE
OSMOSIS SYSTEM
DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME
P-340-0023-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

PROCESS

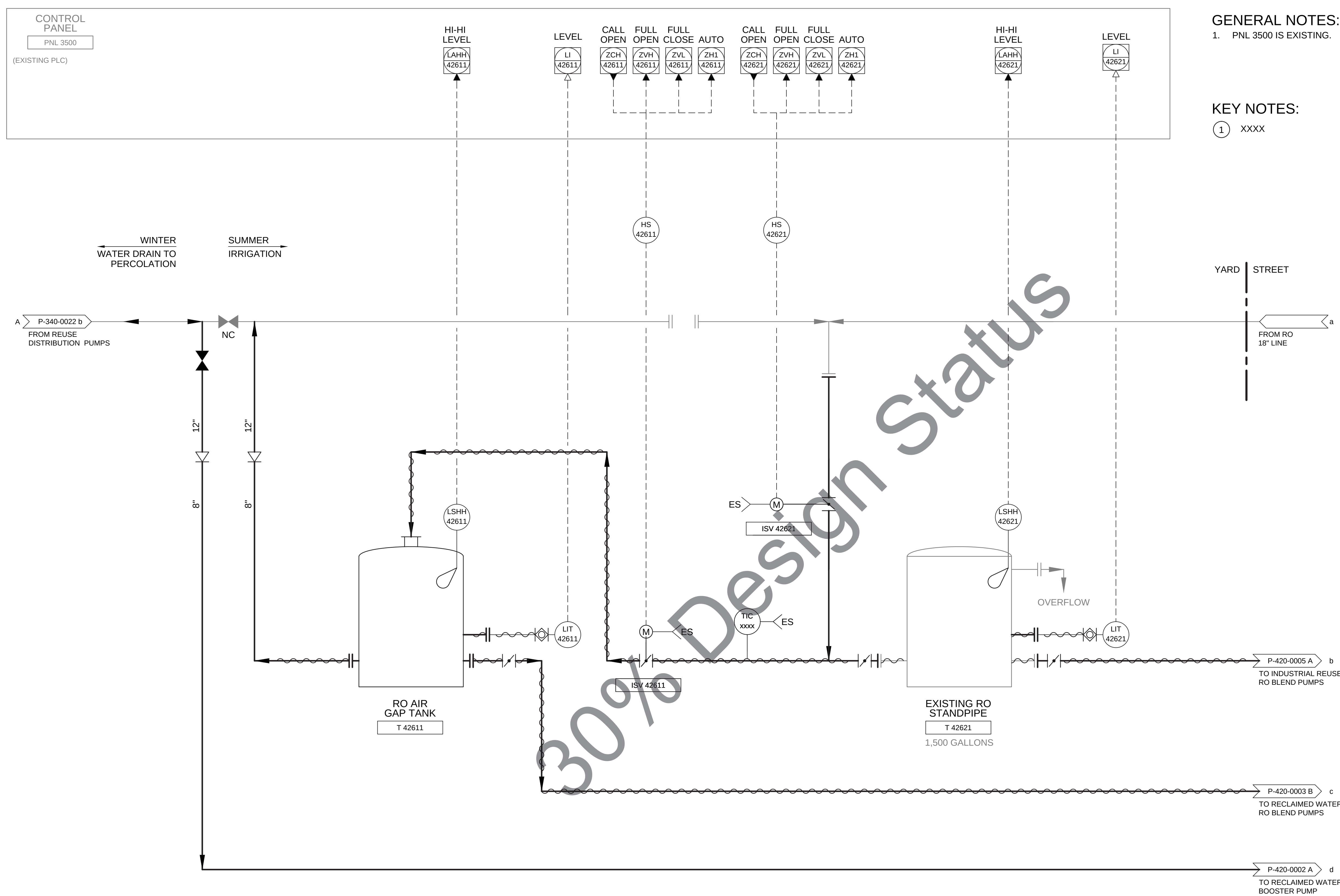
REUSE FILTER
WATER PUMPS
REUSE FILTER
BUILDING

DRAWING NUMBER
P-340-0023

SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\07656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4_5-I-P&IDS FILENAME: P-340-0023-DP4-BC.DWG PLOT DATE: 5/9/2016 9:03 AM CAD USER: KEN WESTERBERG

City of Quincy Logo.JPG



GENERAL NOTES:

1. PNL 3500 IS EXISTING.

KEY NOTES:

(1) XXXX

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

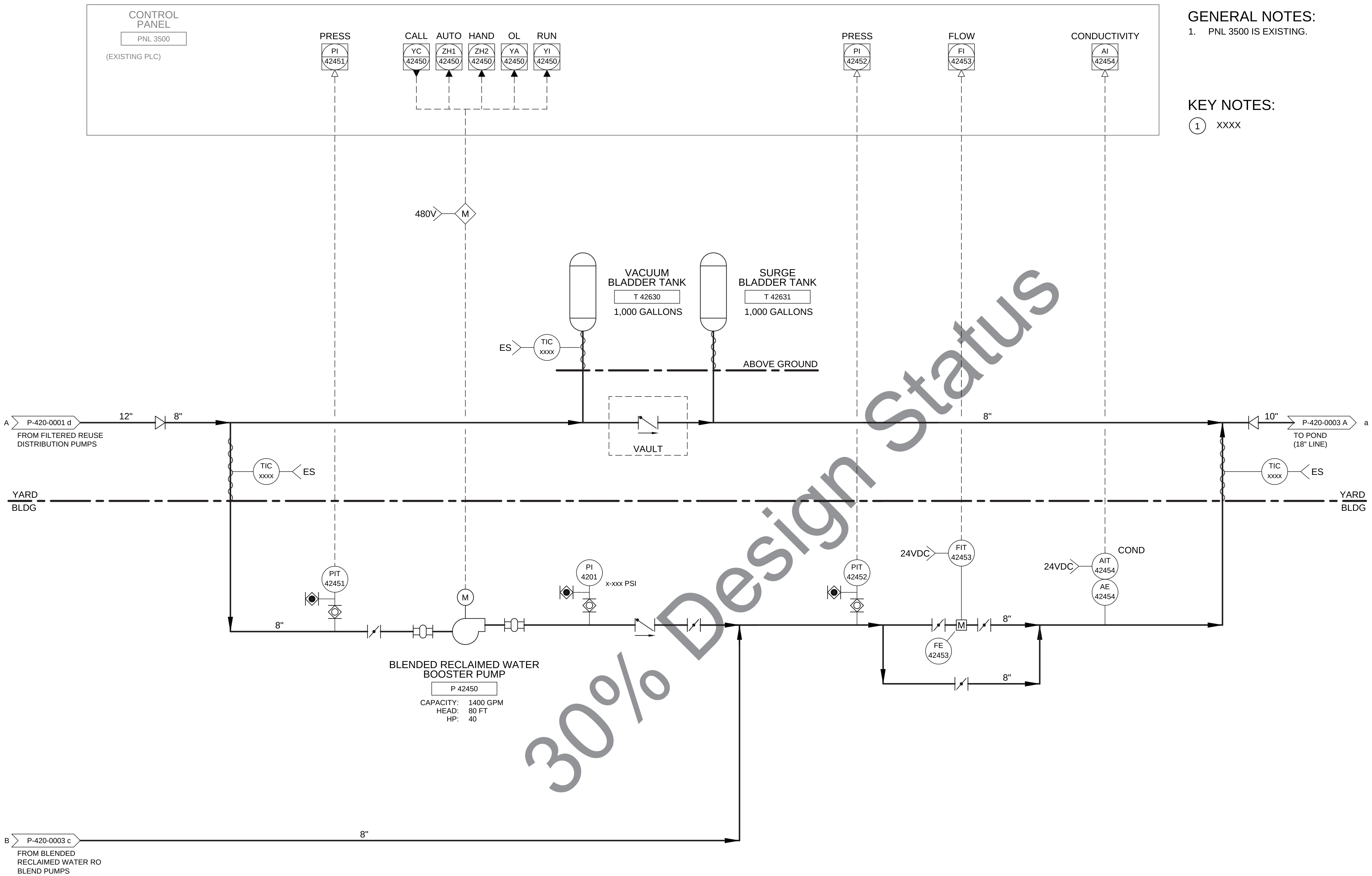
DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME
P-420-0001-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

PROCESS

FILTERED REUSE DISTRIBUTION TANKS

DRAWING NUMBER
P-420-0001
SHEET NUMBER
OF



GENERAL NOTES:

1. PNL 3500 IS EXISTING.

KEY NOTES:

(1) XXXX

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

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A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: E. Voges
DRAWN: K. Westerberg
CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME
P-420-0002-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

PROCESS
BLENDED RECLAIMED WATER BOOSTER PUMP WATER SOFTENER BUILDING

DRAWING NUMBER
P-420-0002

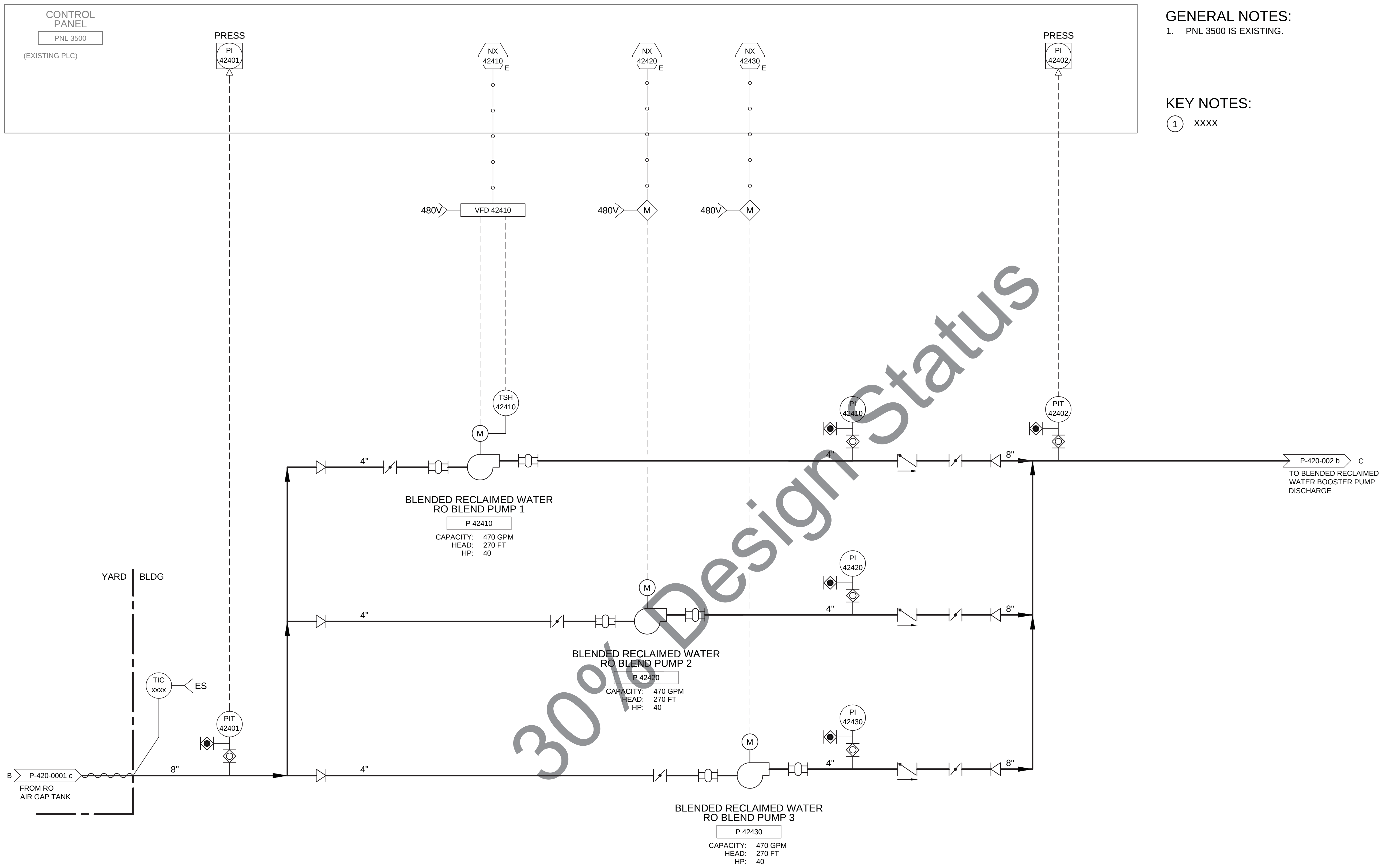
SHEET NUMBER
OF

GENERAL NOTES:

1. PNL 3500 IS EXISTING.

KEY NOTES:

(1) XXXX



30% Design Status

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

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CHECKED: L. Lubke
APPROVED:

FILENAME P-420-0003-DP4-BC.DWG
BC PROJECT NUMBER 148860
QUINCY PROJECT NUMBER

PROCESS

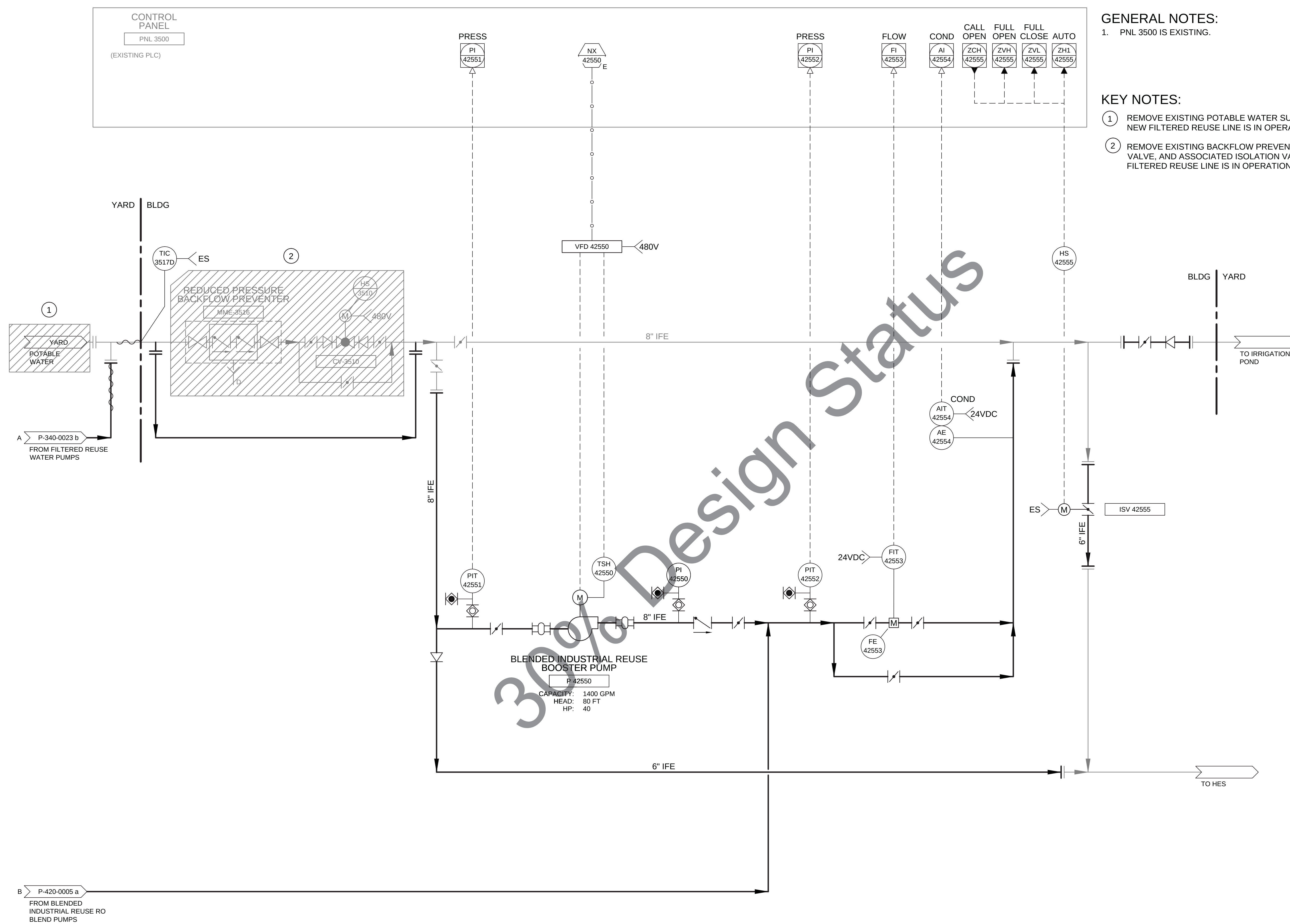
BLENDED RECLAIMED WATER RO BLEND PUMPS WATER SOFTENER BUILDING

DRAWING NUMBER
P-420-0003

SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\6-P-PROC FILENAME: P-420-0003-DP4-BC.DWG PLOT DATE: 5/12/2016 8:21 AM CAD USER: KEN WESTERBERG

City of Quincy Logo.JPG



GENERAL NOTES:

1. PNL 3500 IS EXISTING.

KEY NOTES:

1. REMOVE EXISTING POTABLE WATER SUPPLY LINE AFTER NEW FILTERED REUSE LINE IS IN OPERATION.
2. REMOVE EXISTING BACKFLOW PREVENTER, CONTROL VALVE, AND ASSOCIATED ISOLATION VALVES AFTER NEW FILTERED REUSE LINE IS IN OPERATION.

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

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CHECKED: J. Thomas
CHECKED: L. Lubke
APPROVED:

FILENAME P-420-0004-DP4-BC.DWG
BC PROJECT NUMBER 148860
QUINCY PROJECT NUMBER

PROCESS

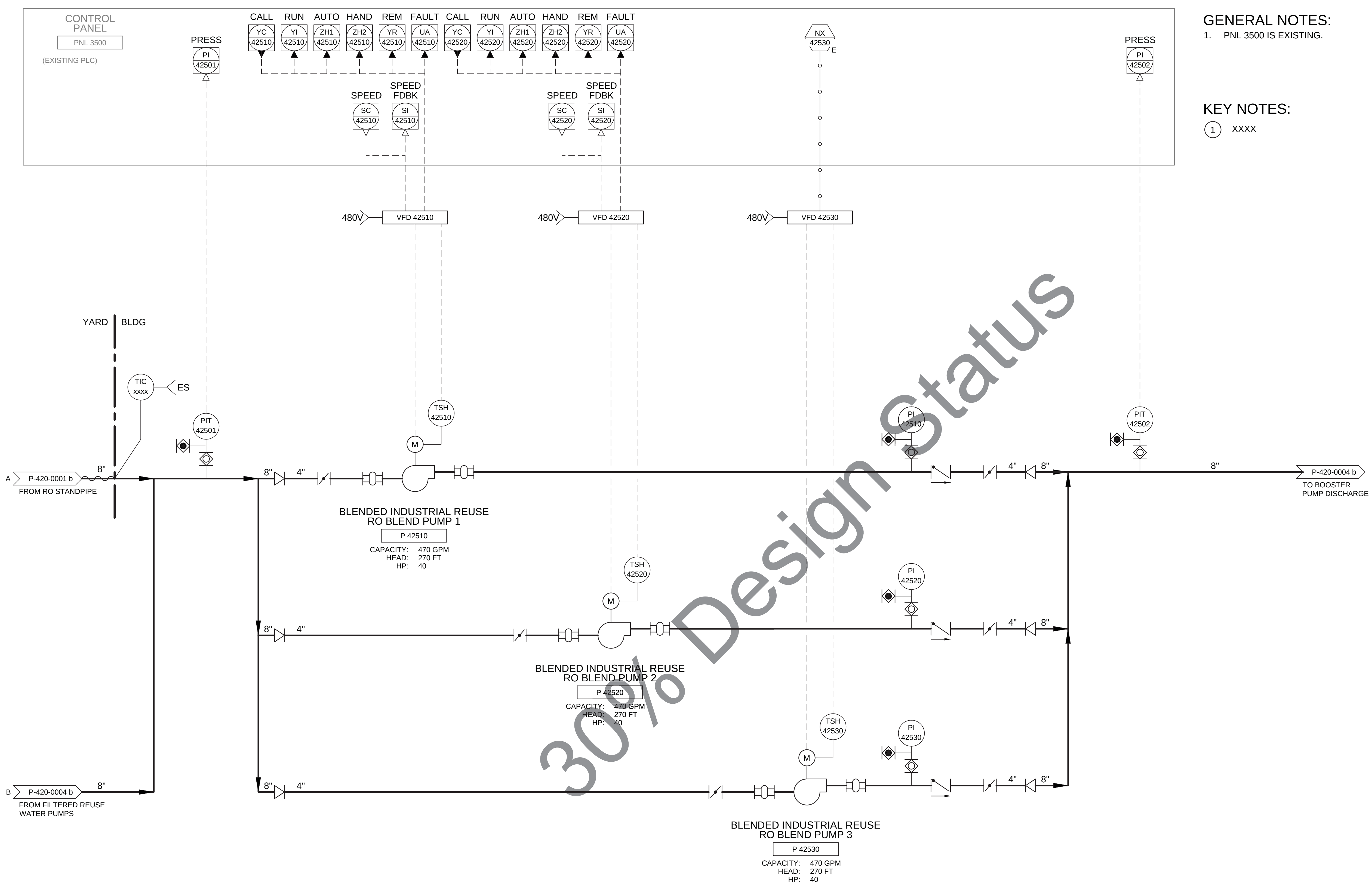
BLENDED INDUSTRIAL REUSE BOOSTER PUMP WATER SOFTENER BUILDING

DRAWING NUMBER

P-420-0004

SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\6-P-PROC FILENAME: P-420-0004-DP4-BC.DWG PLOT DATE: 5/12/2016 8:23 AM CAD USER: KEN WESTERBERG
City of Quincy Logo.JPG



GENERAL NOTES:

1. PNL 3500 IS EXISTING.

KEY NOTES:

(1) XXXX

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\6-P-PROC FILENAME: P-420-0005-DP4-BC.DWG PLOT DATE: 5/12/2016 8:25 AM CAD USER: KEN WESTERBERG

City of Quincy Logo.JPG

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

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A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

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APPROVED:

FILENAME
P-420-0005-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

PROCESS

BLENDED INDUSTRIAL REUSE RO BLEND PUMPS WATER SOFTENER BUILDING

DRAWING NUMBER

P-420-0005

SHEET NUMBER
OF

VALVES

3D PLAN OR ELEVATION	SCHEMATIC OR 2D	VALVE TYPE
		THREE WAY VALVE
		GATE VALVE (FLANGED)
		GATE VALVE (THREADED)
		PLUG VALVE (GEAR OPERATOR)
		PLUG VALVE (LEVER HANDLE)
		BALL VALVE (THREADED)
		BALL VALVE (FLANGED)
		BUTTERFLY VALVE (LUGGED/WAFER)
		BUTTERFLY VALVE (AWWA W/ HANDWHEEL ACTUATOR)
		GLOBE VALVE (FLANGED)
		GLOBE VALVE (THREADED)
		DIAPHRAGM VALVE (FLANGED)
		DIAPHRAGM VALVE (THREADED)
		CHECK VALVE
		PUMP DISCHARGE VALVE
		DOUBLE LEAF CHECK VALVE
		ANGLE VALVE
		FLOAT VALVE
		PINCH VALVE
		FUSIBLE LINK VALVE
		NEEDLE VALVE
		BALL CHECK VALVE

3D PLAN OR ELEVATION	SCHEMATIC OR 2D	VALVE TYPE
		GAUGE OR ROOT VALVE
		KNIFE GATE VALVE
		FLAP GATE
		BALANCING COCK
		CIRCUIT SETTER
		THERMOSTATICALLY CONTROLLED VALVE
		PRESSURE AND VACUUM RELIEF VALVE
		VACUUM RELIEF VALVE
		PRESSURE RELIEF VALVE
		IN-LINE, SPRING LOADED RELIEF VALVE
		PRESSURE REGULATING VALVE
		BACK PRESSURE REGULATING VALVE
	S	SOLENOID VALVE
		DIAPHRAGM OPERATED VALVE
		PRESSURE BALANCE OPERATED VALVE
	M	MOTOR OPERATED VALVE
		PISTON OPERATED VALVE
		CHLORINE INSTITUTE CONTAINER VALVE
		MUD VALVE
		WALL HYDRANT
		TELESCOPING VALVE

MECHANICAL PIPE AND FITTINGS

2D SINGLE LINE	2D DOUBLE LINE	3D DOUBLE LINE	
			FLANGED JOINT
		OR	PLAIN OR GROOVED END MECHANICAL COUPLING
			PUSH ON OR BALL AND SOCKET JOINT
			MECHANICAL JOINT
			WELDED JOINT
			GROOVED END ADAPTER FLANGE x FLANGE
			UNION
			SLEEVE TYPE MECHANICAL COUPLING
			RESTRAINED SLEEVE TYPE MECHANICAL COUPLING
			FLANGED COUPLING ADAPTER
			RESTRAINED FLANGED COUPLING ADAPTER
			ELASTOMER AND FABRIC EXPANSION JOINT
			EXPANSION JOINT (SEE SPECS FOR TYPE)
			FLEXIBLE METAL HOSE
			ELBOW (PLAN)
			ELBOW UP
			ELBOW DOWN
			TEE (PLAN)
			TEE UP
			TEE DOWN
			LATERAL (PLAN)
			LATERAL UP
			LATERAL DOWN
			CONCENTRIC REDUCER
			ECCENTRIC REDUCER
			EQUIPMENT CONNECTION FITTING
			BLIND FLANGE OR CAP

MISCELLANEOUS DEVICES

A	UTILITY STATION (LETTER, IF ANY, DESIGNATES TYPE)
	HOSE RACK
	FLOOR DRAIN
XCO	CLEANOUT; X=DESIGNATION IF ANY
XKIP	RECOMMENDED MAIN ANCHOR POINT WITH ALLOWABLE FORCE ON STRUCTURE
	PIPE ANCHOR
W	SEAL WATER CONTROL UNIT
	QUICK COUPLING
	IN LINE PRESSURE SENSOR

XX	INSTRUMENT
DE	DENSITY ELEMENT
FE	FLOW ELEMENT
LE	LEVEL ELEMENT
PE	PRESSURE ELEMENT
PI	PRESSURE INDICATOR (GAUGE)
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR

	CALIBRATION TUBE
	PULSATION DAMPENER

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
	--	--

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

FILENAME M-000-0001-DP4-BC.DWG
BC PROJECT NUMBER 148860
QUINCY PROJECT NUMBER

MECHANICAL SYMBOLS

DRAWING NUMBER
M-000-0001
SHEET NUMBER
OF

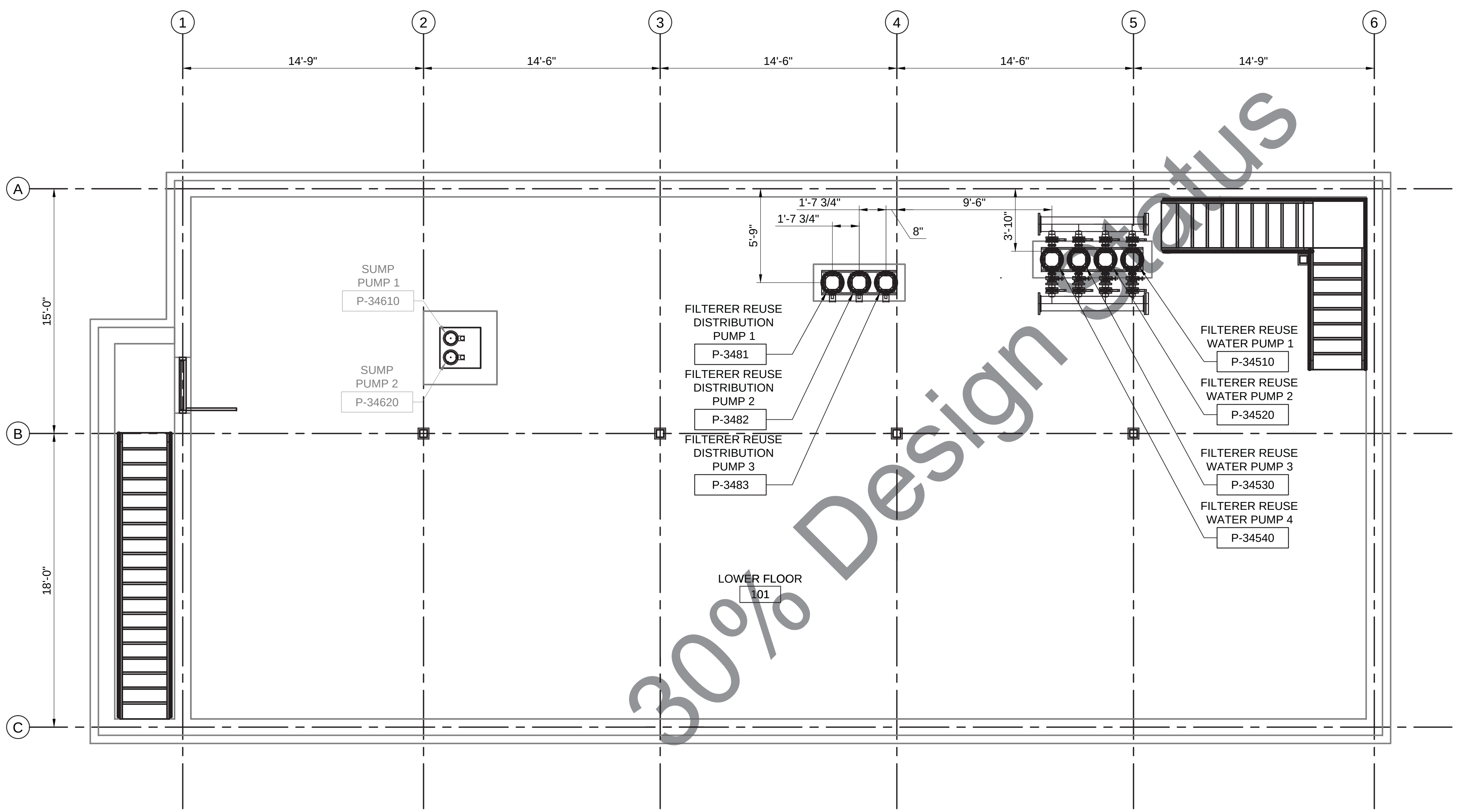
Path: P:\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\7-M-MECH FILENAME: M-000-0001-DP4-BC.DWG PLOT DATE: 5/16/2016 12:30 PM CAD USER: TOM LEMON
City of Quincy Logo.JPG

GENERAL SHEET NOTES

1. GENERAL SHEET NOTES FOLLOW ANY OTHER GENERAL NOTE TYPES HAT MAY APPEAR IN THE NOTE BLOCK.
2. GENERAL SHEET NOTES APPLY ONLY TO THE SHEET ON WHI9CH THEY APPEAR.
3. MTEXT USED WITH LINE SPACING SET TO EXACT. SET TAB SPACING TO 0.375-INCHES.

KEY NOTES:

1 SHEET KEYNOTES FOLLOW ANY OTHER GENERAL NOTE TYPES THAT MAY APPEAR IN THE NOTE BLOCK.
2. KEY NOTE BUBBLES INSERTED ON LAYER G-ANNO-IDEN.



GENERAL ARRANGEMENT PLAN

SCALE: 1/4" = 1'-0"

KEY PLAN

SCALE: NONE

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
	--	--

LINE IS 2 INCHES AT FULL SIZE

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APPROVED:

FILENAME M-340-0001-DP4-BC.DWG
BC PROJECT NUMBER 148860
QUINCY PROJECT NUMBER

MECHANICAL

REUSE FILTER BUILDING BASEMENT GENERAL ARRANGEMENT

DRAWING NUMBER
M-340-0001

SHEET NUMBER
OF

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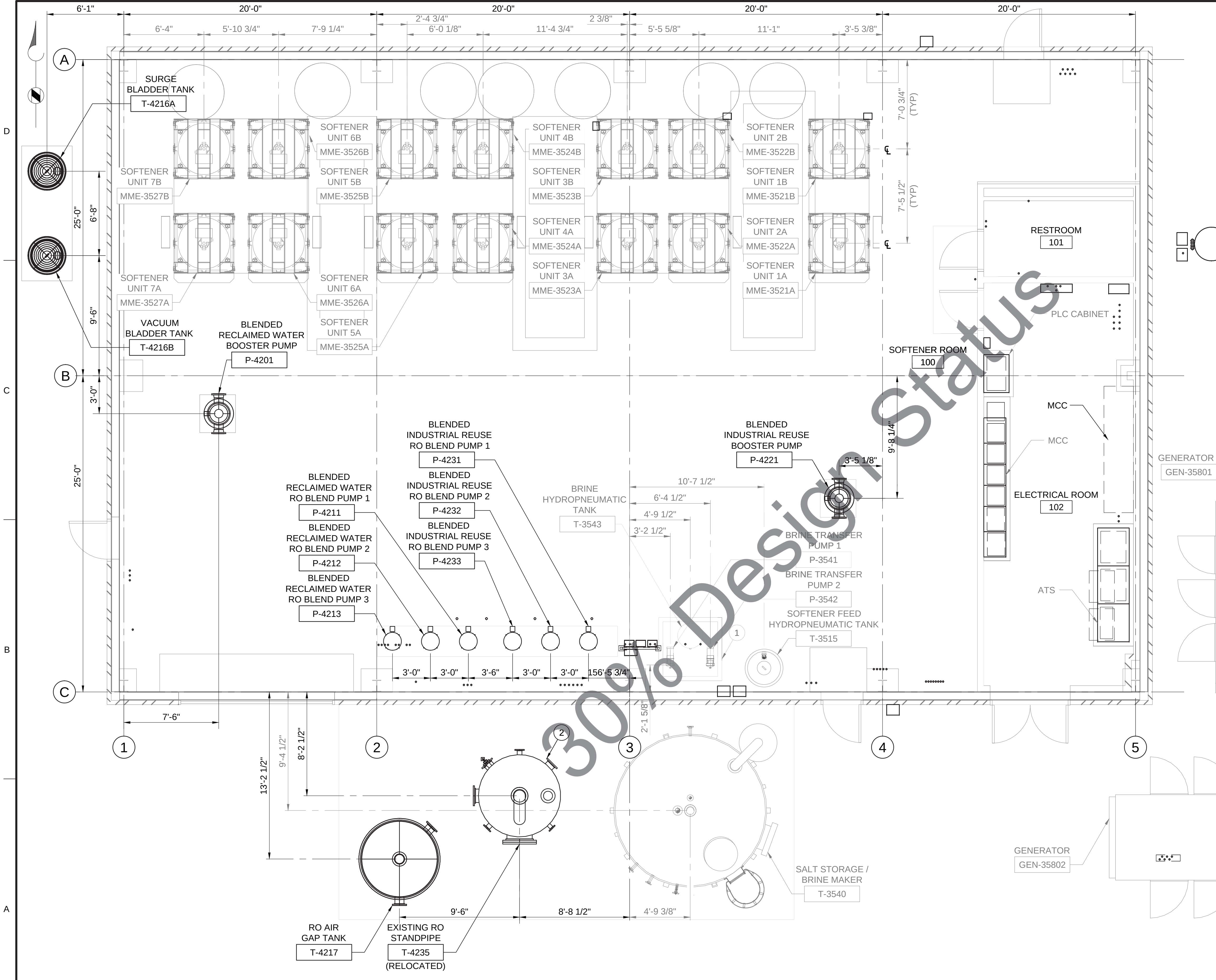

GENERAL ARRANGEMENT PLAN

SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

1. XXX

KEY NOTES:

1. BRINE TRANSFER PUMPS EQUIPMENT PAD 5'-0" L x 5'-0" W x 15 1/4" H. WITH 4" CURB ALL AROUND.
2. SOFTENER STANDPIPE TO BE HEAT TRACED AND INSULATED. SEE 000-M-001 FOR INSULATION SPEC AND ELECTRICAL DRAWINGS FOR HEAT TRACING.

KEY PLAN

SCALE: NONE

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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
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DESIGNED:
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CHECKED:
APPROVED:

FILENAME M-350-0001-DP4-BC.DWG
BC PROJECT NUMBER 148621
QUINCY PROJECT NUMBER

MECHANICAL

WATER SOFTENER BUILDING GENERAL ARRANGEMENT PLAN

DRAWING NUMBER
M-350-0001

SHEET NUMBER
OF

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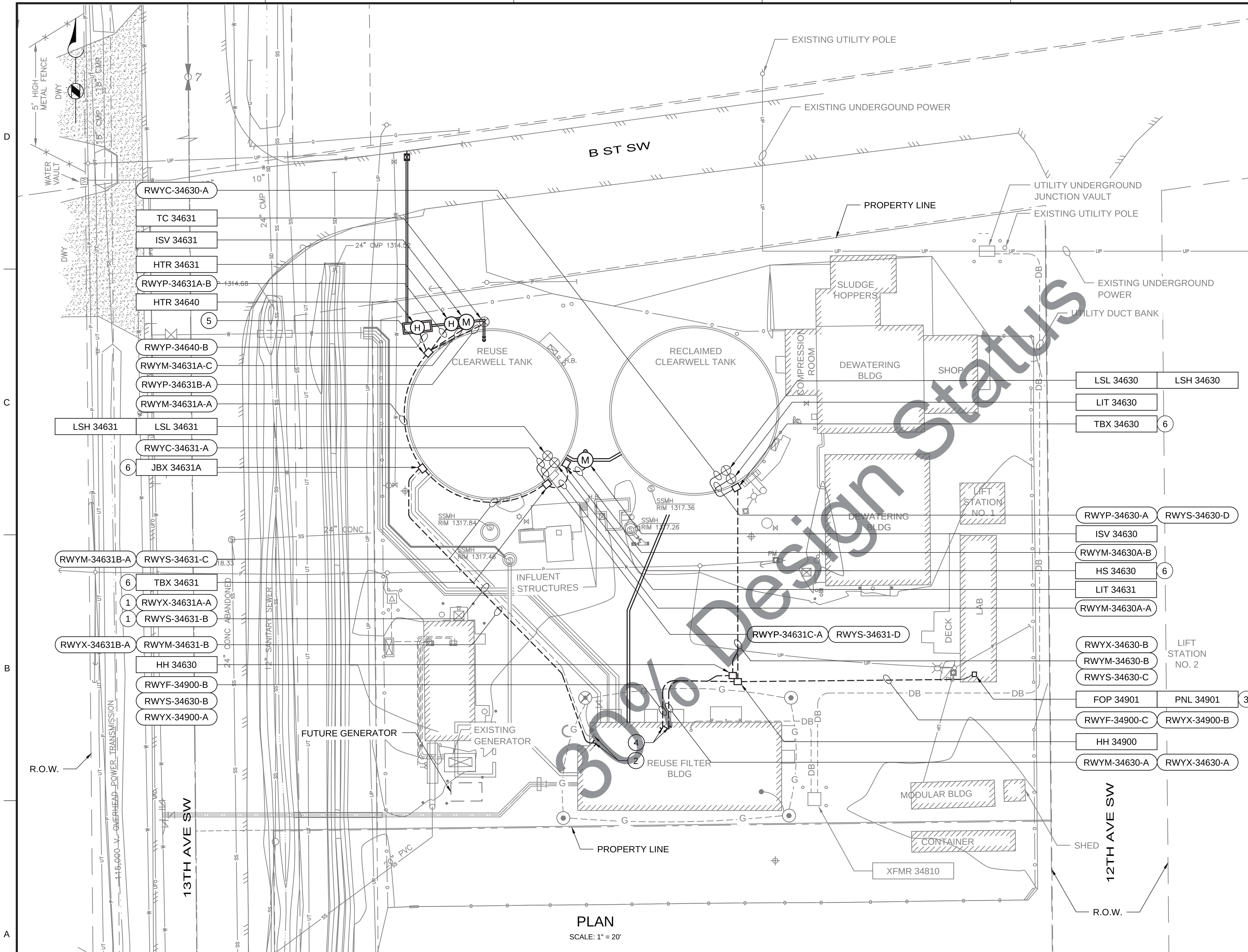
City of Quincy Logo.JPG



PLAN

SCALE: 1" = 20'

GENERAL SHEET NOTES

1. EXISTING UNDERGROUND UTILITIES OBTAINED FROM AS-BUILTS. CONTRACTOR SHALL FIELD VERIFY DEPTH AND LOCATION OF ALL CONSTRUCTION CROSSINGS PRIOR TO EXCAVATION.
2. UNLESS OTHERWISE SPECIFIED MAINTAIN A MINIMUM OF 36" COVER FOR ELECTRICAL DUCTBANKS ABOVE 600V. MAINTAIN A MINIMUM OF 24" COVER FOR ELECTRICAL DUCTBANKS BELOW 600V.
3. COORDINATE ELECTRICAL SITE WORK WITH OTHER SPECIFIED SITE WORK, SEE CIVIL DRAWINGS. CONTRACTOR SHALL PROTECT EXISTING UTILITIES DURING CONSTRUCTION.
4. SWAB AND CLEAN ALL EXISTING RACEWAYS PRIOR TO PULLING NEW CABLES.

KEY NOTES

1. RE-LABEL EXISTING RACEWAY WITH NEW RACEWAY TAG NUMBER.
2. SEE DRAWING E-340-0101 FOR CONTINUATION.
3. COORDINATE WITH OWNER TO FIELD LOCATE FOP 34901 AND PNL 34901. RACEWAY TO STUB UP OUTSIDE OF LAB BUILDING AND PENETRATE EXTERIOR WALL VIA ELBOW. ADHERE TO FIBER OPTIC CABLE BENDING RADIUS REQUIREMENTS.
4. SEE DRAWING E-340-0111 FOR CONTINUATION.
5. MOUNT THE FOLLOWING EQUIPMENT ON UNISTRUT RACK PER DRAWING E-000-XXXX, DETAIL X:
    1. JBX 34631B
    2. DISC 34640
    3. DISC 34631
    4. HS 34631

   FIELD DETERMINE RACEWAY ROUTING ON UNISTRUT RACK FOR THE FOLLOWING RACEWAYS:
    1. RWYP-34640-A
    2. RWYP-34631A-A
    3. RWYM-34631B-B
6. MOUNT EQUIPMENT ON MOUNTING STAND PER DRAWING E-000-XXX, DETAIL X.

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1WATER UTILITY
PHASE 3
DESIGN PACKAGE 4
REUSE WATER
DISTRIBUTION
PUMPING SYSTEMS

REVISIONS

REV	DATE	DESCRIPTION
	--	--

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: J. THOMAS
DRAWN: J. THOMAS
CHECKED:
CHECKED:
APPROVED:

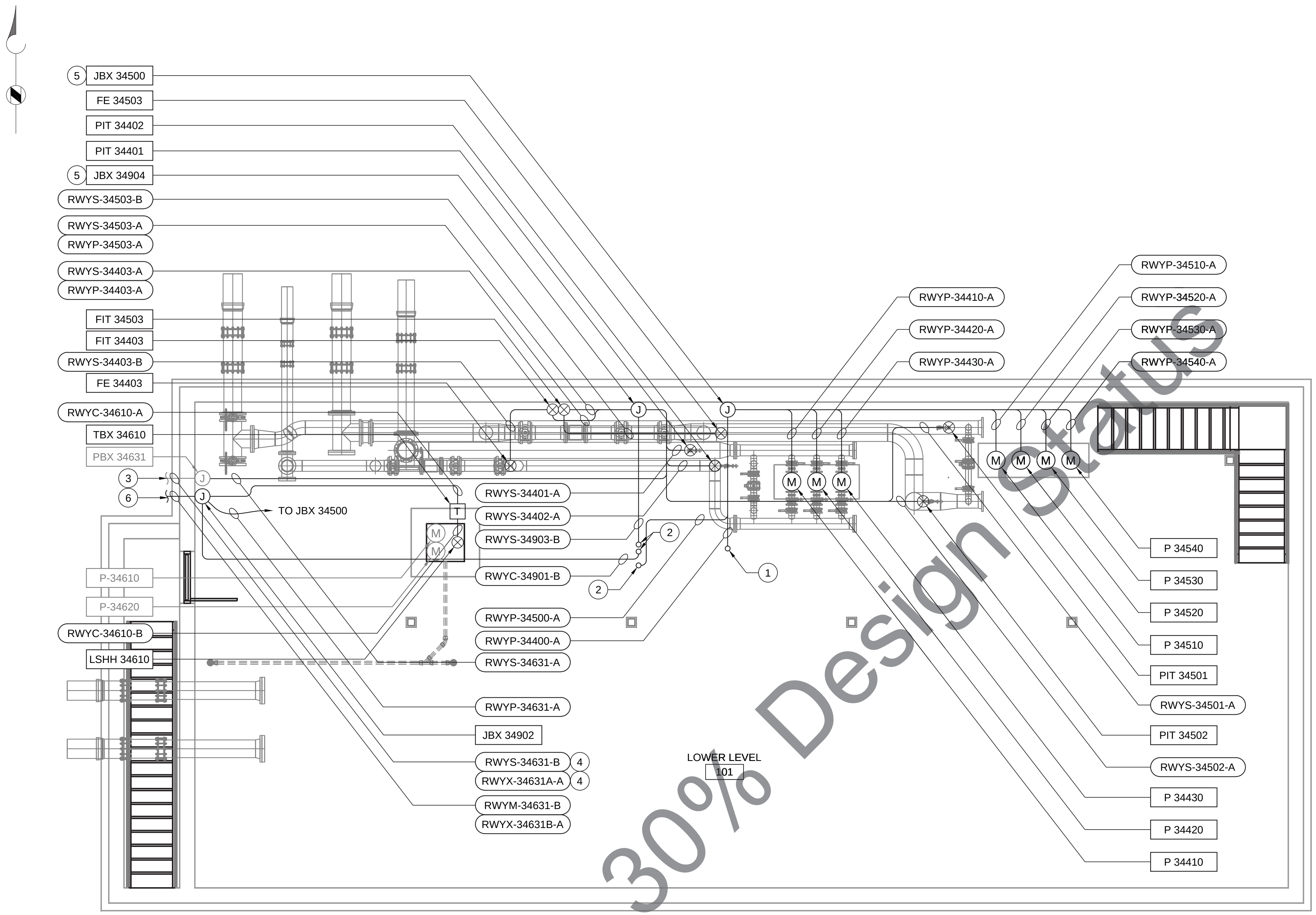
FILENAME
E-340-0001-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

ELECTRICAL

REUSE FILTER
BUILDING
SITE PLAN

DRAWING NUMBER
E-340-0001

SHEET NUMBER
OF



LOWER LEVEL PLAN

SCALE: 1/4" = 1'-0"

GENERAL SHEET NOTES

1. XXXX

KEY NOTES

1. USE EXISTING 4" PENETRATION TO ENTER BOTTOM OF NEW MCC SECTION IN MAIN LEVEL ELECTRICAL ROOM.
2. USE EXISTING 4" STUB-UP TO ENTER MAIN LEVEL ELECTRICAL ROOM AT EASTERN END OF EQUIPMENT PAD.
3. SEE DRAWING E-340-0001 FOR CONTINUATION.
4. RE-LABEL EXISTING RACEWAY WITH NEW RACEWAY TAG NUMBER.
5. FIELD LOCATE JUNCTION BOX IN ACCESSIBLE LOCATION AND AVOID CONFLICTS WITH NEW PROCESS PIPING SPECIFIED ON DRAWINGS.
6. RACEWAYS ENTER BUILDING BELOW GRADE. PENETRATE WALL TO ENTER BACK OF JBX 34902. SEE DRAWING E-340-0001 FOR CONTINUATION.

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1WATER UTILITY PHASE 3 DESIGN PACKAGE 4 REUSE WATER DISTRIBUTION PUMPING SYSTEMS

REVISIONS

REV	DATE	DESCRIPTION
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LINE IS 2 INCHES AT FULL SIZE

DESIGNED: J. THOMAS
DRAWN: J. THOMAS
CHECKED:
CHECKED:
APPROVED:

FILENAME
E-340-0101-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

ELECTRICAL

REUSE FILTER BUILDING LOWER LEVEL POWER, CONTROL, AND SIGNAL PLAN

DRAWING NUMBER
E-340-0101

SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\9-E-ELEC FILENAME: E-340-0101-DP4-BC.DWG PLOT DATE: 5/13/2016 12:25 PM CAD USER: JOHN THOMAS
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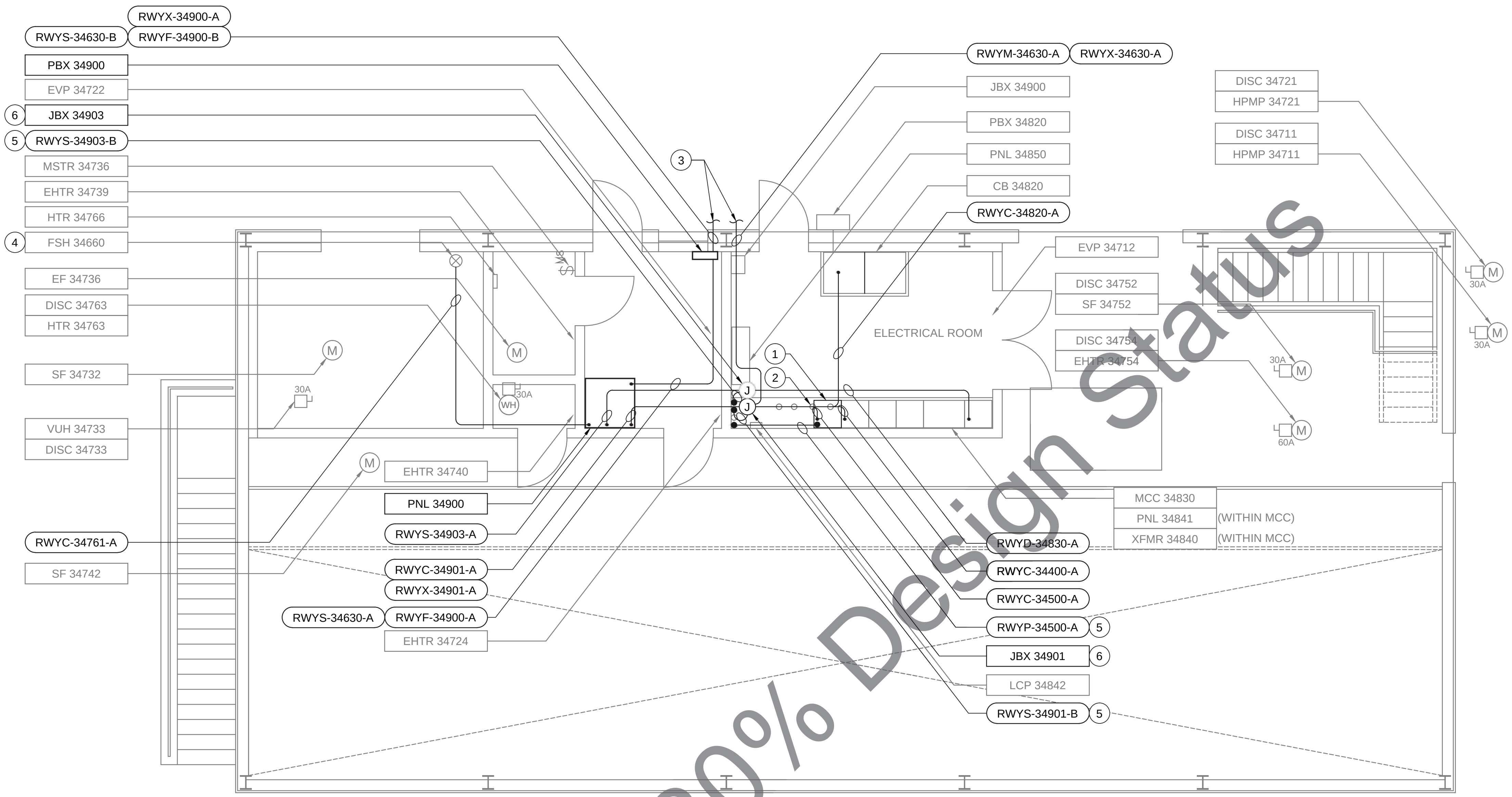

MAIN FLOOR
PLAN
SCALE: 1/4" = 1'-0"

30% Design Status

GENERAL SHEET NOTES

1. ALL NEW RACEWAY INSTALLED IN THE REUSE FILTER BUILDING ELECTRICAL ROOM SHALL BE ROUTED SO AS TO ALLOW AMPLE SPACE FOR MCC 34830 TO BE EXPANDED BY TWO VERTICAL 20" MCC SECTIONS IN THE FUTURE.

KEY NOTES

1. NEW VERTICAL MCC SECTION ADDED TO EXISTING MCC-34830.
2. FILL IN UNUSED CONDUIT FROM BELOW, THAT WILL BE LEFT PARTIALLY EXPOSED, WITH NON-SHRINK GROUT.
3. RACEWAYS TRANSITION FROM UNDERGROUND NEAR NORTH WALL. RUN RACEWAY UP THE NORTH WALL AND ENTER BUILDING VIA LB CONDUIT BODY. SEE DRAWING E-340-0001 FOR CONTINUATION.
4. RENUMBER EXISTING SWITCH TO FSH 34761 AND APPLY NEW EQUIPMENT TAG LABEL.
5. ROUTE RACEWAY THROUGH EXISTING ELECTRICAL ROOM FLOOR PENETRATION.
6. FIELD LOCATE JUNCTION BOX AS REQUIRED TO ALLOW SPACE FOR MCC 34830 TO BE EXPANDED BY TWO VERTICAL 20" MCC SECTIONS IN THE FUTURE.

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1WATER UTILITY
PHASE 3
DESIGN PACKAGE 4
REUSE WATER
DISTRIBUTION
PUMPING SYSTEMS

REVISIONS

REV	DATE	DESCRIPTION
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LINE IS 2 INCHES AT FULL SIZE

DESIGNED:
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FILENAME
E-340-0111-DP4-BC.DWG
BC PROJECT NUMBER
148621
QUINCY PROJECT NUMBER

ELECTRICAL

MAIN FLOOR
POWER, CONTROL
AND SIGNAL PLAN

DRAWING NUMBER
E-340-0111

SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\9-E-ELEC FILENAME: E-340-0111-DP4-BC.DWG PLOT DATE: 5/13/2016 12:25 PM CAD USER: JOHN THOMAS

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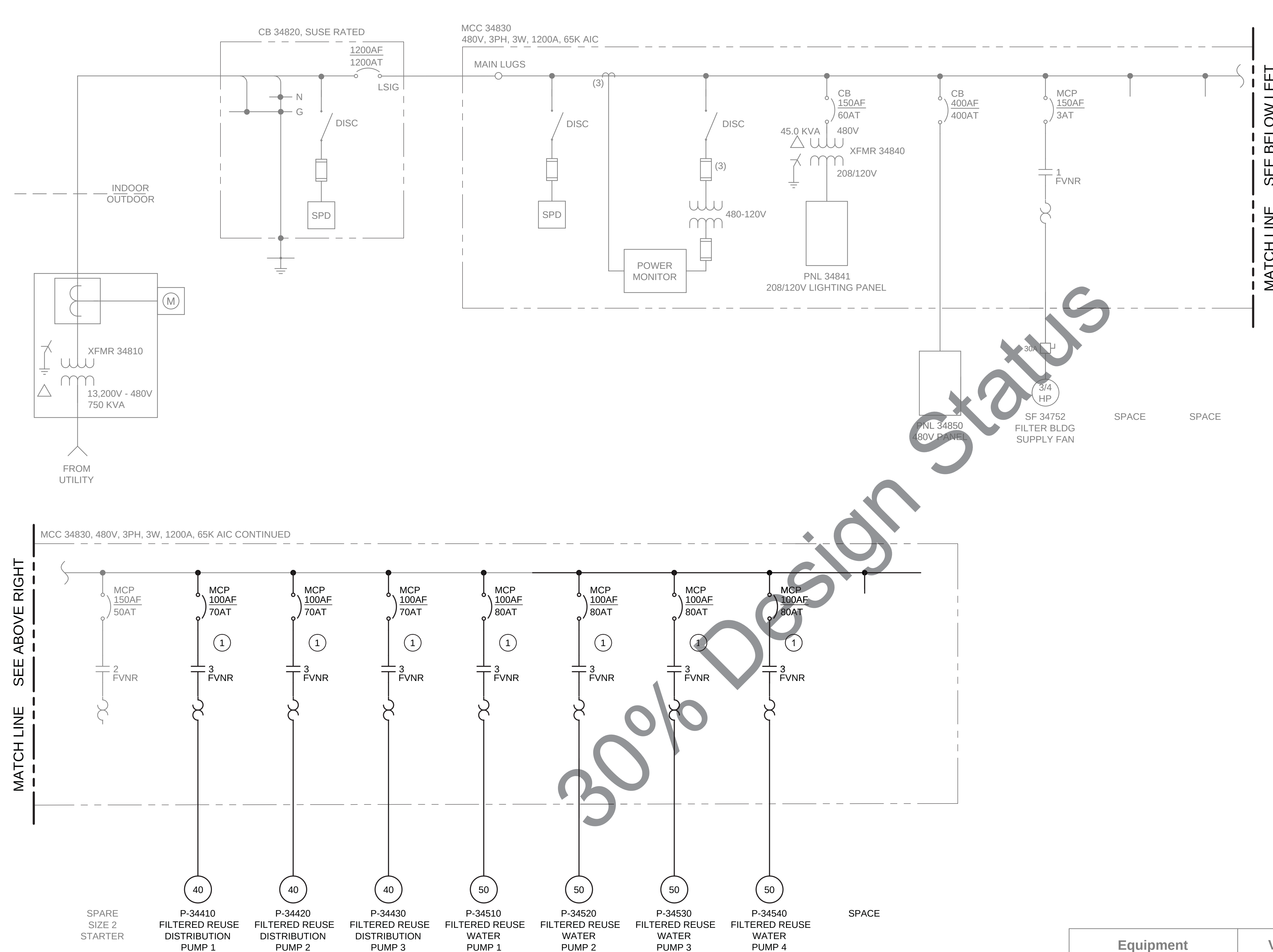

30% Design Status

GENERAL SHEET NOTES

1. XXXX

KEY NOTES

(1) NEW SIZE 3 FVNR STARTER.

Equipment	Voltage, V	Available 3ph Symm Fault Current, kA
Utility Fault Contribution XFMR 34810 Sec	480	40.094
CB 34820	480	38
MCC 34830	480	36
PNL 34850	480	36
PNL 34841	208	5

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1WATER UTILITY
PHASE 3
DESIGN PACKAGE 4
REUSE WATER
DISTRIBUTION
PUMPING SYSTEMS

REVISIONS

REV	DATE	DESCRIPTION
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LINE IS 2 INCHES AT FULL SIZE

DESIGNED: J. Thomas
DRAWN: J. Thomas
CHECKED:
CHECKED:
APPROVED:

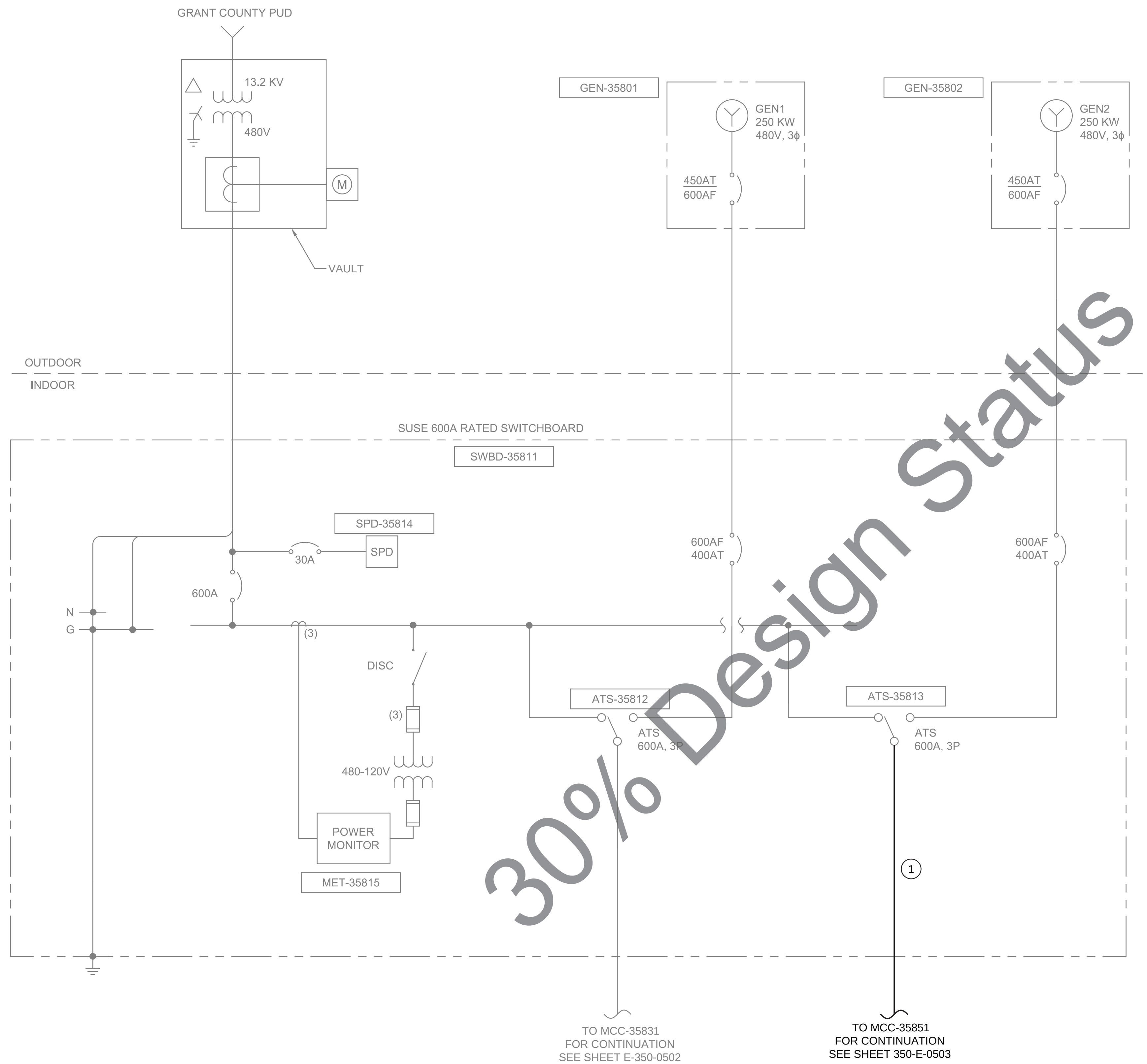
FILENAME
E-340-0501-DP4-BC.DWG
BC PROJECT NUMBER
148621
QUINCY PROJECT NUMBER

ELECTRICAL

FILTERED REUSE
BUILDING
ONE LINE DIAGRAM

DRAWING NUMBER
E-340-0501

SHEET NUMBER
OF



GENERAL NOTES:

1. GEN-35801, GEN-35802, SWBD-35811 PROVIDED BY BROWN AND CALDWELL. ALL EQUIPMENT RECEIVING, INSTALLATION AND CABLE BY CONTRACTOR.
2. CAP AND SEAL UNUSED CONDUITS AND IDENTIFY SPARE.

KEY NOTES:

(1) NEW OVERHEAD FEEDER FROM EXISTING ATS TO NEW MCC-35851.

EQUIPMENT	VOLTAGE, V	AVAILABLE 3PH SYMM FAULT CURRENT, kA
Utility Fault Contribution XFMR-35811 Sec	480V	24.1
SWBD-35811	480V	22.1
MCC-35831	480V	19.8
PNL-35842	208V	4.2
DS-3573	480V	18.7
DS-3574	480V	18.7
DS-3575	480V	18.7

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1WATER UTILITY
PHASE 3
DESIGN PACKAGE 4
REUSE WATER
DISTRIBUTION
PUMPING SYSTEMS

REVISIONS

REV	DATE	DESCRIPTION
	--	--

LINE IS 2 INCHES AT FULL SIZE

DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

FILENAME
E-350-0501-DP4-BC.DWG
BC PROJECT NUMBER
148621
QUINCY PROJECT NUMBER

ELECTRICAL
ONE LINE
DIAGRAM 1

DRAWING NUMBER
E-350-0501
SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\9-E-ELEC FILENAME: E-350-0501-DP4-BC.DWG PLOT DATE: 5/13/2016 9:32 AM CAD USER: JOHN THOMAS
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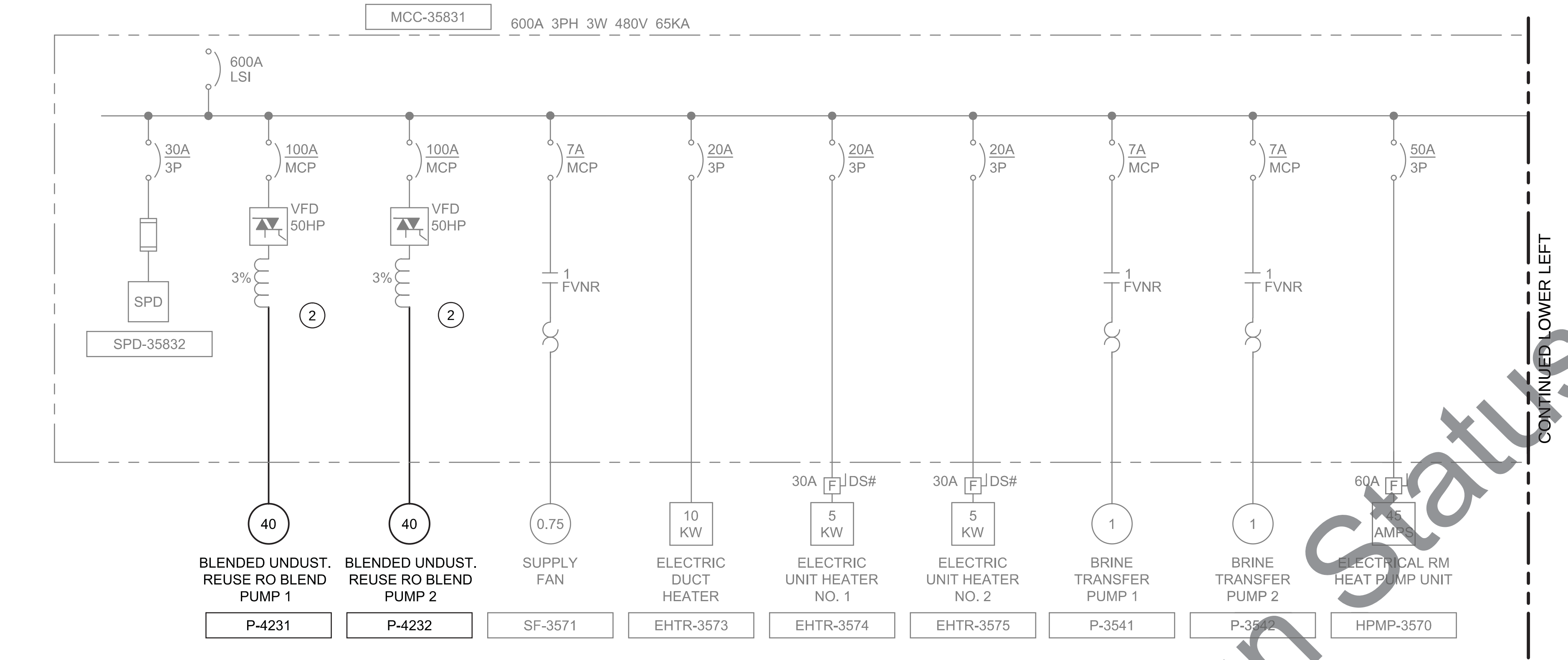
FOR CONTINUATION
SEE SHEET E-350-0501

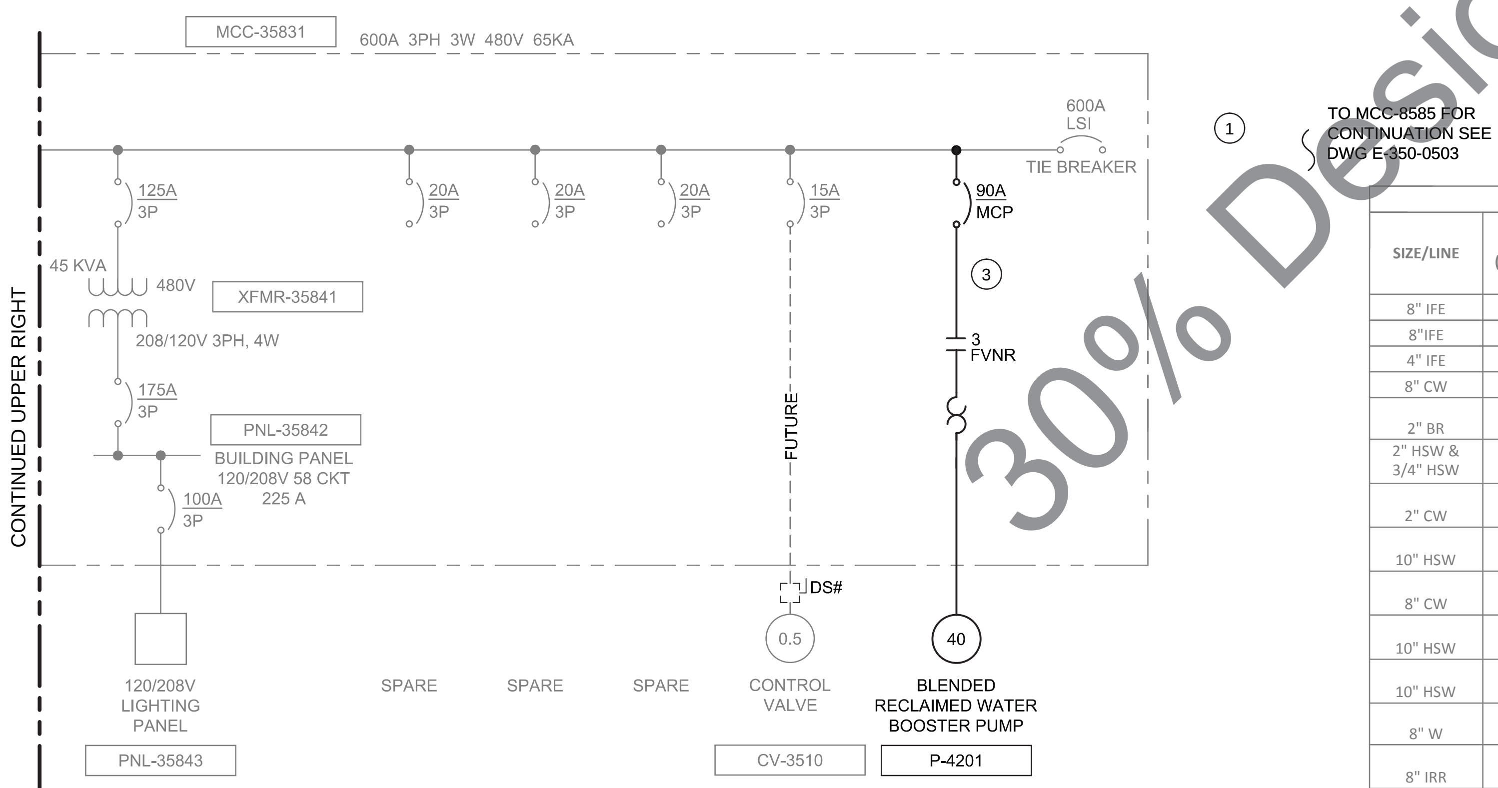


GENERAL NOTES:

1. # - INDICATES THE FOUR DIGIT NUMBER IN THE EQUIPMENT NUMBER OF THE EQUIPMENT FED BY THE CIRCUIT.
2. CAP AND SEAL UNUSED CONDUITS AND IDENTIFY SPARE.
3. MCC-35831 PROVIDED BY BROWN AND CALDWELL. ALL EQUIPMENT RECEIVING, INSTALLATION AND CABLE BY CONTRACTOR.

KEY NOTES:

1. PROVIDE NEW CONNECTION FROM EXISTING TIE BREAKER TO NEW MCC-35851.
2. UTILIZE EXISTING VFD FOR NEW PUMP.
3. NEW SIZE SIZE 3 FVNR STARTER.
4. HEAT TRACE DESIGN BASED AROUND NELSON SELF REGULATING HEAT TRACE SYSTEM. FOR HEAT TRACE SYSTEM OTHER THAN NELSON CONTRACTOR SHALL SUBMIT PRODUCT DATA AND DESIGN CALCULATIONS.
5. LENGTHS ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY REQUIRED LENGTHS. LENGTHS SHOWN DO NOT INCLUDE ALLOWANCES FOR VALVES FLANGES ETC.
6. FOR TRACE RATIO SEE DETAIL D/000-E-503.
7. HEAT TRACE CIRCUITS FED FROM PNL-35842.



HEAT TRACE INFORMATION - PIPING (SEE KEY NOTE 4)					
SIZE/LINE	LENGTH (LF) (SEE KEY NOTE 5)	LOCATION	TRACE RATIO (SEE KEY NOTE 6)	JBOX/PANEL CIRCUIT NUMBER (SEE KEY NOTE 7)	P&ID / INSTRUMENT TAG
8" IFE	10	SOFTENER FEED PUMP SECTION LINE - WEST	1	TBP-3517 / 1-3	350-P-001 / TIC-3517C
8"IFE	15	SOFTENER FEED PUMP SECTION LINE - EAST	1	TBP-3517 / 1-3	350-P-001 / TIC-3517B
4" IFE	20	SOFTENER FEED PUMP RETURN TO SOFTENER STANDPIPE	1	TBP-3517 / 1-3	350-P-001 /
8" CW	25	POTABLE WATER TO SOFTENER STANDPIPE FROM BUILDING	1	TBP-3517 / 1-3	350-P-001 / TIC-3517A
2" BR	10	BRINE TRANSFER PUMP SECTION AND BRINE LOOP RETURN FROM SALT STORAGE/BRINE MAKER TO BUILDING	1	TBP-3544 / 1-3	350-P-001 / TIC-3544
2" HSW & 3/4" HSW	50	SOFTENED WATER TO SALT STORAGE/BRINE MAKER	1	TBP-3544 / 1-3	350-P-004 / TIC-3545
2" CW	5	FROM UNDERGROUND CONNECTION TO BUILDING, POTABLE WATER TO BUILDING SERVICES (SOUTH)	1	TBP-3500A / 1-3	350-
10" HSW	10	FROM UNDERGROUND PIPING CONNECTION TO BUILDING, SOFTNENED WATER SUPPLY SOUNT ROUTE (SOUTH)	3	TBP-3500A / 1-3	350-P-003
8" CW	10	FROM UNDERGROUND PIPING CONNECTION TO BUILDING, POTABLE WATER TO SOFTENER STANDPIPE (SOUTH)	1	TBP-3517 / 1-3	350-P-001 / TIC-3517D
10" HSW	10	FROM UNDERGROUND PIPING CONNECTION TO BUILDING, SOFTENED WATER SUPPLY IRWTP AND CO 1/2 NORTH ROUTE (NORTH)	3	TBP-3500C / 13-15	350-P-003
10" HSW	10	FROM UNDERGROUND PIPING CONNECTION TO BUILDING, SOFTENED WATER SUPPLY OXFORD NORTH ROUTE (NORTH)	3	TBP-3500C / 13-15	350-P-002
8" W	10	FROM UNDERGROUND PIPING OCNNECTION TO BUILDING WELL WATER (NORTH)	2	TBP-3500C / 13-15	350-P-002
8" IRR	10	FROM UNDERGROUND PIPING CONNECTION TO BUILDING, LANDSCAPE IRRIGATION (NORTH)	1	TBP-3500C / 13-15	350-P-002
4" NBW	5	FROM UNDERGROUND PIPING CONNECTION TO BUILDING, BRINE WASTE TO IRWTP EVAPORATION PONDS (NORTH)	1	TBP-3500C / 13-15	350-P-004

HEAT TRACE INFORMATION - TANKS					
SIZE/LINE	LENGTH (LF)	LOCATION	TRACE RATIO	JBOX	P&ID / INSTRUMENT TAG
STANDPIPE	65	STANDPIPE TANK	1	TBP-3510 / 5-7	350-P-001 / T-3510
SALT STORAGE	VENDOR PROVIDED	SALT STORAGE TANK	-	TBP-3540B / 9-10	350-P-004 / T-3540

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1WATER UTILITY
PHASE 3
DESIGN PACKAGE 4
REUSE WATER
DISTRIBUTION
PUMPING SYSTEMS

REVISIONS		
REV	DATE	DESCRIPTION
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LINE IS 2 INCHES AT FULL SIZE

DESIGNED:
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CHECKED:
CHECKED:
APPROVED:

FILENAME
E-350-0502-DP4-BC.DWG
BC PROJECT NUMBER
148621
QUINCY PROJECT NUMBER

ELECTRICAL ONE LINE DIAGRAM 2

DRAWING NUMBER
E-350-0502
SHEET NUMBER
OF

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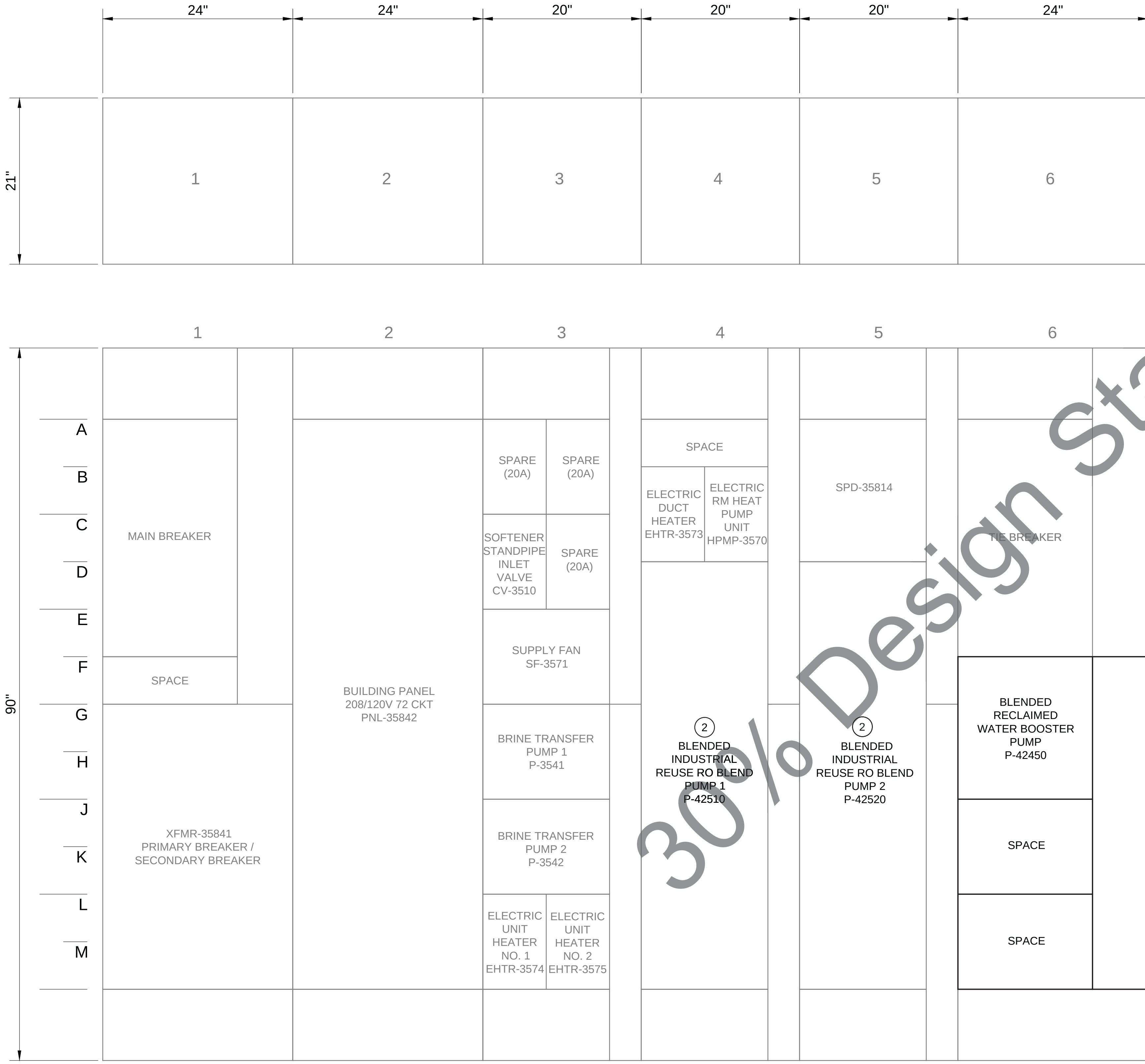

MCC-35831
ELEVATION
NONE

GENERAL SHEET NOTES

1. EXISTING MCC-35831 IS A 600 AMP, 3PH, 3W, 65KAIC EATON FREEDOM 2100 SERIES MCC CONNECTED AT 480V. NEW COMPONENTS SHALL BE OF THE SAME RATING AND MATCH EXISTING.

KEY NOTES

(1) UTILIZE THE EXISTING 3.5SF (42") SPACE WITH BLANK DOOR FOR NEW SIZE 3 FVNR STARTER AND TWO BLANK SPACE DOORS AS SHOWN.

(2) UTILIZE EXISTING VFD IN MCC TO FEED NEW PUMP AND RE-LABEL MCC BUCKET AS SHOWN.

LOAD SCHEDULE

EQUIPMENT DESIGNATION:	MCC-35831
LOCATION:	WATER SOFTENER BUILDING
VOLTAGE:	480 V, 3 PHASE, 3 WIRE
MINIMUM AIC RATING:	65K AIC
BUS RATING (AMPS):	600
MAIN RATING (AMPS):	600
MAIN TYPE:	CB
FED FROM:	SWBD-35811

LOAD TYPE	LOAD DESCRIPTION	KVA	HP	CONNECTED LOADS (KVA)		
				AΦ	BΦ	CΦ
C	*XFMR-35841*	45	---	15.0	15.0	15.0
M	*SOFTENER STANDPIPE INLET VALVE*	---	0.5	0.3	0.3	0.3
M	*SUPPLY FAN*	---	0.75	0.4	0.4	0.4
M	*BRINE TRANSFER PUMP 1*	---	1	0.6	0.6	0.6
M	*BRINE TRANSFER PUMP 2*	---	1	0.6	0.6	0.6
SH	*ELECTRIC UNIT HEATER NO. 1*	5	---	1.7	1.7	1.7
SH	*ELECTRIC UNIT HEATER NO. 2*	5	---	1.7	1.7	1.7
SH	*ELECTRIC DUCT HEATER*	10	---	3.3	3.3	3.3
C	*ELECTRICAL RM HEAT PUMP UNIT*	37	---	12.5	12.5	12.5
M	*B. I. R. PUMP RO BLEND PUMP 1*	---	40	16.9	16.9	16.9
M	*B. I. R. PUMP RO BLEND PUMP 2*	---	40	16.9	16.9	16.9
LM	**B. R. WATER BOOSTER PUMP**	**---**	**40**	**14.4**	**14.4**	**14.4**

CALCULATED LOAD TYPE, X DEMAND FACTOR, AND CALCULATED LOADS (KVA)			
NONCONTINUOUS NON-MOTOR (TYPE 'N') X 100%	0.0	0.0	0.0
CONTINUOUS NON-MOTOR (TYPE 'C') X 125%	34.3	34.3	34.3
LARGEST MOTOR (TYPE 'LM') X 125%	18.0	18.0	18.0
MOTOR (TYPE 'M') X 100%	35.7	35.7	35.7
NONCOINCIDENT (TYPE 'NC') X 0%	0.0	0.0	0.0
FIXED ELECTRIC SPACE HEATING (TYPE 'SH') X 100%	6.7	6.7	6.7
CALCULATED LOAD TOTALS EACH PHASE	**94.7**	**94.7**	**94.7**
CALCULATED LOAD TOTAL (KVA)	**284.2**		
CALCULATED LOAD TOTAL (AMPS)	**341.9**		

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CITY OF QUINCY
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1WATER UTILITY PHASE 3 DESIGN PACKAGE 4 REUSE WATER DISTRIBUTION PUMPING SYSTEMS

REVISIONS

REV	DATE	DESCRIPTION
	--	--

LINE IS 2 INCHES AT FULL SIZE

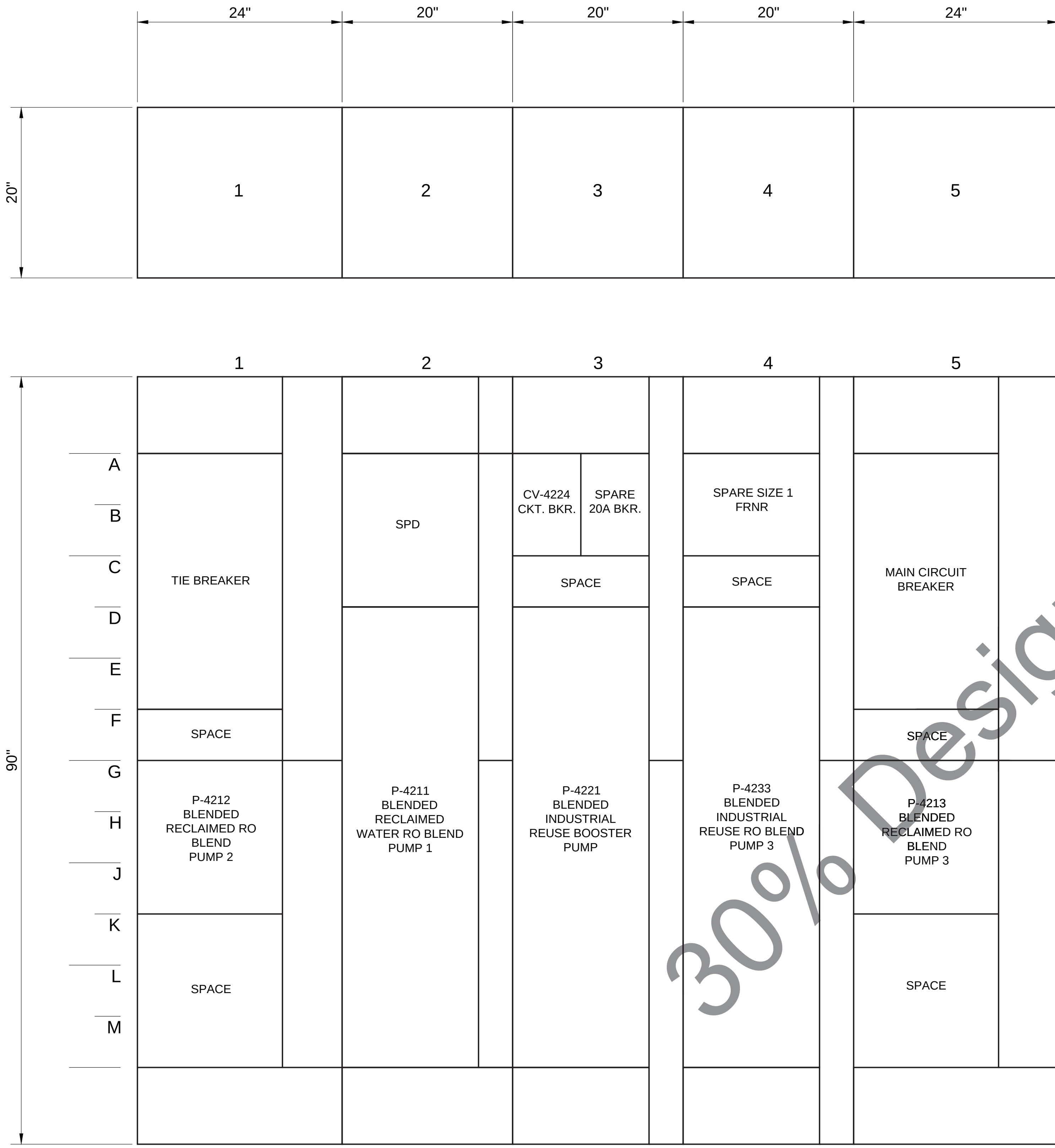
DESIGNED: J. Thomas
DRAWN: J. Thomas
CHECKED:
CHECKED:
APPROVED:

FILENAME
E-350-0504-DP4-BC.DWG
BC PROJECT NUMBER
148621
QUINCY PROJECT NUMBER

ELECTRICAL
MCC-35831 ELEVATION AND LOAD SCHEDULE

DRAWING NUMBER
E-350-0504
SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\9-E-ELEC FILENAME: E-350-0504-DP4-BC.DWG PLOT DATE: 5/10/2016 12:30 PM CAD USER: KEN WESTERBERG
City of Quincy Logo.JPG



MCC-35832
ELEVATION
NONE

LOAD SCHEDULE

EQUIPMENT DESIGNATION:	MCC-35832
LOCATION:	WATER SOFTENER BUILDING
VOLTAGE:	480 V, 3 PHASE, 3 WIRE
MINIMUM AIC RATING:	65K AIC
BUS RATING (AMPS):	600
MAIN RATING (AMPS):	600
MAIN TYPE:	CB
FED FROM:	SWBD-35811

LOAD TYPE	LOAD DESCRIPTION	KVA	HP	CONNECTED LOADS (KVA) AΦ	BΦ	CΦ
M	B. I. R. PUMP RO BLEND PUMP 3	---	40	16.9	16.9	16.9
M	B. I. R. BOOSTER PUMP	---	40	16.9	16.9	16.9
M	B. R. W. RO BLEND PUMP 1	---	40	16.9	16.9	16.9
LM	B. R. W. RO BLEND PUMP 2	---	40	14.4	14.4	14.4
M	B. R. W. RO BLEND PUMP 3	---	40	14.4	14.4	14.4
M	ISV 42621	---	0.5	0.3	0.3	0.3

CALCULATED LOAD TYPE, X DEMAND FACTOR, AND CALCULATED LOADS (KVA)	AΦ	BΦ	CΦ
NONCONTINUOUS NON-MOTOR (TYPE 'N') X 100%	0.0	0.0	0.0
CONTINUOUS NON-MOTOR (TYPE 'C') X 125%	0.0	0.0	0.0
LARGEST MOTOR (TYPE 'LM') X 125%	18.0	18.0	18.0
MOTOR (TYPE 'M') X 100%	65.4	65.4	65.4
NONCOINCIDENT (TYPE 'NC') X 0%	0.0	0.0	0.0
FIXED ELECTRIC SPACE HEATING (TYPE 'SH') X 100%	0.0	0.0	0.0
CALCULATED LOAD TOTALS EACH PHASE	**83.4**	**83.4**	**83.4**
CALCULATED LOAD TOTAL (KVA)	**250.3**		
CALCULATED LOAD TOTAL (AMPS)	**301.1**		

GENERAL SHEET NOTES

1. XXXX

KEY NOTES

(1) XXXX

Brown AND Caldwell
Seattle, Washington

CITY OF QUINCY
Opportunities Unlimited !

1WATER UTILITY
PHASE 3
DESIGN PACKAGE 4
REUSE WATER DISTRIBUTION PUMPING SYSTEMS

REVISIONS

REV	DATE	DESCRIPTION
	--	--

LINE IS 2 INCHES AT FULL SIZE

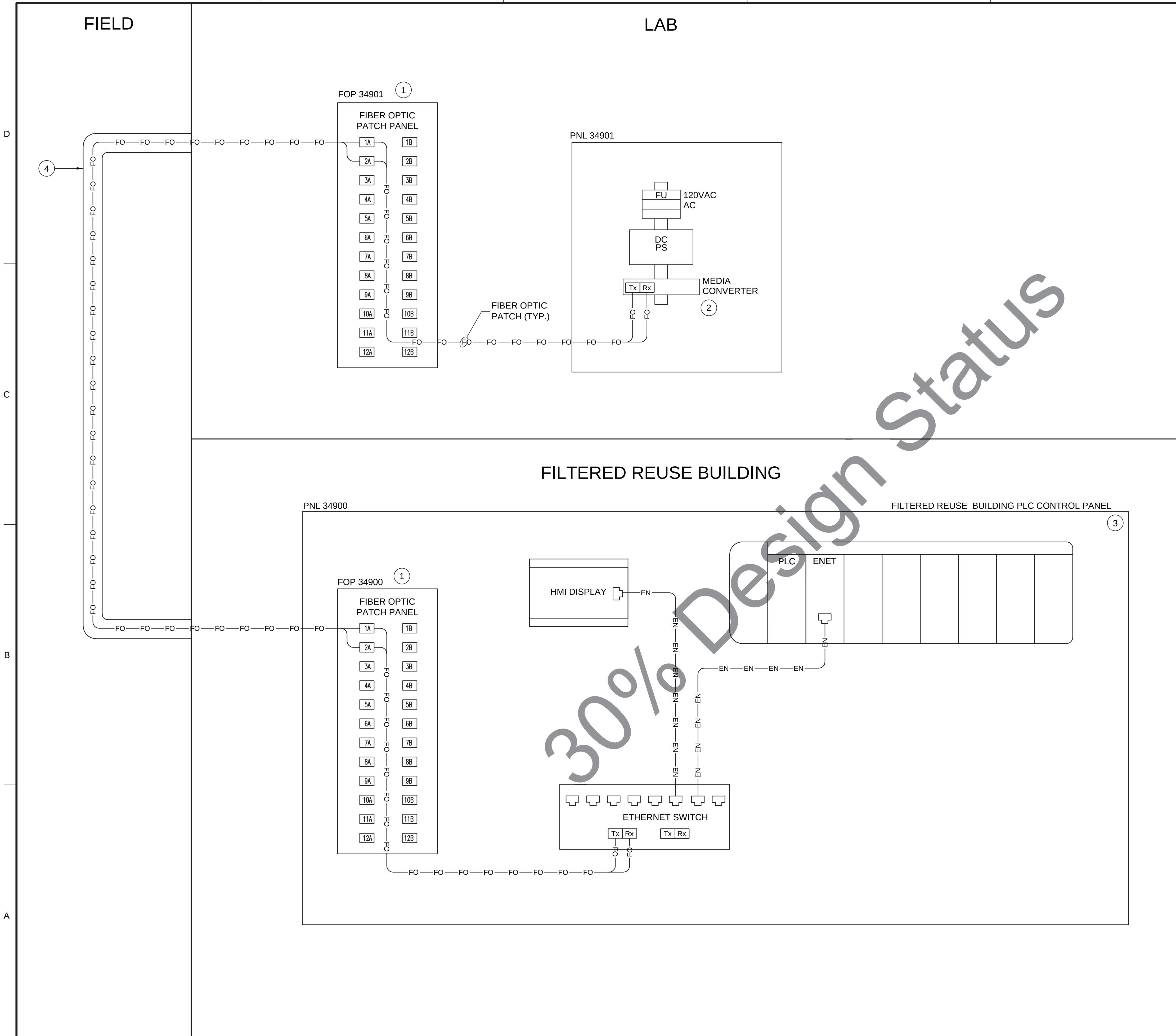
DESIGNED: J. Thomas
DRAWN: J. Thomas
CHECKED:
CHECKED:
APPROVED:

FILENAME
E-350-0505-DP4-BC.DWG
BC PROJECT NUMBER
148621
QUINCY PROJECT NUMBER

ELECTRICAL
MCC-35852
ELEVATION AND LOAD SCHEDULE

DRAWING NUMBER
E-350-0505
SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\9-E-ELEC FILENAME: E-350-0505-DP4-BC.DWG PLOT DATE: 5/10/2016 12:30 PM CAD USER: KEN WESTERBERG
City of Quincy Logo.JPG



GENERAL NOTES:

1. x

KEY NOTES:

1. PROVIDE FIBER OPTIC PATCH PANEL PER SECTION 17815.
2. OWNER TO CONNECT PNL 34901 ETHERNET TO THE EXISTING NETWORK.
3. REFER TO DRAWING I-340-1010 FOR PANEL LAYOUT.
4. CONTRACTOR TO ROUTE NEW UNDERGROUND CONDUIT FROM REUSE FILTER BUILDING TO LAB. REFER TO ELECTRICAL PLAN DRAWINGS.

LEGEND:

—FO—FO— FIBER OPTIC CABLE

—EN—EN— ETHERNET CABLE

Brown AND Caldwell
Seattle, Washington

CITY OF QUINCY
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QUINCY 1WATER IRWTP REVERSE OSMOSIS SYSTEM DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: K. Westerberg
DRAWN: K. Westerberg
CHECKED: L. Lubke
CHECKED: J. Thomas
APPROVED:

FILENAME
I-340-0001-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

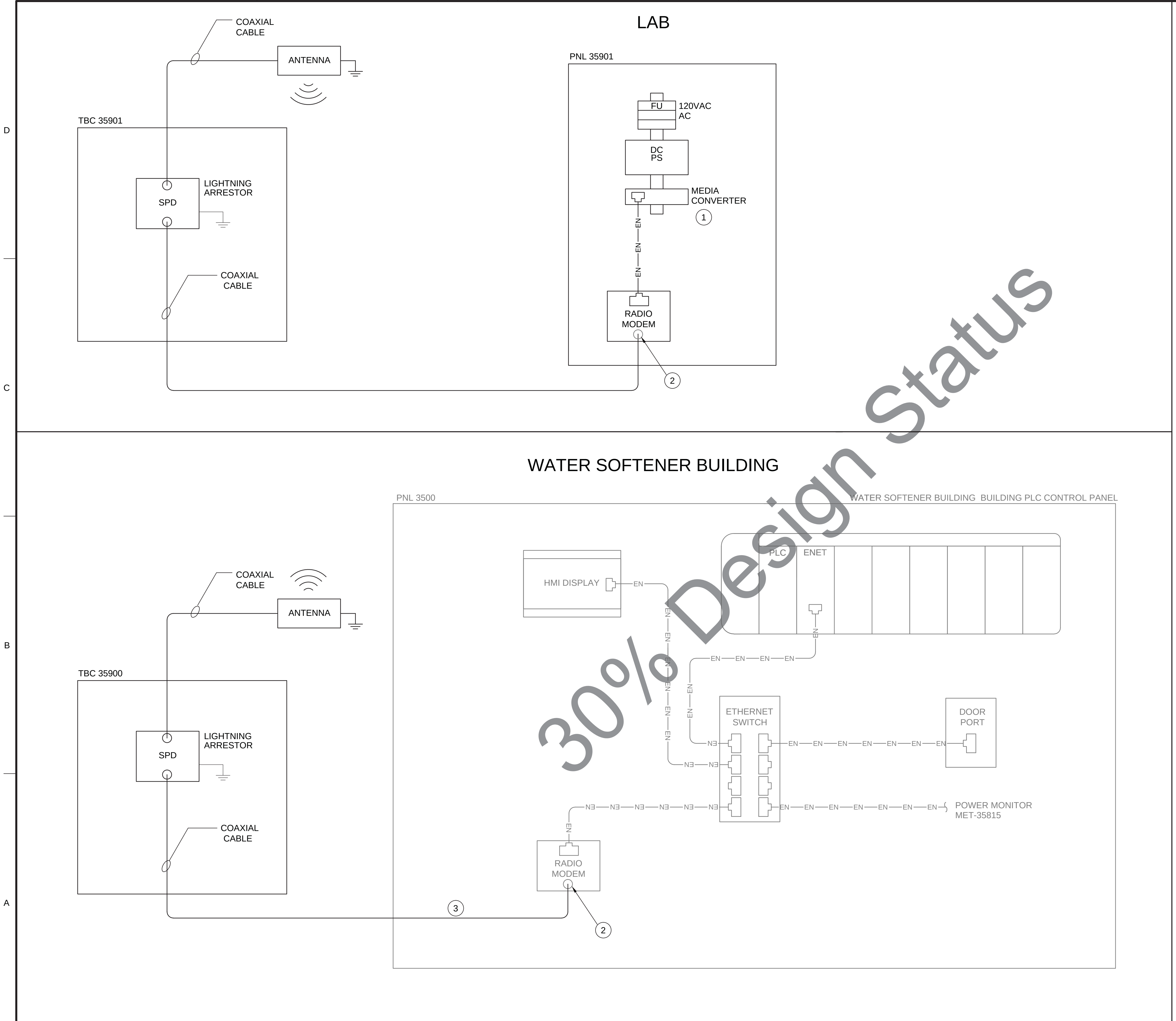
INSTRUMENTATION

REUSE FILTER BUILDING COMMUNICATION BLOCK DIAGRAM

DRAWING NUMBER
I-340-0001
SHEET NUMBER
OF

Path: \\BCSEA06\PROJECTS\076656 - QUINCY, CITY OF (WA)\5_Q1W GIS-CAD\2-SHEETS\DP 4\10-I-INSTR FILENAME: I-340-0001-DP4-BC.DWG PLOT DATE: 5/9/2016 9:35 AM CAD USER: KEN WESTERBERG

City of Quincy Logo.JPG



GENERAL NOTES:

1. x

KEY NOTES:

1. OWNER TO CONNECT PNL 3500B ETHERNET TO THE EXISTING NETWORK.
2. REVERSE POLARITY SMA CONNECTOR, FEMALE, 50 OHM.
3. EXISTING MODEM WILL BE CONNECTED TO AN ANTENNA OUTSIDE THROUGH A LIGHTNING ARRESTOR IN TBC-3500A WITH COAXIAL CABLE, COAX CABLE 20-50 FEET SHALL BE LMR400, COAX CABLE OVER 50 FEET SHALL BE LMR600.

LEGEND:

—FO—FO— FIBER OPTIC CABLE

—EN—EN— ETHERNET CABLE

Brown AND Caldwell
Seattle, Washington

CITY OF QUINCY
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QUINCY 1WATER
IRWTP REVERSE OSMOSIS SYSTEM
DESIGN PACKAGE 4

REVISIONS

REV	DATE	DESCRIPTION
A	06/2016	90% SUBMITTAL

LINE IS 2 INCHES AT FULL SIZE

DESIGNED: K. Westerberg
DRAWN: K. Westerberg
CHECKED: L.Lubke
CHECKED: J. Thomas
APPROVED:

FILENAME
I-350-0001-DP4-BC.DWG
BC PROJECT NUMBER
148860
QUINCY PROJECT NUMBER

INSTRUMENTATION
WATER SOFTENER BUILDING
COMMUNICATION BLOCK DIAGRAM

DRAWING NUMBER
I-350-0001

SHEET NUMBER
OF

Attachment B: Equipment and Instrument List

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Q1W Reuse Pumping System - Basis of Design

Equip No.	Equipment No OLD	Description 1	Description 2	Building Location	Spec Section	P&ID	Design Package	Vendor Package	Rated Capacity	Max Capacity	Units	Head / Pressure	Max Head/Pressure	Units2	Equipment Speed (RPM)	Speed Range (RPM)	Motorized	VFD	Motor Speed (RPM)	Size / Power	Units3	Voltage	Gen Load	Units4	Supplier	Supplier2	Manufacturers	Cost	Notes
HMI-3500		WSB	HUMAN MACHINE INTERFACE	350														NO	---	UPS							AB 2711P-T15C4AP	I&C Quote ($6000)	I&C Quote- price is gross estimate
PNL PLC-3500		WSB	PLC CONTROL PANEL	350														NO	---	20	A	115V/120V |1PH					Custom fabrication required	I&C Quote- ($36000)	Rough estimate based on 90" x 36" x 20" cabinet
P-3501		WSB	SOFTENER FEED PUMP 1	350												---		YES		40	HP	460V/480V | 3PH					GRUNDFOS	12101	Includes freight to Quincy
P-3502		WSB	SOFTENER FEED PUMP 2	350												---		YES	---	40	HP	460V/480V | 3PH					GRUNDFOS	12101	Includes freight to Quincy
PIT-3507		WSB	PRESSURE TRANSMITTER	350		P-001					PSI							NO	---	20	mA						E&H PMP71-8FF3/0	I&C Quote ($1766)	I&C Quote- price is gross estimate
PI-3508		WSB	PRESSURE GAGE	350		P-003					PSI							NO	---	---	---						Ashcroft 1279	I&C Quote ($118)	I&C Quote- price is gross estimate
PIT-3508		WSB	PRESSURE TRANSMITTER	350		P-003					PSI							NO	---	20	mA						E&H PMP71-8FF3/0	I&C Quote ($1766)	I&C Quote- price is gross estimate
PIT-3509		WSB	PRESSURE TRANSMITTER	350							PSI							NO	---	20	mA						E&H PMP71-8FF3/0	I&C Quote ($1766)	I&C Quote- price is gross estimate
LSHH-3511	P-3463	WSB	LEVEL SWITCH	350		P-001					FT							NO	---	---	---						Flotec/Dwyer, L6EPB-B-S-3-0	I&C Quote ($148)	I&C Quote- Product cost from www.dwyer-inst.com
PIT-3512		WSB	PRESSURE TRANSMITTER	350		P-001																							
PRV-3513		WSB	PRESSURE REGULATING VALVE	350																									
PI-3514		WSB	SOFTNER FEED PUMP BYPASS	350		P-001					PSI							NO	---	---	---						Ashcroft 1279	I&C Quote ($826)	I&C Quote- price is gross estimate
T-3515		WSB	SOFTENER FEED HYDROPNEUMATIC TANK	350					---	---	---	---	---	---	---	---			---			NO PWR REQD						0	Existing equipment, to be relocated
MME-3516		WSB	STANDPIPE REDUCED PRESSURE BACKFLOW PREVENTER	350														NO				NO PWR REQD					WATTS	7860.51	
MME-3518		WSB	POTABLE WATER REDUCED PRESSURE BACKFLOW PREVENTER	350						---							NO	NO				NO PWR REQD					WATTS	$ 400.00	
MME 3519		WSB	UTILITY STATIONS REDUCED PRESSURE BACKFLOW PREVENTER	350													NO	NO				NO PWR REQD					WATTS	$ 400.00	
AE/AIT-3520		WSB	WATER HARDNESS ANALYZER	350				Vendor										NO	1725	100	VA	115V/120V |1PH							Existing unit from Water Softener Unit Vendor
MME-3521		WSB	SOFTENER UNIT 1	350														NO				115V/120V |1PH					WCTI	0	Existing equipment, to be relocated
CV-3521C		WSB	BRINE DAY TANK 1 INLET VALVE	350														NO	---	0.2	A	115V/120V |1PH					Valworx, 561216	$400	
MME-3522		WSB	SOFTENER UNIT 2	350														NO				115V/120V |1PH					WCTI	0	Existing equipment, to be relocated
CV-3522C		WSB	BRINE DAY TANK 2 INLET VALVE	350														NO	---	0.2	A	115V/120V |1PH					Valworx, 561216	$400	
MME-3523		WSB	SOFTENER UNIT 3	350														NO				115V/120V |1PH					WCTI	0	Existing equipment, to be relocated
CV-3523C		WSB	BRINE DAY TANK 3 INLET VALVE	350														NO	---	0.2	A	115V/120V |1PH					Valworx, 561216	$400	
MME-3524		WSB	SOFTENER UNIT 4	350														NO				115V/120V |1PH					WCTI	0	Existing equipment, to be relocated
CV-3524C		WSB	BRINE DAY TANK 4 INLET VALVE	350														NO	---	0.2	A	115V/120V |1PH					Valworx, 561216	$400	
MME-3525		WSB	SOFTENER UNIT 5	350														NO				115V/120V |1PH					WCTI		
CV-3525C		WSB	BRINE DAY TANK 5 INLET VALVE	350														NO	---	0.2	A	115V/120V |1PH					Valworx, 561216	$400	
MME-3526		WSB	SOFTENER UNIT 6	350														NO				115V/120V |1PH					WCTI		
CV-3526C		WSB	BRINE DAY TANK 6 INLET VALVE	350														NO	---	0.2	A	115V/120V |1PH					Valworx, 561216	$400	
MME-3527		WSB	SOFTENER UNIT 7	350														NO				115V/120V |1PH					WCTI		
CV-3527C		WSB	BRINE DAY TANK 7 INLET VALVE	350														NO	---	0.2	A	115V/120V |1PH					Valworx, 561216	$400	
AE-3530		WSB	CONDUCTIVITY SENSOR	350														NO	---	See AIT							Hach, D3422D3	I&C Quote ($540)	I&C - Quote: Product cost from www.hach.com
AIT-3530		WSB	CONDUCTIVITY ANALYZER/TRANSMITTER	350														NO	---	100	VA	115V/120V |1PH					Hach, SC200 (digital sensor)	I&C Quote ($1740)	I&C - Quote: Product cost from www.hach.com
FE-3530		WSB	MAGNETIC FLOW METER	350		P-003					GPM							NO	---	See FIT							E&H 72F2F-SK0BA1NAB4AA	I&C Quote ($10,800)	I&C Quote- price is gross estimate
FIT-3530		WSB	MAGNETIC FLOW TRANSMITTER	350		P-003					GPM							NO	---	20	mA						See FE		FIT integral with FE and incl in FE mfr/cost
PI-3530		WSB	PRESSURE GAGE	350		P-003					FT							NO	---	---	---						Ashcroft 1279	I&C Quote ($118)	I&C Quote- price is gross estimate
PI-3930		WSB	PRESSURE GAGE	350		P-004		NO			PSI							NO	---	---	---						Ashcroft 1279	I&C Quote ($118)	I&C Quote- price is gross estimate
AE-3531		WSB	CONDUCTIVITY SENSOR	350														NO	---	See AIT							Hach, D3422D3	I&C Quote ($540)	I&C - Quote: Product cost from www.hach.com
AIT-3531		WSB	CONDUCTIVITY ANALYZER/TRANSMITTER	350														NO	---	100	VA	115V/120V |1PH					Hach, SC200 (digital sensor)	I&C Quote ($1740)	I&C - Quote: Product cost from www.hach.com
FE-3531		WSB	MAGNETIC FLOW METER	350		P-003					GPM							NO	---	See FIT							E&H 72F3H-SK0BA1NAB4AA	I&C Quote ($10,800)	I&C Quote- price is gross estimate
FIT-3531		WSB	MAGNETIC FLOW TRANSMITTER	350		P-003					GPM							NO	---	20	mA						See FE		FIT integral with FE and incl in FE mfr/cost
PI-3531		WSB	PRESSURE GAGE	350							PSI							NO	---	---	---						Ashcroft 1279	I&C Quote ($118)	I&C Quote- price is gross estimate
AE-3532		WSB	CONDUCTIVITY SENSOR	350		P-003												NO	---	See AIT							Hach, D3422D3	I&C Quote ($540)	I&C - Quote: Product cost from www.hach.com
AIT-3532		WSB	CONDUCTIVITY ANALYZER/TRANSMITTER	350		P-003												NO	---	100	VA	115V/120V |1PH					Hach, SC200 (digital sensor)	I&C Quote ($1740)	I&C - Quote: Product cost from www.hach.com
FE-3532		WSB	MAGNETIC FLOW METER	350		P-003					GPM							NO	---	See FIT							E&H 72F2F-SK0BA1NAB4AA	I&C Quote ($10,800)	I&C Quote- price is gross estimate
FIT-3532		WSB	MAGNETIC FLOW TRANSMITTER	350		P-003					GPM							NO	---	20	mA						See FE		FIT integral with FE and incl in FE mfr/cost
PI-3532		WSB	PRESSURE GAGE	350							PSI							NO	---	---	---						Ashcroft 1279	I&C Quote ($118)	I&C Quote- price is gross estimate
T-3540		SALT SILO	SALT SILO (W/CONTROLS)			P-004		YES														115V/120V |1PH					BRINE MAKER	123,688	Includes freight to Quincy
AE-3540		SALT SILO	LEAK SENSOR			P-004		YES																			BRINE MAKER		
AIC3540		SALT SILO	LEAK CONTROLLER			P-004		YES																			BRINE MAKER		
LV-3540-A		SALT SILO	BRINE LEVELCONTOL VALVE			P-004		YES																			BRINE MAKER		
LT-3540-A		SALT SILO	BRINE LEVEL TRANSMITTER			P-004		YES																			BRINE MAKER		
LIC-3540-A		SALT SILO	BRINE LEVEL CONTROLLER			P-004		YES																			BRINE MAKER		
LIT-3540-B		SALT SILO	SALT LEVEL TRANSMITTER			P-004		YES																					
LIC-3540-B		SALT SILO	SALT LEVEL CONTROLLER			P-004		YES																					
TBP-3540-B		SALT SILO	SALT LEVEL CONTROL TERMINAL BOX POWER			P-004		NO																					
JBP-3540-A		SALT SILO	BRINE LEVEL CONTROL JUNCTION BOX POWER			P-004		NO																					
P-3541		WSB	BRINE TRANSFER PUMP 1			P-004		NO	23	36	GPM	40	58	ft head	3500	---	YES	NO	3600	1	HP	208V | 3PH	0.48				IWAKI AMERICA	1012.2	Does not include freight to Quincy, lead time 1-2 weeks to ship
HS-3541		WSB	BRINE TRANSFER PUMP 1 HAND SWITCH			P-004		NO																					
P-3542		WSB	BRINE TRANSFER PUMP 2			P-004		NO	23	36	GPM	40	58	ft head	3500	---	YES	NO	3600	1	HP	208V | 3PH	0				IWAKI AMERICA	1012.2	Does not include freight to Quincy, lead time 1-2 weeks to ship
HS-3542		WSB	BRINE TRANSFER PUMP 2 HAND SWITCH			P-004		NO																					
PI-3543		WSB	BRINE HYDROPNEUMATIC TANK PRESSURE GAGE			P-004		NO			PSI							NO	---	---	---						Ashcroft 1279	I&C Quote ($118)	I&C Quote- price is gross estimate
PIT-3543		WSB	BRINE TRANSFER PUMP 2 HAND SWITCH			P-004		NO			PSI																		
T-3543		WSB	BRINE HYDROPNEUMATIC TANK			P-004		NO	79	79	gal	---	100	psi	---	---	---	NO	---	---	---	NO PWR REQD					Wessels	2000	Does not include freight to Quincy
TIC-3544		WSB	PIPING TEMPERATURE CONTROLLER			P-004		NO																					
TBP-3544		SALT SILO	PIPING TEMPERATURE CONTROLLER TERMINAL BOX			P-004																							
TIC-3545		WSB	PIPING TEMPERATURE CONTROLLER			P-004		NO																					
CV-3546		WSB	BRINE RECIRC SOLENOID VALVE 1			P-004		NO																					
HS-3546		WSB	BRINE RECIRC SOLENOID VALVE 1 HAND SWITCH			P-004		NO																					
CV-3547		WSB	BRINE RECIRC SOLENOID VALVE 2			P-004		NO																					
HS-3547		WSB	BRINE RECIRC SOLENOID VALVE 2 HAND SWITCH			P-004		NO																					

Q1W Reuse Pumping System - Basis of Design

Equip No.	Equipment No OLD	Description 1	Description 2	Building Location	Spec Section	P&ID	Design Package	Vendor Package	Rated Capacity	Max Capacity	Units	Head / Pressure	Max Head/Pressure	Units2	Equipment Speed (RPM)	Speed Range (RPM)	Motorized	VFD	Motor Speed (RPM)	Size / Power	Units3	Voltage	Gen Load	Units4	Supplier	Supplier2	Manufactuers	Cost	Notes
LSH-3960		WSB	LEVEL SWITCH		---	P-004		NO			FT							NO	---	---	---						MJK 7030	I&C Quote ($110)	I&C Quote- price is gross estimate
T-3960		WSB	WASTE PUMPS SUMP		---	P-004		NO	---	??	gal	---	---	---	---	---	NO	NO	---	---	---	NO PWR REQD					XERXES	34851	Includes freight to Quincy
TBC-3960		WSB	???		---	E-102		NO										NO											
P-3961		WSB	WASTE SUMP PUMP 1		---	P-004		NO	---	46	FT	---	27	ft head	3450	---	YES	NO	3450	0.4	HP	115V/120V |1PH	8.5	KW			BJM	18068	Includes freight to Quincy
TBP-3961		WSB	???		---	E-101		NO										NO											
RECP-3961A		WSB	WASTE SUMP PUMP RECEPTACLE		---	E-101		NO										NO											
RECP-3961B		WSB	WASTE SUMP PUMP RECEPTACLE		---	E-101		NO																					
P-3962		WSB	WASTE SUMP PUMP 2		---	P-004		NO	---	46	FT	---	27	ft head	3450	---	YES	NO	3450	0.4	HP	115V/120V |1PH	0	KW			BJM	18068	Includes freight to Quincy
TBP-3962		WSB	???		---	E-101		NO										NO											
RECP-3962A		WSB	WASTE SUMP PUMP RECEPTACLE		---	E-101		NO										NO											
RECP-3962B		WSB	WASTE SUMP PUMP RECEPTACLE		---	E-101		NO																					
HPMP-3570		ELECTRICAL ROOM	PACKAGED HEAT PUMP UNIT	350					76.62		MBTUH	1.5		In. W.C.				YES		50-A MOCP		460V/480V | 3PH					CARRIER 50TCQ	$ 11,680.00	76.62-MBH COOLING SENSIBLE. W/ ECONOMIZER, 13.9-KW ELECTRIC HEATER, AND POWER EXHAUST. INCLUDED IN MOCP. VFD IS INCLUDED WITH
SF-3571		WSB	SUPPLY FAN	350					500	---	CFM	1.5	---	In. W.C.	2284	---		NO		0.75	HP	460V/480V | 3PH					GREENHECK	$ 2,145.00	
EF-3572		WSB	EXHAUST FAN	350					550	---	CFM	0.1		In. W.C.	1118			NO		0.25	HP	115V/120V |1PH					GREENHECK	$ 1,246.00	
EHTR-3573		WSB	ELECTRIC DUCT HEATER	350					10,000	---	Watts	0.06	---	In. W.C.	---	---		NO	---	10	KW	460V/480V | 3PH					GREENHECK	$ 858.80	800 FPM MINIMUM 10x10 DUCT
EHTR-3574		WSB	ELECTRIC UNIT HEATER NO. 1	350					5,000	---	Watts	---	---	---	---	---		NO		5	KW	460V/480V | 3PH					QMARK	$ 755.00	
EHTR-3575		WSB	ELECTRIC UNIT HEATER NO. 2	350					5,000	---	Watts	---	---	---	---	---		NO		5	KW	460V/480V | 3PH					QMARK	$ 755.00	
EHTR-3576		RESTROOM	ELECTRIC WALL HEATER	350					750	---	Watts	---	---	---	---	---		NO		0.75	KW	115V/120V |1PH					QMARK	$ 233.00	
EHTR-3577		RESTROOM	ELECTRIC INSTANT WATER HEATER	350					4,160	---	Watts	---	---	---	---	---	NO	NO	---	4.2	KW	208V | 1PH					CHRONOMITE LABORATORIES		
SOL-3578		RESTROOM	ELECTRONIC TRAP PRIMER	350					120	---	Volts	---	---	---	---	---	NO	NO	---			115V/120V |1PH					PRECISION PLUMBING PRODUCTS		
P-3579		RESTROOM	SEWAGE GRINDER PUMP STATION	350					25		GPM	32		ft head	---	---	YES	NO	---	1	HP	115V/120V |1PH					PROVORE MODEL P382XPRG101	$ 1,735.00	FLA = 12 / LRA = 47
DG-35801		WSB	STANDBY GENERATOR	350					---	---	---	---	---	---	---	---			---	350	KW	460V/480V | 3PH					CUMMINS	$85,000.00	
SWBD-35811		WSB	SERVICE ENTRANCE SWITCHBOARD						---	---	---	---	---	---	---	---			---	1200	A	460V/480V | 3PH					EATON	$123,000.00	Includes Cost for SE Switchboard and the MCC as a packaged bid.
ATS-35821		WSB	AUTOMATIC TRANSFER SWITCH						---	---	---	---	---	---	---	---			---	800	A	460V/480V | 3PH					ASCO	$30,000.00	
MCC-35831		WSB	STANDBY MCC						---	---	---	---	---	---	---	---			---	800	A	460V/480V | 3PH					EATON		See SE switchboard cost.
LCP-35843		WSB	LIGHTING CONTROL PANEL						---	---	---	---	---	---	---	---			---			115V/120V |1PH							
LS-35xx	T-3440	WSB	SOFTENER DISCHARGE PRESSURE								FT							NO	---								Wika, RSM	I&C Quote ($2800)	I&C Quote- Rough estimate based on fourteen floats (2 per water softner)
RAD-35xx		WSB	WIRELESS TRANSMITTER/RECEIVER															NO				115V/120V |1PH					Prosoft	I&C Quote- ($4000)	Prosoft $1563.10 per unit without antena
-35xx		WSB	HSW NORTH ROUTE PSV															NO				NO PWR REQD					CLA-VAL	11028	Includes freight to Quincy
-35xx		WSB	HSW SOUTH ROUTE PSV															NO				NO PWR REQD					CLA-VAL	11028	Includes freight to Quincy
-35xx		WSB	HSW IRWTP/CO1/2 ROUTE PSV															NO				NO PWR REQD					CLA-VAL	11028	Includes freight to Quincy
-35xx		WSB	SOFTENER FEED PRV															NO				NO PWR REQD					CLA-VAL	2889	Includes freight to Quincy
PIT-34401		RW IFE PUMPS	INLET PRESSURE			P-340-0022	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
PIT-34402		RW IFE PUMPS	DISCHARGE PRESSURE			P-340-0022	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
FE-34403		RW IFE PUMPS	DISCHARGE FLOW ELEMENT			P-340-0022	DP4	NO										NO	---	---	---						E&H 10W		
FIT-34403		RW IFE PUMPS	DISCHARGE FLOW TRANSMITTER			P-340-0022	DP4	NO										NO	---	---	---						E&H 10W		
M-34410		RW IFE PUMP 1	MOTOR	340		P-340-0022	DP4	NO										NO		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-34410		RW IFE PUMP 1	HAND STATION	340		P-340-0022	DP4	NO																					
P-34410		RW IFE PUMP 1		340		P-340-0022	DP4	NO	417	1250	GPM	240		FEET	3525											PUMPTECH	GRUNDFOS	14,776.50	
PI-34410		RW IFE PUMP 1	DISCHARGE PRESSURE GAUGE	340		P-340-0022	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
M-34420		RW IFE PUMP 2	MOTOR	340		P-340-0022	DP4	NO										NO		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-34420		RW IFE PUMP 2	HAND STATION	340		P-340-0022	DP4	NO																					
P-34420		RW IFE PUMP 2		340		P-340-0022	DP4	NO	417	1250	GPM	240		FEET	3525											PUMPTECH	GRUNDFOS	14,776.50	
PI-34420		RW IFE PUMP 2	DISCHARGE PRESSURE GAUGE	340		P-340-0022	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
M-34430		RW IFE PUMP 3	MOTOR			P-340-0022	DP4	NO										NO		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-34430		RW IFE PUMP 3	HAND STATION			P-340-0022	DP4	NO																					
P-34430		RW IFE PUMP 3				P-340-0022	DP4	NO	417	1250	GPM	240		FEET	3525											PUMPTECH	GRUNDFOS	14,776.50	
PI-34430		RW IFE PUMP 3	DISCHARGE PRESSURE GAUGE			P-340-0022	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
PIT-34501		IRW IFE PUMPS	INLET PRESSURE	340		P-340-0023	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
PIT-34502		IRW IFE PUMPS	DISCHARGE PRESSURE	340		P-340-0023	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
FE-34503		IRW IFE PUMPS	DISCHARGE FLOW ELEMENT	340		P-340-0023	DP4	NO										NO	---	---	---						E&H 10W		
FIT-34503		IRW IFE PUMPS	DISCHARGE FLOW TRANSMITTER	340		P-340-0023	DP4	NO										NO	---	---	---						E&H 10W		
M-34510		IRW IFE PUMP 1	MOTOR	340		P-340-0023	DP4	NO										NO	3550	50	HP	460V/480V | 3PH				PUMPTECH	BALDOR		Skid Mounted, Quote is in processing
HS-34510		IRW IFE PUMP 1	HAND STATION	340		P-340-0023	DP4	NO										NO	---	---	---								
P-34510		IRW IFE PUMP 1		340		P-340-0023	DP4	NO	520		GPM	270		FEET	3550			NO	---	---	---					PUMPTECH	GRUNDFOS		Skid Mounted, Quote is in processing
PI-34510		IRW IFE PUMP 1	DISCHARGE PRESSURE GAUGE	340		P-340-0023	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
M-34520		IRW IFE PUMP 2	MOTOR	340		P-340-0023	DP4	NO										NO	3550	50	HP	460V/480V | 3PH				PUMPTECH	BALDOR		Skid Mounted, Quote is in processing
HS-34520		IRW IFE PUMP 2	HAND STATION	340		P-340-0023	DP4	NO										NO	---	---	---								
P-34520		IRW IFE PUMP 2		340		P-340-0023	DP4	NO	520		GPM	270		FEET	3550			NO	---	---	---					PUMPTECH	GRUNDFOS		Skid Mounted, Quote is in processing
PI-34520		IRW IFE PUMP 2	DISCHARGE PRESSURE GAUGE	340		P-340-0023	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
M-34530		IRW IFE PUMP 3	MOTOR	340		P-340-0023	DP4	NO										NO	3550	50	HP	460V/480V | 3PH				PUMPTECH	BALDOR		Skid Mounted, Quote is in processing
HS-34530		IRW IFE PUMP 3	HAND STATION	340		P-340-0023	DP4	NO										NO	---	---	---								
P-34530		IRW IFE PUMP 3		340		P-340-0023	DP4	NO	520		GPM	270		FEET	3550			NO	---	---	---					PUMPTECH	GRUNDFOS		Skid Mounted, Quote is in processing
PI-34530		IRW IFE PUMP 3	DISCHARGE PRESSURE GAUGE	340		P-340-0023	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
M-34540		IRW IFE PUMP 4	MOTOR	340		P-340-0023	DP4	NO										NO	3550	50	HP	460V/480V | 3PH				PUMPTECH	BALDOR		Skid Mounted, Quote is in processing
HS-34540		IRW IFE PUMP 4	HAND STATION	340		P-340-0023	DP4	NO										NO	---	---	---								
P-34540		IRW IFE PUMP 4		340		P-340-0023	DP4	NO	520		GPM	270		FEET	3550			NO	---	---	---					PUMPTECH	GRUNDFOS		Skid Mounted, Quote is in processing
PI-34540		IRW IFE PUMP 4	DISCHARGE PRESSURE GAUGE	340		P-340-0023	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
PRV-34600		RFB	DISTRIBUTION PUMPS BACK PRESSURE VALVE			P-340-0022	DP4	NO										NO	---	---	---	NO PWR REQD							
PRV-34601		RFB	REUSE WATER PUMPS BACK PRESSURE VALVE			P-340-0023	DP4	NO										NO	---	---	---	NO PWR REQD							
ISV-34630		RW IFE CLEARWELL TANK	INLET VALVE			P-340-0021	DP4	NO										NO	---	---	---								

Q1W Reuse Pumping System - Basis of Design

Equip No.	Equipment No OLD	Description 1	Description 2	Building Location	Spec Section	P&ID	Design Package	Vendor Package	Rated Capacity	Max Capacity	Units	Head / Pressure	Max Head/Pressure	Units2	Equipment Speed (RPM)	Speed Range (RPM)	Motorized	VFD	Motor Speed (RPM)	Size / Power	Units3	Voltage	Gen Load	Units4	Supplier	Supplier2	Manufacturers	Cost	Notes
HS-34630		RW IFE CLEARWELL TANK	INLET VALVE HAND STATION			P-340-0021	DP4	NO										NO	---	---	---								
LE-34630		RW IFE CLEARWELL TANK	LEVEL ELEMENT			P-340-0021	DP4	NO										NO	---	---	---	NO PWR REQD							
LIT-34630		RW IFE CLEARWELL TANK	LEVEL TRANSMITTER			P-340-0021	DP4	NO										NO	---	---	---	115V/120V |1PH							
LSH-34630		RW IFE CLEARWELL TANK	HIGH LEVEL			P-340-0021	DP4	NO										NO	---	---	---						ANCHOR SCIENTIFIC		
LSL-34630		RW IFE CLEARWELL TANK	LOW LEVEL			P-340-0021	DP4	NO																			ANCHOR SCIENTIFIC		
TK-34630		RW IFE CLEARWELL TANK				P-340-0021	DP4	NO										NO	---	---	---	NO PWR REQD							
ISV-34631		IRW IFE CLEARWELL TANK	POTABLE WATER VALVE	340		P-340-0021	DP4	NO										NO	---	---	---								
HS-34631		IRW IFE CLEARWELL TANK	POTABLE WATER VALVE HAND STATION	340		P-340-0021	DP4	NO										NO	---	---	---								
LE-34631		IRW IFE CLEARWELL TANK	LEVEL ELEMENT	340		P-340-0021	DP4	NO										NO	---	---	---								
LIT-34631		IRW IFE CLEARWELL TANK	LEVEL TRANSMITTER	340		P-340-0021	DP4	NO										NO	---	---	---	115V/120V |1PH							
LSH-34631		IRW IFE CLEARWELL TANK	LEVEL HIGH	340		P-340-0021	DP4	NO										NO	---	---	---						ANCHOR SCIENTIFIC		
LSL-34631		IRW IFE CLEARWELL TANK	LEVEL LOW	340		P-340-0021	DP4	NO										NO	---	---	---						ANCHOR SCIENTIFIC		
BFP-34640		IRW IFE CLEARWELL TANK	POTABLE WATER BACKFLOW PREVENTER	340		P-340-0021	DP4	NO										NO	---	---	---								
M-4201		RW BOOSTER PUMP	MOTOR			P-420-0002	DP4	NO										NO		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4201		RW BOOSTER PUMP	HAND STATION			P-420-0002	DP4	NO										NO	---	---	---								
P-4201		RW BOOSTER PUMP				P-420-0002	DP4	NO	1400		GPM	80		FEET	1780			---	---	---	---					PUMPTECH	GRUNDFOS	11,487.70	
PI-4201		RW BOOSTER PUMP	DISCHARGE PRESSURE GAUGE			P-420-0002	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
PIT-4202A		RW BOOSTER PUMP	SUCTION PRESSURE			P-420-0002	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
PIT-4202B		RW BOOSTER PUMP	DISCHARGE PRESSURE			P-420-0002	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
FE-4203		RW BOOSTER PUMP	DISCHARGE FLOW ELEMENT			P-420-0002	DP4	NO										NO	---	---	---						E&H 10W		
FIT-4203		RW BOOSTER PUMP	DISCHARGE FLOW TRANSMITTER			P-420-0002	DP4	NO										NO	---	---	---						E&H 10W		
AE-4204		BLENDED RW PUMPS	CONDUCTIVITY ELEMENT			P-420-0002	DP4	NO										NO	---	---	---								
AIT-4204		BLENDED RW PUMPS	CONDUCTIVITY TRANSMITTER			P-420-0002	DP4	NO										NO	---	---	---								
M-4211		RW RO BLENDING PUMP 1	MOTOR			P-420-0003	DP4	NO										NO		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4211		RW RO BLENDING PUMP 1	HAND STATION			P-420-0003	DP4	NO										NO	---	---	---								
P-4211		RW RO BLENDING PUMP 1				P-420-0003	DP4	NO	1250		GPM	270		FEET	3525			---	---	---	---					PUMPTECH	GRUNDFOS	14,776.50	
VFD-4211		RW RO BLENDING PUMP 1	VARIABLE FREQUENCY DRIVE			P-420-0003	DP4	NO										YES				460V/480V | 3PH							
PI-4211		RW RO BLENDING PUMP 1	DISCHARGE PRESSURE GAUGE			P-420-0003	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
TSH-4211		RW RO BLENDING PUMP 1	MOTOR TEMPERATURE SWITCH			P-420-0003	DP4	NO										NO	---	---	---								
M-4212		RW RO BLENDING PUMP 2	MOTOR			P-420-0003	DP4	NO										NO		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4212		RW RO BLENDING PUMP 2	HAND STATION			P-420-0003	DP4	NO										NO	---	---	---								
P-4212		RW RO BLENDING PUMP 2				P-420-0003	DP4	NO	1250		GPM	270		FEET	3525			---	---	---	---					PUMPTECH	GRUNDFOS	14,776.50	
PI-4212		RW RO BLENDING PUMP 2	DISCHARGE PRESSURE GAUGE			P-420-0003	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
M-4213		RW RO BLENDING PUMP 3	MOTOR			P-420-0003	DP4	NO										YES		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4213		RW RO BLENDING PUMP 3	HAND STATION			P-420-0003	DP4	NO										NO	---	---	---								
P-4213		RW RO BLENDING PUMP 3				P-420-0003	DP4	NO	1250		GPM	270		FEET	3525			---	---	---	---					PUMPTECH	GRUNDFOS	14,776.50	
PI-4213		RW RO BLENDING PUMP 3	DISCHARGE PRESSURE GAUGE			P-420-0003	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
PIT-4214A		RW RO BLENDING PUMPS	SUCTION PRESSURE			P-420-0003	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
PIT-4214B		RW RO BLENDING PUMPS	DISCHARGE PRESSURE			P-420-0003	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
T-4216A		BLENDED RW	SURGE BLADDER TANK			P-420-0002	DP4	NO										NO	---	---	---								
T-4216B		BLENDED RW	VACUUM BLADDER TANK			P-420-0002	DP4	NO																					
CV-4217		RW RO AIR GAP TANK	ISOLATION VALVE			P-420-0001	DP4	NO										NO	---	---	---								
HS-4217		RW RO AIR GAP TANK	ISOLATION VALVE HAND STATION			P-420-0001	DP4	NO										NO	---	---	---								
LIT-4217		RW RO AIR GAP TANK	LEVEL TRANSMITTER			P-420-0001	DP4	NO										NO	---	---	---	115V/120V |1PH					E&H FMD77		
LSHH-4217		RW RO AIR GAP TANK	LEVEL SWITCH HIGH HIGH			P-420-0001	DP4	NO										NO	---	---	---						ANCHOR SCIENTIFIC		
T-4217		RW	RO AIR GAP TANK			P-420-0001	DP4	NO																					
M-4221		IRW BOOSTER PUMP	MOTOR	350		P-420-0004	DP4	NO										NO		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4221		IRW BOOSTER PUMP	HAND STATION	350		P-420-0004	DP4	NO										NO	---	---	---								
P-4221		IRW BOOSTER PUMP		350		P-420-0004	DP4	NO	1400		GPM	80		FEET	1780			---	---	---	---					PUMPTECH	GRUNDFOS	11,487.70	
VFD-4221		IRW BOOSTER PUMP	VARIABLE FREQUENCY DRIVE	350		P-420-0004	DP4	NO										YES				460V/480V | 3PH							
PI-4221		IRW BOOSTER PUMP	DISCHARGE PRESSURE	350		P-420-0004	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
TSH-4221		IRW BOOSTER PUMP	MOTOR TEMPERATURE SWITCH	350		P-420-0004	DP4	NO										NO	---	---	---								
PIT-4222A		IRW BOOSTER PUMP	SUCTION PRESSURE	350		P-420-0004	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
PIT-4222B		IRW BOOSTER PUMP	DISCHARGE PRESSURE	350		P-420-0004	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
FE-4223		IRW BOOSTER PUMP	DISCHARGE FLOW ELEMENT	350		P-420-0004	DP4	NO										NO	---	---	---								
FIT-4223		IRW BOOSTER PUMP	DISCHARGE FLOW TRANSMITTER	350		P-420-0004	DP4	NO										NO	---	---	---								
CV-4224		WSB	HES BYPASS VALVE			P-420-0004	DP4	NO																					
HS-4224		WSB	HES BYPASS VALVE HAND STATION			P-420-0004	DP4	NO																					
AE-4225		BLENDED IRW PUMPS	CONDUCTIVITY ELEMENT			P-420-0004	DP4	NO										NO	---	---	---								
AIT-4225		BLENDED IRW PUMPS	CONDUCTIVITY TRANSMITTER			P-420-0004	DP4	NO										NO	---	---	---								
M-4231		IRW RO BLENDING PUMP 1	MOTOR			P-420-0005	DP4	NO										YES		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4231		IRW RO BLENDING PUMP 1	HAND STATION			P-420-0005	DP4	NO										NO	---	---	---								
P-4231		IRW RO BLENDING PUMP 1				P-420-0005	DP4	NO	1250		GPM	270		FEET	3525			---	---	---	---					PUMPTECH	GRUNDFOS	14,776.50	
VFD-4231		IRW RO BLENDING PUMP 1	VARIABLE FREQUENCY DRIVE			P-420-0005	DP4	NO										YES				460V/480V | 3PH							
PI-4231		IRW RO BLENDING PUMP 1	DISCHARGE PRESSURE			P-420-0005	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
TSH-4231		IRW RO BLENDING PUMP 1	MOTOR TEMPERATURE SWITCH			P-420-0005	DP4	NO										NO	---	---	---								
M-4232		IRW RO BLENDING PUMP 2	MOTOR			P-420-0005	DP4	NO										YES		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4232		IRW RO BLENDING PUMP 2	HAND STATION			P-420-0005	DP4	NO										NO	---	---	---								
P-4232		IRW RO BLENDING PUMP 2				P-420-0005	DP4	NO	1250		GPM	270		FEET	3525			---	---	---	---					PUMPTECH	GRUNDFOS	14,776.50	
VFD-4232		IRW RO BLENDING PUMP 2	VARIABLE FREQUENCY DRIVE			P-420-0005	DP4	NO										YES				460V/480V | 3PH							
PI-4232		IRW RO BLENDING PUMP 2	DISCHARGE PRESSURE			P-420-0005	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		

Q1W Reuse Pumping System - Basis of Design

Equip No.	Equipment No OLD	Description 1	Description 2	Building Location	Spec Section	P&ID	Design Package	Vendor Package	Rated Capacity	Max Capacity	Units	Head / Pressure	Max Head/Pressure	Units2	Equipment Speed (RPM)	Speed Range (RPM)	Motorized	VFD	Motor Speed (RPM)	Size / Power	Units3	Voltage	Gen Load	Units4	Supplier	Supplier2	Manufactuers	Cost	Notes
TSH-4232		IRW RO BLENDING PUMP 2	MOTOR TEMPERATURE SWITCH			P-420-0005	DP4	NO										NO	---	---	---								
M-4233		IRW RO BLENDING PUMP 3	MOTOR			P-420-0005	DP4	NO										YES		40	HP	460V/480V | 3PH				PUMPTECH	BALDOR		
HS-4233		IRW RO BLENDING PUMP 3	HAND STATION			P-420-0005	DP4	NO										NO	---	---	---								
P-4233		IRW RO BLENDING PUMP 3				P-420-0005	DP4	NO	1250		GPM	270		FEET	3525			---	---	---	---					PUMPTECH	GRUNDFOS	14,776.50	
VFD-4233		IRW RO BLENDING PUMP 3	VARIABLE FREQUENCY DRIVE			P-420-0005	DP4	NO										YES				460V/480V | 3PH							
PI-4233		IRW RO BLENDING PUMP 3	DISCHARGE PRESSURE			P-420-0005	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					Ashcroft 1279		
TSH-4233		IRW RO BLENDING PUMP 3	MOTOR TEMPERATURE SWITCH			P-420-0005	DP4	NO										NO											
PIT-4234A		IRW RO BLENDING PUMPS	SUCTION PRESSURE			P-420-0005	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
PIT-4234B		IRW RO BLENDING PUMPS	DISCHARGE PRESSURE			P-420-0005	DP4	NO	---	---	PSI							NO	---	---	---	NO PWR REQD					E&H PMP71		
T-4235		EXISTING FILTER REUSE	RO STANDPIPE			P-420-0001	DP4	NO										NO	---	---	---								
CV-4235		RW RO STANDPIPE	ISOLATION VALVE			P-420-0001	DP4	NO										NO	---	---	---								
HS-4235		RW RO STANDPIPE	ISOLATION VALVE HAND STATION			P-420-0001	DP4	NO										NO	---	---	---								
LIT-4235		RW RO STANDPIPE	LEVEL TRANSMITTER			P-420-0001	DP4	NO										NO	---	---	---	115V/120V |1PH					E&H FMD77		
LSHH-4235		RW RO STANDPIPE	LEVEL HIGH HIGH			P-420-0001	DP4	NO										NO	---	---	---						ANCHOR SCIENTIFIC		
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Appendix G: Technical Memorandum Quincy Solids Management Feasibility

Dated November 15, 2011

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Brown AND Caldwell

Technical Memorandum

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Seattle, Washington 98101
Tel: 206-624-0100
Fax: 206-749-2200

Prepared for: City of Quincy

Project Title: Industrial Reuse Predesign

Project No.: 141055.300

Technical Memorandum

Subject: Quincy Solids Management Feasibility

Date: November 15, 2011

To: Tim Snead – City of Quincy

From: Emil Voges, Project Manager

Copy to: Ariel Belino – City of Quincy

Jay Favor – American Water/EMC

Prepared by: ______________________

Steve Wilson, Chief Scientist

Reviewed by: ______________________

Emil Voges, Program Manager

Limitations:

This is a draft memorandum and is not intended to be a final representation of the work done or recommendations made by Brown and Caldwell. It should not be relied upon; consult the final report.

This document was prepared solely for the City of Quincy in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Quincy and Brown and Caldwell dated _____. This document is governed by the specific scope of work authorized by the City of Quincy; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Quincy and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Introduction

The City of Quincy (City) is developing an Industrial Reuse Water Treatment Plant (IRWTP) to serve the needs of local industry. In addition to the current program generating biological solids from wastewater treatment for land application, the upgraded system will generate lime softening (LS) solids and brine reject from the new reverse osmosis (RO) system. A recent addition to the treatment system is the new anaerobic digester, which has some effect on the quantity and characteristics of the biological solids that are produced. The feasibility of integrating the three solids streams to maximize reuse as a by-product was considered in this study. Methods of utilizing existing infrastructure were also considered for purposes of economy.

The original operation provided primary solids removal for animal feed. Primary effluent was treated in a sequencing batch reactor (SBR), with secondary (biological) solids being sent to lagoons for storage, stabilization, and consolidation. Storage lagoons were cleaned out periodically and the solids were applied to agricultural land as a fertilizer and soil amendment. Contract removal and land application of solids was expensive and a considerable inventory of stored solids remains for future reuse.

Figure 1 illustrates the original layout of the secondary treatment facility. Lagoon 2 was converted to an anaerobic digester in 2011. Lagoons 1 and 3 are used to store the current inventory of biological solids. The solids treatment function of Lagoon 6 was discontinued several years ago. Future solids integration, handling, and storage within the footprint of the treatment facility are under discussion and several options are explored in this memorandum.

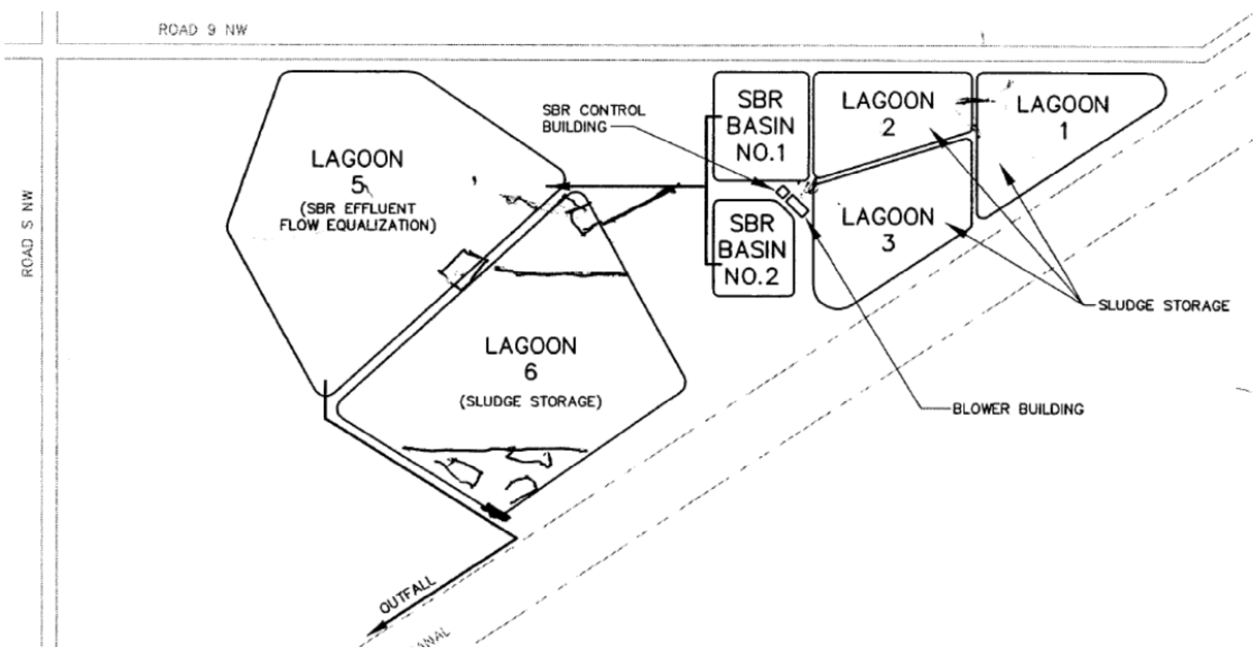

Figure 1. Original IRWTP layout

(Reference 1)

Three types of solids will be generated at the upgraded facility; biological (digested) solids, lime softening solids (LS), and brine reject from reverse osmosis (RO) treatment. The quantity/quality of these 3 types of wastewater solids will be discussed in the following sections along with potential to manage in an integrated fashion for optimal beneficial reuse.

Solids Quantities and Characteristics

Environmental Management Corporation (EMC) operations records indicate that in March 2011, the biological solids inventory in Lagoons 1 and 3 totaled approximately 4,300 dry tons (DT) of solids. EMC is responsible for about half of the inventory while the City retains responsibility for the balance of original inventory prior to operations contract initiation. The total quantity is based on an assumed solids concentration of 2 percent. This assumption and the actual quantity stored in lagoons should be verified by an updated lagoon survey.

Projected biological solids production from the new digester is 2,600 DT annually (Reference 2). Biological solids value as a soil amendment can be estimated based on typical nutrient and fertilizer commodity value. At typical nitrogen (N) concentrations and an assumed available fraction of 35 percent, 2.44 DT of biological solids per acre would be required to meet an assumed agronomic requirement of 100 lb available N/acre (Reference 3). Nutrient quantities and projected agronomic value are presented in Table 1.

Table 1. Projected Nutrient Content and Agronomic Value for Biological Solids

Nutrient	Expressed as	Total nutrient % dry weight	Available nutrient % total	Nutrient cost $/lb	Value per DT, $	Value per acre, $
Nitrogen	N	5.5	35	0.57	21.95	53.52
Phosphorous	P	2.5	40	0.70	14.00	34.15
Potassium	K	0.3	100	0.50	3.00	7.32*
Sulfur	S	1.0	35	0.13	0.91	2.22*
Total					39.86	97.21*

** Additional value from LS and RO sludge not considered.*

Nutrient value is potentially diminished by product availability and delivery considerations. For example, commercial fertilizer is more concentrated and can be delivered and spread on demand. Biological solids are typically applied as a more dilute slurry (e.g., 2-6 percent solids) with delivery and scheduling limitations. Hence a landowner may be more willing to recognize the value of the product only if it can be delivered within the scheduling window that meets his needs.

Delivery costs can be very significant. Operations records indicate that the most recent contract land application resulted in a cost totaling $525/DT. The cost for removal of additional inventory was estimated at over $2 million. Significant potential exists to offset these costs through advanced planning to reduce haul distance and be compatible with farm management needs. Incorporating LS and RO solids to supplement nutrient value should also be considered.

LS quantity is projected at approximately 600 DT/year. Information on LS characteristics is limited, but this material will likely complement biological solids to supplement soil calcium and provide some liming value. It is assumed that LS can be blended with digested biological solids and/or existing stored inventory.

RO reject solids are projected to be high in potassium (K) as well as sodium (Na) salts. Potassium has the potential to increase the nutrient value of biological solids as a blend. However, potential for blending is limited by sodium. For planning purposes, with a projected Na content of 25 percent for RO brine, the maximum amount that should be applied to agricultural land is 1.1 DT/acre. This limitation is based on increasing soil exchangeable sodium percentage (ESP) by no more than 5 percent for typical soils with a cation exchange capacity (CEC) of 25 milliequivalents per 100 grams (meq/100g). Soil CEC is variable and this limit should be reassessed based on actual site characteristics.

Using the assumptions above, RO brine could be blended with biological solids on a ratio of approximately 2 parts biological solids to 1 part RO brine on a dry weight basis. With future RO brine quantity projected at 2,100 DT/year, 57 percent of the material can be used beneficially for land application. Alternatives for RO brine disposition include use as a deicing agent for roads, ion separation to product individual salts as commodities, or landfill disposal. These alternatives require additional study.

Product Handling and Utilization Options

Solids generated from wastewater treatment are developed into a wide range of products for reuse. Examples range from a slurry product that can be used on agricultural land to dried product suitable for a wider variety of uses. A key factor differentiating product types is moisture content. While slurry (2–6 percent solids concentration) can simply be pumped into a tank truck for land spreading, volume and transport costs are significant. Dried product may be as much as 95 percent solids, resulting in a much lower volume and transport cost. In the middle of this spectrum, mechanically dewatered (e.g., centrifuge) product is in the range of 20–25 percent solids concentration. Dewatered product is less expensive to haul but presents handling issues and is not as marketable as dried product. A summary of product types and features is shown in Table 2.

Table 2. Summary of Wastewater Solids Product Types and Market Options

Product	Market options
Slurry (2%–6% solids)	Agricultural land application, short haul
Dewatered cake (20%–25% solids)	Agricultural land application or compost feedstock
Air-dried product (70% solids)	Soil improvement, landscaping, compost feedstock
Thermally dried product (90%–95% solids)	Fertilizer blending, soil improvement, turf application

Because solids are generated from industrial wastewater rather than municipal sewage, public health and pathogen reduction should not be an issue for these products. However, appearance, odor potential, and percent moisture all affect marketability. All of these products can be beneficially reused. Each additional level of processing adds cost depending on local circumstances.

Brown and Caldwell developed a simplified cost model to illustrate differential cost for solids management alternatives. Variables included moisture content, cycle time per load, haul cost, application cost, process cost for dewatering and solar or thermal drying, and monitoring/management. Detailed assumptions are provided in Appendix A.

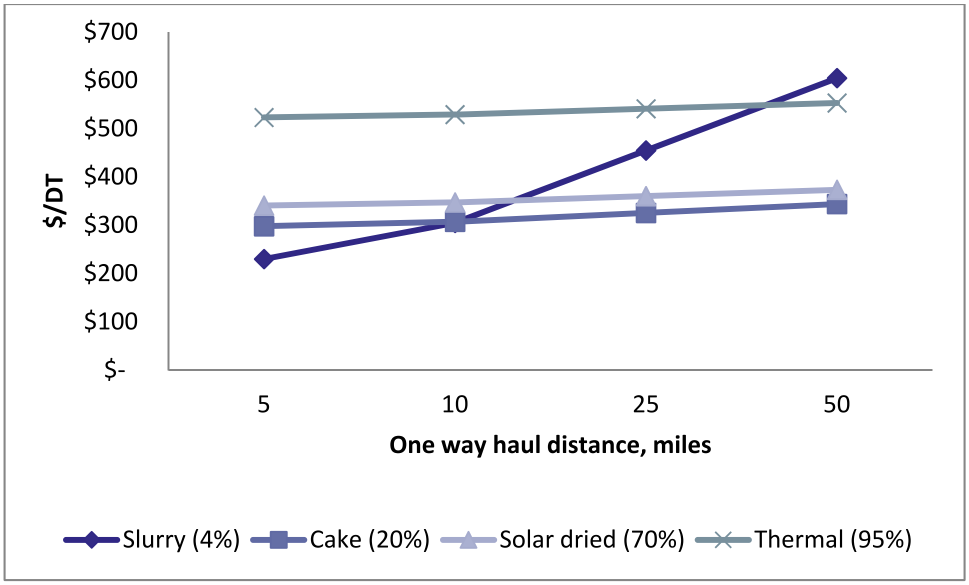

Figure 2. Unit cost summary for solids management alternatives

A unit cost summary for hauling the various solids management alternatives is presented in Figure 2 above. Results illustrate that at short haul distances, slurry application is the most cost-effective. At 5 miles, for example, slurry application saves $68/DT over the second-best option (mechanical dewatering). At longer haul distances, slurry rapidly loses its cost advantage. This is consistent with Brown and Caldwell's project experience at various locations over many years.

The model does not consider potential product revenue, which could range from $10–$30/DT for dried products. Product revenue might improve the return on investment for solar drying on a seasonal basis if space is available for that purpose. Drying a portion of the annual solids production might also be considered to diversify the solids reuse operation. However, thermal drying is unattractive due to the high energy cost associated with evaporating the water using supplemental fuels.

Application of slurry to local agricultural land should be feasible but requires advanced planning to ensure that adequate land is available at times that do not interfere with crop management. Dry land in a fallow cycle is ideal for this purpose. This study has not evaluated land availability in the area; this should be done as a follow-up. Based on quantity projections, savings of $68/DT would translate to more than $200,000 in annual operating savings for blended biological solids plus LS. Additional savings could be realized for existing solids inventory as well.

Evaporation Pond Product Blending with Slurry

The RO reject is estimated to be produced out of the RO system with a mineral (total dissolved solids or TDS) concentration of approximately 18,000 milligrams per liter (mg/L), or 1.8 percent, in a volume of 28 million gallons per year (mgy). Via a combination of mechanical and natural evaporation in the brine ponds, the concentration would be increased up to 100,000 mg/L (10 percent), with the volume reduced to 4.8 mgy.

Assuming a slurry concentration of 4 percent, the volume of digested solids (2,600 DT/year) would be 15 mgy. This could be blended with 57 percent of the 4.8 mgy of RO reject, or 2.7 mgy. Thus, the total slurry/RO reject volume would be 17.7 mgy. Applying a final evaporation step in a drying bed or other device, the volume could be reduced back to 15 mgy at 4 percent slurry and hauled off at the slurry hauling cost. In other words, the slurry hauling serves as an RO reject hauling medium to the eventual land application location and the RO reject hauling is essentially done at no cost for the useable fraction.

Initial rate estimates were developed assuming RO reject/brine disposal at $300/DT. Hauling 57 percent of the 2,100 DT/year of RO reject at no cost would eliminate approximately $350,000/year from the initial operational costs.

Conclusion

Biological solids and LS solids have strong potential for reuse as an agricultural soil amendment. The relatively small quantity of LS could be blended with biological solids from the digester to enhance product value. Blending could be done in the existing storage lagoons for convenience.

Biological solids application on land is typically limited by available nitrogen. Projected available N is based on literature values and requires confirmation by product testing. If projections are accurate, approximately 1,100 acres will be required for land application on an annual basis. A typical return interval for private farmland would be 3–4 years, so a larger land base is needed to maintain the program. Quincy is in the midst of a productive agricultural area but much of the nearby land is irrigated and may be unavailable at times depending on crop cycles.

RO brine has limitations for reuse as a soil amendment due to projected high sodium content. Brown and Caldwell does not recommend direct land application. However, if blended on a limited basis with biological solids, RO brine would enhance the potassium and sulfur fertilizer value of a blended product. Of the projected quantity of RO brine, 57 percent is suitable for this purpose. Other alternatives like road deicing or ion separation will need to be considered to avoid significant costs for disposal for the balance of RO solids.

It is evident that the biosolids, lime solids, and brine reject could be integrated into a program that provides overall industrial wastewater operational cost savings for the IRWTP. Potential for ion separation from brine reject and separate commoddity (e.g. potassium fertilizer) require additional investigation.

Recommendations

The following recommendations were derived from this study:

- Via pilot scale testing, confirm the characteristics and quantity of LS and RO brine.
- Confirm the digested solids production rate and characteristics.
- Evaluate the feasibility and cost of ion separation for RO brine.
- Evaluate the feasibility and cost for storage of RO brine and use as a deicing agent.
- Conduct a detailed survey of biological solids inventory to confirm quantity and characteristics.
- Update the site master plan to identify available areas for solids blending, handling, and storage.
- Evaluate the availability of local land for application of blended solids and existing solids inventory. Identify landowners with interest in cooperating and define schedule windows for land application.
- Determine the preferred operational approach for solids reuse: outside contractor or EMC.

References

1. Industrial Secondary Wastewater Treatment Facility Operations and Maintenance Manual. EarthTech, Dec. 2002.
2. Preliminary process Engineering Evaluations and Capital Development Review for Anaerobic Treatment. Stover Group, Dec. 2009.
3. PNW 508, Fertilizing With Biosolids, 2007. OSU, WSU, UI Extension.

Appendix A: Cost Model Assumptions

	Assumptions			Unit
1	Hauling			DT/load
	slurry load = 5,000 gallons; 4% solids; 0.834 DT			0.834
	cake load = 34 tons; 20% solids; 6.8 DT			6.8
	dry product load = 21 CY @ 1300 # = 13.65 tons @ 70% = 9.55 DT			9.55
	thermal product = 21 CY @ 1100# = 10.97 @ 95% = 10.42			10.42
2	Cycle time per load (includes 1 hr for loading/unloading)			hrs
	5 mile			1.5
	10 mile			2
	25 mile			3
	50 mile			4
3	Hauling cost for truck and operator based on $125/hr			$125
4	Application cost is based on $15/ton (cake)			
		$/WT	$/DT	$/DT
	slurry *		0	0
	cake	15	65	65
	dry product	15	16	16
5	Dewatering, $/DT			$200
6	Solar drying, $/DT			$100
7	Thermal drying, $/DT			$300
8	Monitoring and management: $25,000			$5
	* slurry application from haul vehicle; incl. in haul cost			

Additional References:

Fertilizer Prices

http://www.ers.usda.gov/AmberWaves/March09/Features/FertilizerPrices.htm

During 2007 and 2008, farmers saw a rapid run-up in fertilizer prices to record highs, followed by lower prices in late 2008. The significant volatility of the market in 2008 serves as a textbook example of supply-and-demand analysis in price determination.

Though U.S. nominal prices of nitrogen, phosphate, and potash fertilizers, among others, began trending upward as early as 2002, they increased sharply and reached historical highs in mid-2008. During the 12 months ending in April 2008, nitrogen prices increased 32 percent, phosphate prices 93 percent, and potash prices 100 percent. This price surge in 2008 was due to strong domestic and global demand for fertilizers, low fertilizer inventories, and the inability of the U.S. fertilizer industry to adjust production levels (see charts).

By late 2008, monthly average prices had fallen. Global fertilizer demand softened in response to the record-high fertilizer prices and declining crop prices. Some U.S. farmers postponed fertilizer application, tighter credit availability slowed fertilizer purchases, and fertilizer supplies from overseas increased, all contributing to the price decline.

PNW 508, Fertilizing with Biosolids, 2007. OSU, WSU, UI Extension

Fertilizer replacement value of biosolids

Table 4 estimates the fertilizer replacement value of biosolids nitrogen, phosphorus, potassium, and sulfur for the first year after application. This estimate is based on typical biosolids analyses and estimates of nutrient availability from university field trials.

The fertilizer replacement value for nutrients besides N depends on existing soil test values and the cropping system. Typically, a biosolids application to meet crop N requirements eliminates the need for annual P and S applications.

The fertilizer replacement values shown in Table 4 do not include the potential benefits to soil quality from biosolids. Soil quality benefits are difficult to express in simple economic terms and are unique to every location.

To convert values given for P and K in Table 4 to units used in fertilizer marketing: multiply P by 2.29 to get P_2O_5, and multiply K by 1.2 to get K_2O. For example, biosolids with 2.5 percent P and 0.3 percent K contain 5.7 percent P_2O_5 (phosphate) and 0.36 percent K_2O (potash).

Table 4. Approximate first-year fertilizer replacement value for anaerobically digested biosolids.

Nutrient	Expressed as	Total nutrient	Available nutrient[a]	Nutrient cost[b]	Value per dry ton
		(% dry wt.)	(% of total nutrient)	($ per lb)	($)
Nitrogen	N	5.0	35	0.41	14.35
Phosphorus	P	2.5	40	0.94	18.80
Potassium	K	0.3	100	0.29	1.74
Sulfur	S	1.0	35	0.13	0.91
Total					35.80

[a]Estimated plant-available nutrient released in the first year after biosolids application.

[b]Approximate nutrient cost is based on Willamette Valley bulk dry fertilizer prices, June 2006. The actual cost of a pound of fertilizer N, P, or K varies depending on nutrient form and analysis (e.g., costs differ for anhydrous ammonia and calcium nitrate as a source of N), transportation charges, market conditions, and the quantity purchased. Cost of fertilizer application is not included.

http://www.ers.usda.gov/Data/FertilizerUse/

Table 7. Average U.S. farm prices of selected fertilizers

Year	Month	Anhydrous ammonia	Nitrogen solutions (30%)	Urea 44-46% nitrogen	Ammonium nitrate	Sulfate of ammonium	Super-phosphate 20% phosphate	Super-phosphate 44-46% phosphate	Diammonium phosphate (18-46-0)	Potassium chloride 60% potassium
						Dollars per ton				
2007	Apr.	523	277	453	382	288	NA	418	442	280
2008	Apr.	755	401	552	509	391	NA	800	850	561
2009	Mar.	680	320	486	438	378	NA	639	638	853
2010	Mar.	499	283	448	398	326	NA	507	508	511
2011	Mar.	749	351	526	479	423	NA	633	703	601

NA = Not available.

Source: Agricultural Prices, National Agricultural Statistics Service, USDA.

http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1002

Appendix H: SEPA

Draft Quincy SEPA Checklist, Dated October 30, 2016

SF 299 Supplement: City of Quincy Responses to Application for Transportation and Utility Systems and Facilities on Federal Lands

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SEPA ENVIRONMENTAL CHECKLIST

CITY OF QUINCY
INDUSTRIAL REUSE WATER TREATMENT PLANT-STAGE 1 PROJECT

Purpose of checklist:

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help the City of Quincy to identify impacts from the proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

A. BACKGROUND

A1. Name of proposed Project, if applicable:

The City of Quincy Industrial Reuse Water Treatment Plant-Stage 1 Project, which consists of upgrades to the City's industrial wastewater treatment system.

A2. Name of applicant:

City of Quincy

A3. Address and phone number of applicant and contact person:

Tim Snead
City Administrator
City of Quincy
P.O. Box 338
Quincy, WA 98848
509.787.3523 ext 275
tsnead@quincywashington.us

A4. Date checklist prepared:

October 12, 2016

A5. Agency requesting checklist:

City of Quincy (City)

A6. Proposed timing or schedule (including phasing, if applicable):

The Engineering Report for the Industrial Reuse Water Treatment Plant-Stage 1 Project has been submitted to the Washington Department of Ecology (Ecology) for review and approval.

The City plans to build Stage 1 with sufficient capacity to supply reuse water for industrial cooling and for total dissolved solids control at the Municipal Water Reclamation Facility (MWRF) percolation beds. The City will still rely on wasteway discharge, because the IRWTP will not have sufficient capacity to treat the entire IWTP effluent flow. The City will use the period when only Stage 1 is in operation to develop new demands for reuse water to optimize the treatment processes and identify improvements that can be incorporated into the design of Stage 2. Later, the IRWTP capacity will be expanded in Stage 2 to treat all of the IWTP effluent, thus allowing removal of the discharge from the wasteway.

The operational conditions described in the IRWTP Stage 1 ER are Projected to begin in mid-2017.

A7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

After Stage 1 is complete, Stage 2 will be developed to treat all of the IWTP effluent to meet Class A Reclaimed Water standards. Any future property-specific irrigation infrastructure is not part of this proposed Project.

A8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

Several engineering and environmental documents have been prepared that are related to the Industrial Reuse Water Treatment Plant-Stage 1 Project, the sites, and the Project area. These include:

- Brown and Caldwell, 2012. City of Quincy Industrial Wastewater New Outfall Development Plan and Technical Appendices. December 31, 2012. [Outfall Plan]
- Brown and Caldwell, 2013. Engineering Report – City of Quincy Beneficial Reuse Project. October, 2013. [Engineering Report]
- Brown and Caldwell, 2016. Engineering Report – City of Quincy Industrial Reuse Water Treatment Plant-Stage 1 Project. October, 2016. [Engineering Report]

A9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

There are no applications for other proposals affecting the Project sites.

A10. List any government approvals or permits that will be needed for your proposal, if known.

The major permits and approvals for the proposed Project include:

- SEPA Environmental Review, for the proposed Project (City of Quincy)
- Engineering Report Review and Approval (Ecology)
- State Environmental Review Process (SERP) and Federal Cross Cutters, for state funding (Ecology)
- Local zoning/grading/development permits, for upgraded facilities at the individual sites (City of Quincy and/or Grant County)
- Right-of-way use (short-term), for construction work within the public right-of-way (City of Quincy and Grant County)

A11. Give brief, complete description of your proposal, including the proposed uses and the size of the Project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on Project description.)

The City of Quincy (City) is located in eastern Washington. It has an industrial base that includes major food processors and data centers (computer server farms). Facing industrial growth and the associated effects on its water and wastewater systems and permitting, the City is developing a new utility that will integrate its industrial and municipal wastewater treatment systems; it is called the Quincy 1Water Utility (Q1W). The Q1W will make use of the benefits of water reclamation and reuse using industrial and municipal wastewater and groundwater to create a system of near-zero environmental discharge and a sustainable water supply for the City's future. It will apply innovative solutions using existing infrastructure to minimize construction costs and stranded assets.

The activities needed to develop the complete Q1W include modifying and expanding components of the Industrial Wastewater Treatment Plant (IWTP) and Industrial Reuse Water Treatment Plant (IRWTP), constructing a conveyance system to deliver reclaimed water for irrigation of a new crop production area north of the city and installing an aquifer storage and recovery (ASR) well system. The activities have been grouped into four Projects, each of which will include the development of an engineering report (ER). The first Project is for the IRWTP Stage 1 Project, as described with the City's ER submitted in October 2016.

Background

The City serves as an agricultural processing hub for Grant County, Washington, and the surrounding area. Food crops are processed and packaged at two major plants located in Quincy. The City operates an IWTP to service these plants and other industries located in Quincy. In addition, the City operates the Municipal Water Reclamation Facility (MWRF) for domestic wastewater.

The IWTP is currently permitted to discharge to an irrigation drainage ditch, or wasteway, under Washington State Department of Ecology (Ecology) National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit WA-002106-7. Wasteway operation and use is regulated by the United States Bureau of Reclamation (USBR). The City's agreement with USBR for use of the wasteway expires in September 2017. However, the USBR is planning to issue the City a license to allow the IWTP to continue discharging treated effluent with the condition that the City make consistent progress toward implementation of alternative discharge solutions. Thus, in addition to the other needs for the Plan, it was developed and will be periodically updated to satisfy the USBR condition. The City has prepared multiple studies, investigations and evaluations to support selection of the optimal components that will comprise the Q1W.

Planned Uses of Reuse Water

The City plans to treat IWTP effluent and reuse it, rather than discharging it to the wasteway. Currently there are five planned uses:

- Percolation using existing MWRF percolation bed capacity. Blending low-TDS reuse water with MWRF effluent will reduce the TDS of the water being percolated.
- Reuse by industries for cooling system makeup and other uses.
- Crop production supply.
- Aquifer injection/ASR. Unlike percolation, these provide a direct augmentation to the City's water supply.

Each of these will use IWTP effluent treated in the IRWTP to meet Class A reclaimed water standards, which will require coagulation and filtration of 100 percent of the IWTP effluent. Each will also require TDS reduction. Reuse by industries, particularly in cooling systems and boilers, will require removal of scale forming constituents, which include hardness ions (calcium and magnesium), silica and carbonate alkalinity.

IRWTP Development

Class A reclaimed water must be coagulated and filtered, but the intended uses of the reuse water demand additional treatment. The required water quality for these uses can only be achieved by at least partial demineralization. Based on these requirements, the IRWTP will consist of the seven processes listed in Table 1.

Table 1. IRWTP Processes

Process	Equipment	Required for Class A Reclaimed Water?	Purpose
Coagulation	Lime and ferric chloride feed systems	Yes	Meet Class A requirements; coagulate organics to prevent UF fouling; and reduce hardness, phosphate and silica concentrations to prevent fouling of RO membranes and cooling system surfaces
Sedimentation	Clarifiers	No	Reduce the load of solids to the UF
Filtration	UF	Yes	Meet Class A requirements, achieve disinfection and prevent fouling of RO membranes
Disinfection	UF	Yes	Meet Class A requirements
IX	High efficiency softening	No	Remove remaining hardness to allow RO to be operated at high pH, which prevents silica scaling
RO	RO system	No	Remove TDS
Blending	Piping system and instruments	No	Combine RO and UF in correct proportions to satisfy water quality requirements of reuse water users

The IX and RO processes will generate brine, which will be collected in the existing and, if necessary new, brine evaporation ponds. Evaporation enhancements may be implemented.

The operation of the IRWTP may be improved by modifications to the existing IWTP process. Possible modifications will be considered during Stage 1 testing.

Preliminary IRWTP Design Basis

USBR is in the process of postponing the date by which the City must cease wasteway discharge. This extension allows the City to begin producing industrial reuse water without having to find an immediate demand for the entire IWTP effluent flow. Therefore, the City plans to construct the IRWTP in two stages. IRWTP Stage 1 will produce reuse water for industrial cooling and for blending with MWRF reclaimed water to reduce its TDS concentration.

Consistent with the requirements of Section 173-240-110 of the Washington Administrative Code (WAC), an ER has been prepared for the construction and operation of IRWTP Stage 1. It describes the processes by which IWTP effluent will be treated to produce industrial reuse water, or reuse water. A second ER will be prepared prior to construction of IRWTP Stage 2.

The operational conditions described in the IRWTP Stage 1 ER are Projected to begin in mid-2017. The IRWTP will treat 2.0 mgd to 2.5 mgd of IWTP effluent. Of this, an average 0.5 mgd to 0.7 mgd will be used for industrial cooling, with daily peaks exceeding 1.0 mgd. The balance will be blended with MWRF effluent for percolation.

Early in Stage 1 operation and possibly for several months, chemical dosing optimization and sludge and brine production minimization tests will be conducted. In addition, the reuse water will be characterized for use in studies of crop production and ASR.

IWTP outfall decommissioning is Projected to occur between 2020 and 2025, at which point all IWTP effluent will flow to uses managed under reuse and/or state waste discharge permits. Prior to that, the IRWTP Stage 2, or Buildout, ER will be prepared for the IRWTP capacity expansion that will be needed. The IRWTP Stage 2 ER will present the annual and seasonal water balance to manage 100 percent of IWTP effluent. It will describe equipment upgrades and/or capacity increases to be implemented for treating the full IWTP effluent flow. It will also describe the City's plan for full exit from the wasteway and will refer to and be associated with the ERs for the Crop Production Supply and ASR Projects, which are part of the water balance.

The coagulation, clarifier and UF system capacity requirements will be governed by IWTP effluent flow rates. Currently, the IRWTP Stage 2 (also called "Buildout") capacity is Projected to be 4.0 mgd to 5.0 mgd. The annual average rate of blended water production is estimated at 2.0 mgd to 2.5 mgd. Modular expansion capability and space planning will be included to support longer planning horizons.

While the IRWTP will be designed to meet criteria for individual constituents (e.g., hardness and silica), its effect on TDS is illustrative. The IWTP effluent TDS concentration is typically between 1,200 mg/L and 1,500 mg/L. The planning-basis target water quality criterion for TDS is 500 mg/L, which is consistent with state drinking water standards and would comply with state antidegradation standards. Thus, 60 percent to 70 percent of the TDS must be removed. RO will be used to achieve this removal. Since RO effluent will contain only 25 mg/L to 75 mg/L TDS, not all of the coagulated filtered water needs to be treated by RO. The RO system design flow rate capacity is between 1.2 and 1.7 mgd at Buildout conditions.

IRWTP Infrastructure Summary

This section describes the general IRWTP infrastructure and does not distinguish between Stage 1 and Stage 2 conditions. As discussed above, the IWTP and IRWTP can incorporate selective treatment applications on various quantities of the wastewater stream, depending on the intended end use of the wastewater.

All IWTP effluent that is not discharged to the wasteway will be treated with coagulation, sedimentation and UF. A portion of the UF-filtered water will be treated further using the existing IX water softening system and RO. The RO effluent will be blended with UF effluent water to meet anti-degradation standards for subsequent groundwater recharge at the percolation beds, for use on crops or for ASR. The demineralized water can also be conveyed to other industries to offset potable water demands including those of food processors.

The remainder of this section includes brief descriptions of Project components.

Cover SBR Effluent Equalization Basin:

The existing SBR effluent EQ basin, which is open to atmosphere, will be covered to prevent dust intrusion and algae growth. Flow routing modifications may also be incorporated.

Coag-Sed System and UF:

The coagulation-sedimentation (Coag-Sed) system and the UF processes will treat IWTP effluent to meet Washington Class A reclaimed water standards. The Coag-Sed system will consist of chemical storage and additional equipment and reactor-clarifiers. The UF system will be a vendor-provided package with membranes and backwash handling equipment.

The Coag-Sed system, which will be constructed west of the IWTP SBRs, will be designed to meet the following water quality objectives:

- With Washington Class A reclaimed water standard as a basis, provide chemical coagulation of IWTP secondary effluent
- Reduce TSS loading on the UF system to maximize treatment rate (flux) and minimize backwash cycles
- Using lime and ferric as the coagulants:
  - Assist in organic solids removal to protect the UF membranes
  - Remove hardness to minimize loading on the IX water softeners, which will protect the RO membranes and cooling system from scaling
  - Remove silica and phosphorus to protect RO membranes and cooling systems from scaling

The UF system will be designed to perform the following:

- With Washington Class A reclaimed water standard as a basis, provide filtration
- Using UF membranes (instead of sand, other media or microfilters), protect the RO system from fouling by reducing silt density index (SDI)

Because Stage 1 IRWTP implementation will be at partial buildout scale, an interim/temporary inorganic sludge management system has been defined in the IRWTP Stage 1 ER.

Clarified Industrial Effluent Pump Station:

The UF system will be installed in the existing Reuse Filter Building (RFB, constructed in advance to accelerate UF implementation) at the IWTP abandoned-primary clarifier site. To convey Coag-Sed effluent to the RFB, a new Clarified Industrial Effluent Pump Station will be constructed near the Coag-Sed system. Buildout capacity will be installed during Stage 1 because of the economy of scale and the inefficiency of retrofitting a pump station. The pump station will discharge to an existing, 18-inch-diameter high-density polyethylene (HDPE) pipe. UF feed pressure may be boosted by new pumps at the RFB.

UF Filtrate Storage:

One of the former IWTP primary clarifiers was converted for use as a UF filtrate clear well.

IX Softening and RO:

An IX Softening system, also referred to as a high efficiency softening (HES) system, is installed in the Water Softening Building (WSB) and has a capacity of 1,050 gpm. The RO system is being installed in the Reverse Osmosis Building (RO Building) adjacent to the brine ponds.

Initially, the IX and RO systems will treat potable water before use for industrial cooling as a means to reduce TDS discharges in cooling system blowdown. Once the Coag-Sed system, Clarified Industrial Effluent Pump Station and UF are operational and producing coagulated, filtered IWTP effluent, potable water feed to the IX and RO systems will be replaced by a portion of the UF effluent. As discussed above, the balance of the UF effluent will be blended with RO effluent to produce water with the desired quality.

Residuals Management: Brine and Chemical Sludge:

IX brine and RO reject will be discharged to the existing brine pond system. The IRWTP development will include sizing for the ultimate operations and capacity of the brine ponds. The current plan is to install a fifth, 1-acre/1-MG brine pond in late 2016. Preliminary Projections indicate tens of additional acres of ponds may be needed for Stage 1 and Stage 2 conditions. The IRWTP Stage 1 ER will include an analysis of the brine pond capacity needs and evaporation enhancement technologies that could potentially be used to increase capacity without adding pond footprint. Chemical, sludge from the Coag-Sed system will be dewatered and either land applied or landfilled. The IRWTP Stage 1 ER contains an evaluation of sludge management options. This chemical sludge may be managed in conjunction with biosolids from the IWTP and/or with concentrated brine from the brine evaporation ponds in an overall residuals management system. That system could potentially manage wastes from the MWRF and individual industries as well.

IWTP Tertiary Treatment System:

The existing IWTP tertiary treatment system, consisting of chlorine disinfection, temperature control (used to meet summer effluent temperature limits), dechlorination, and reaeration, will be decommissioned after discharge to the wasteway has ended. These processes are only used to meet surface water discharge standards and will no longer be necessary when 100 percent of the IWTP effluent is reused. Decommissioning will be addressed in the IRWTP Stage 2 ER.

Project Status:

Some components of the IRWTP are in place, some are in procurement and others are in the planning and design stage. Table 2-2 shows the status of each component as of August 2016.

Table 2. IRWTP Development Status

Process	Component	Status As of August 2016
Coag-Sed System	Chemical feed systems, reactor clarifiers and associated equipment	In Predesign Phase
Conveyance to UF	Clarified Industrial Effluent Pump Station	In Predesign Phase
	Pipeline	Installed
UF	UF system	Procurement documents being prepared
	Clearwell	Installed
IX	HES system	Installed
RO	RO system	Under construction
	Pipelines to and from IX	Installed
Brine management	Brine ponds	Four installed; additional pond(s) under consideration
	Pipelines to and between brine ponds	Installed

Below is a bulleted summary of the key milestones for the IRWTP Projects:

- August 2016: RO system installation begins
- October 2016: Completion of Coag-Sed predesign report
- October 2016: Scheduled completion of IRWTP Stage 1 ER.
- December 2016, (pending permitting): Installation and operation of fifth lagoon
- Fall 2016: Commissioning of IX water softeners and RO system using potable water (not IWTP effluent). Procurement of UF system. Design of Coag-Sed system and Clarified Industrial Effluent Pump Station.
- Mid-2017: Commissioning of Coag-Sed system, pump station and UF. Replacement of potable water with UF effluent as feed water to IX-RO systems, creating complete IRWTP system at partial capacity. Reduction of potable water use and wasteway discharge.
- 2017-2022: City increases use of industrial reuse water as demands are identified and users are connected to system.
- Approximately 2019: City develops IRWTP Stage 2 ER to describe full exit from drainage wasteway.
- Approximately 2022: Commissioning of full-capacity IRWTP and decommissioning of IWTP tertiary treatment system, with full exit from wasteway.

A12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed Project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The Industrial Reuse Water Treatment Plant-Stage 1 Project will include new/upgraded treatment and conveyance facilities within or adjacent to the City's existing infrastructure throughout the Quincy area. Figures 1, 2 and 3 show salient features of the Q1W Utility, as described in response to A11.

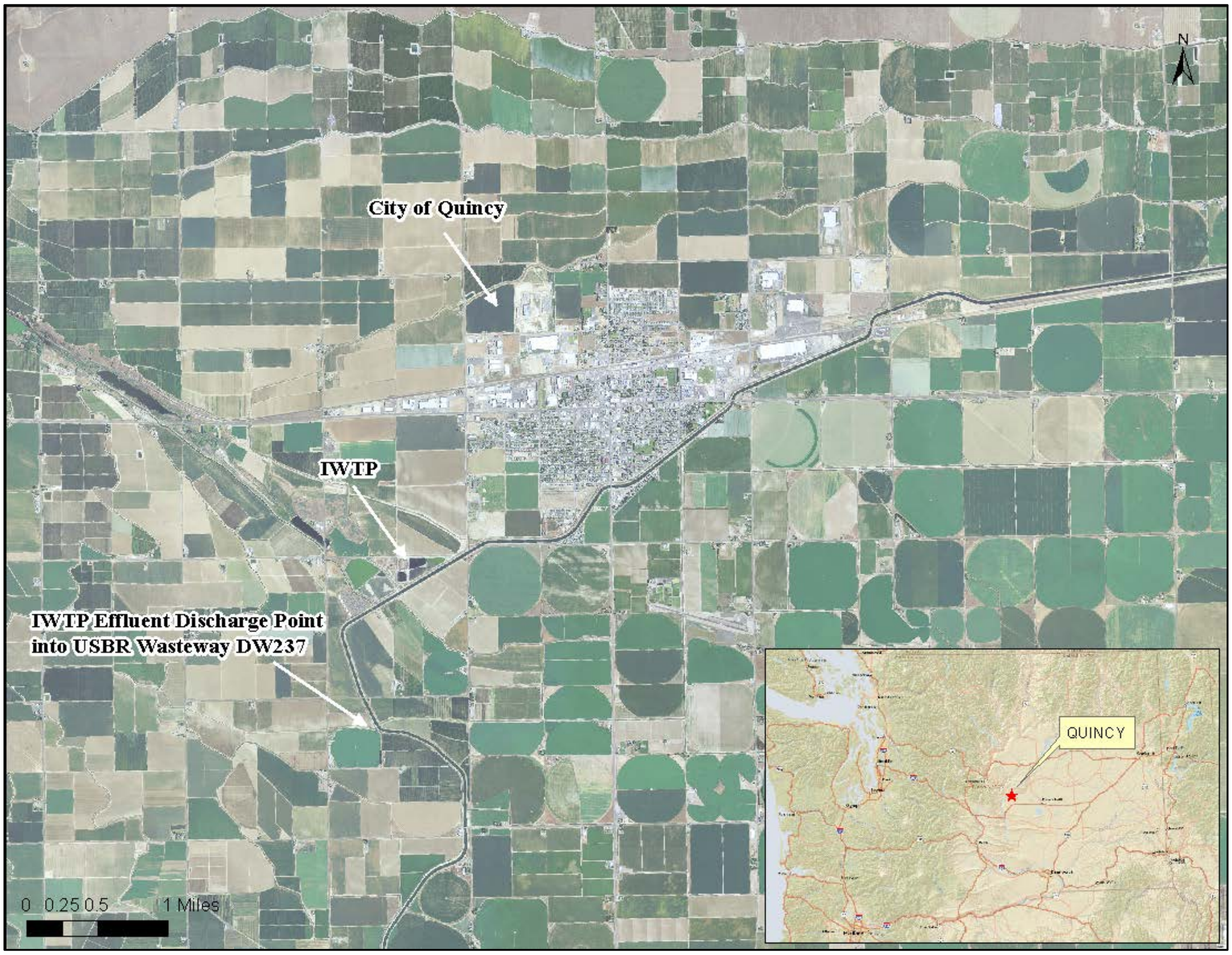


Figure 1. Vicinity map

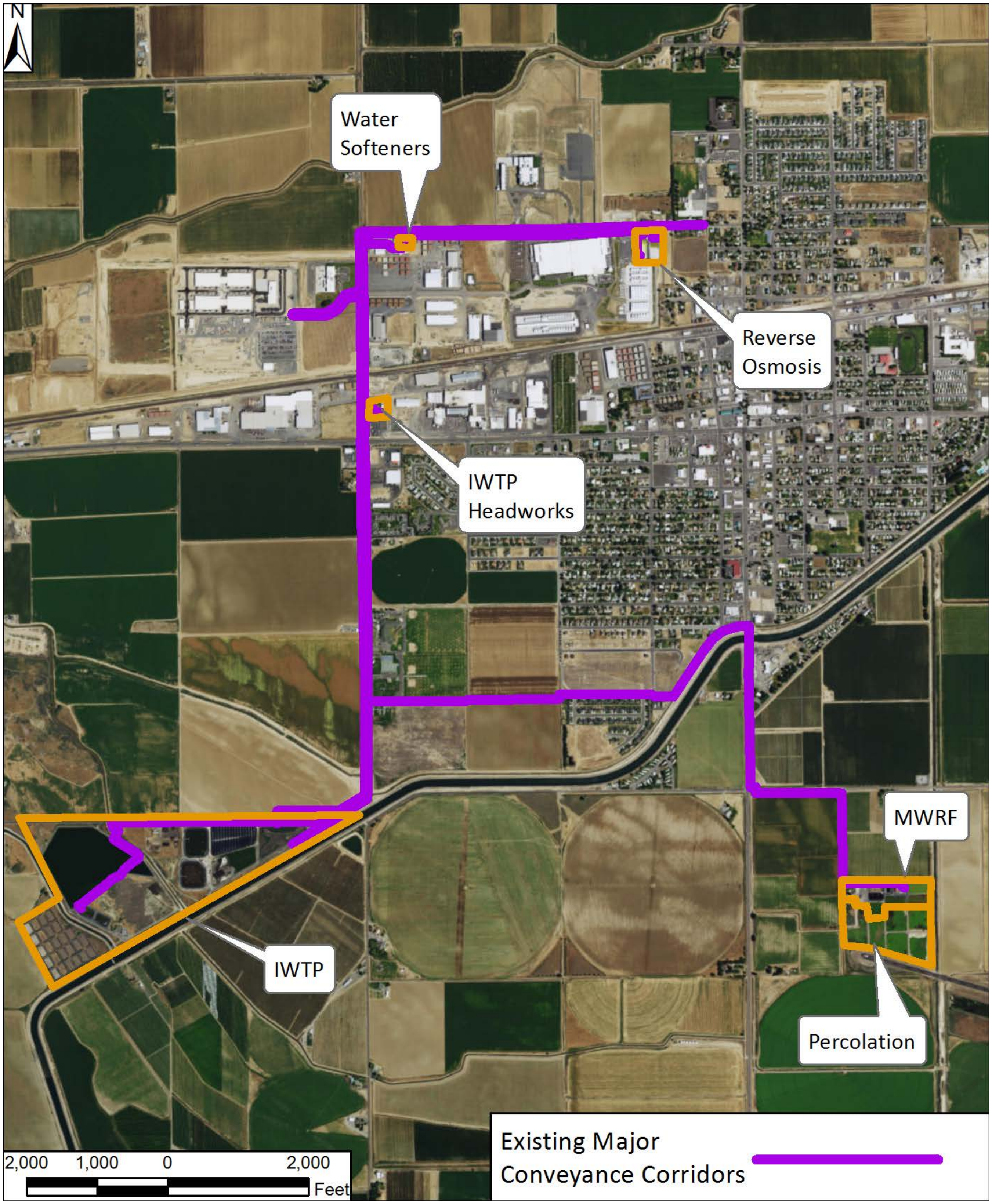


Figure 2. Overview of the City's existing wastewater and reuse water facilities

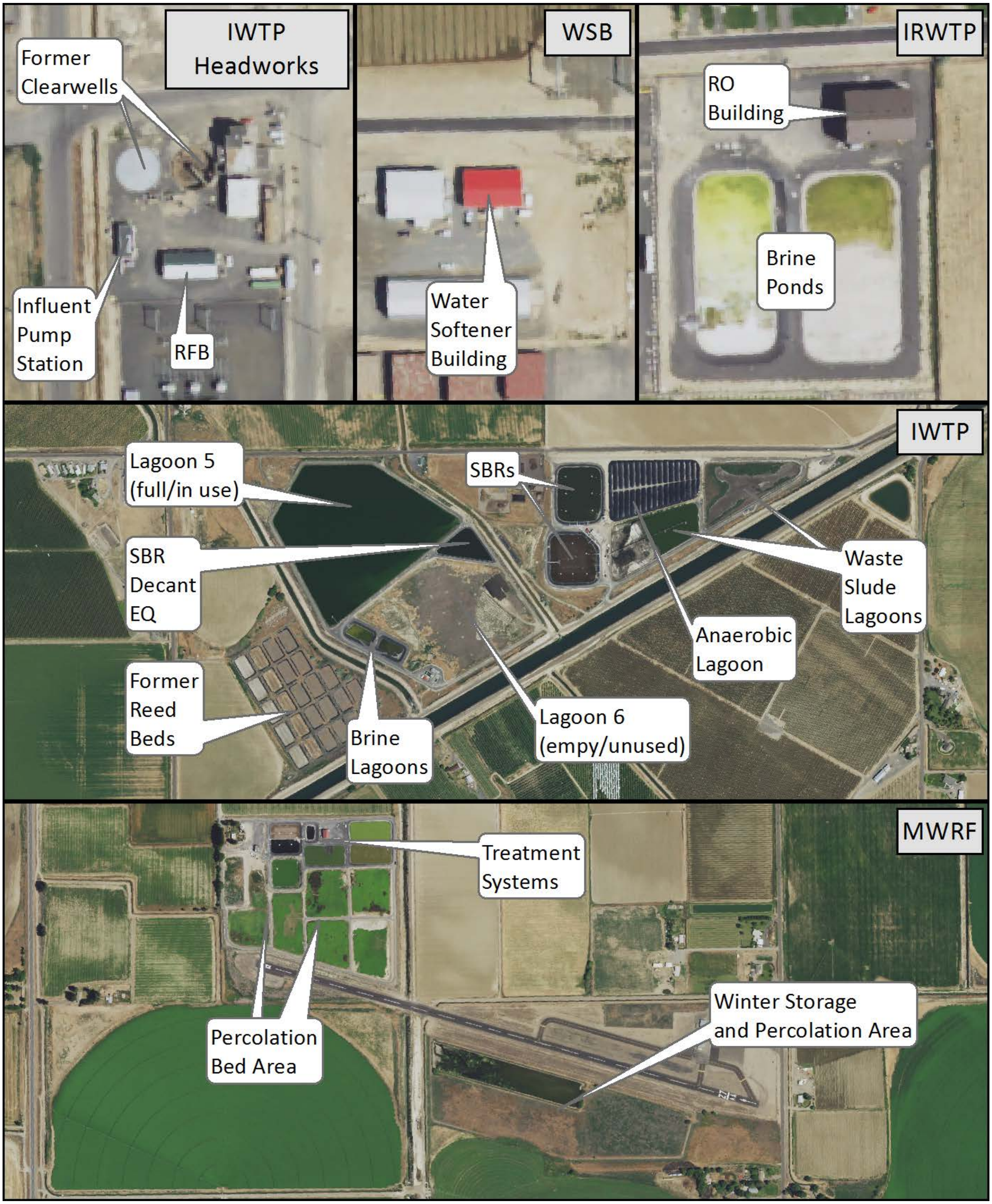


Figure 3. Detailed view of the City's existing wastewater components

A description of the physical locations of the sites and the associated new/upgraded facilities are described below.

IWTP Headworks Site: The City owns the site of the former primary treatment facility, referred to as the IWTP Headworks Site, which is located in an industrial area in the west side of the City at the northeast corner of Road R NW and State Route 28.

IWTP Site: The City of Quincy IWTP is southwest of Quincy, and is east of Road S NW and south of Road 9 NW.

MWRF Site: City of Quincy MWRF is located southeast of Quincy, and is east of Route 281 and south of Road 9 NW. The MWRF site includes the existing surface recharge basins (percolation beds), where treated municipal wastewater is currently discharged to groundwater. The percolation beds will continue to receive Class A Reclaimed Water, and will also receive demineralized water produced by the IRWTP.

RO Site: The RO Site is located in the developed industrial area of Quincy, south of D Street NW.

WSB Site: The WSB Site is located in the developed industrial area of Quincy, south of D Street NW and east of 13th Ave SW. An IX Softening system, also referred to as a high efficiency softening (HES) system, is installed in the WSB.

B. ENVIRONMENTAL ELEMENTS

B1. Earth

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other . . . . . .

At each Project site, the existing ground surface is relatively flat and level with adjacent properties.

b. What is the steepest slope on the site (approximate percent slope)?

Steep slopes are not present on the Project sites. Slopes in the Quincy area generally are in the range of 0 to 2 percent. The steepest slope is approximately 2 percent.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

The most common soil type in the Quincy area is Warden silt loam. Previous geotechnical studies reported that the City of Quincy is primarily underlain by loose to medium-dense silty sand to silt that overlays a very dense caliche and/or layer of silty sand (caliche is a layer of soil in which the soil particles have been cemented together by precipitated calcium or magnesium carbonate).
The hydric properties of the soils are considered to be “B-Moderate Infiltration Rate” around the City of Quincy, and a mix of “C or D- Low to Moderate Infiltration Rate” north of Quincy.
The Project sites within the City of Quincy are not currently prime farmlands. These sites are located in previously disturbed land within the footprint of an existing facility, and are on land already committed to urban uses within the City of Quincy.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Landslide or seismic hazard areas have not been identified within the City of Quincy.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.
Construction activity will not require any filling or grading at the sites.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.
Construction activities could temporarily result in exposed soils and erosion, if uncontrolled. Potential erosion impacts will be mitigated with construction best management practices (BMPs).

g. About what percent of the site will be covered with impervious surfaces after Project construction (for example, asphalt or buildings)?
Upgrades at the other Project sites will have an insignificant increase in impervious surfaces.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:
Construction activities will include best management practices (BMPs) to reduce erosion.

B2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the Project is completed? If any, generally describe and give approximate quantities if known.
Construction activities will intermittently generate dust, engine exhaust, and odors. Construction emissions area considered short-term or temporary impacts, and will occur only while construction activities are in progress. Operation of the proposed Project will not emit any additional air pollutants or +greenhouse gases (GHGs). New odors are not anticipated from the upgraded treatment facilities.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
There are no off-site sources of air emissions that could affect the proposed Project. The Quincy area is considered to be in attainment for all regulated air pollutants, which means that existing air quality is below state and federal air quality standards.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:
Construction of the proposed Project will include reasonable mitigation measures to reduce dust and engine exhaust. Construction dust will be controlled by spraying with water, where necessary. Construction equipment also will include emission-control devices on gasoline and diesel engines to reduce GHGs and other air emissions. Construction activities will comply with any applicable dust-control requirements by the City of Quincy.

B3. Water

a. Surface Water:

1) **Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.**

The Project sites are not located in the immediate vicinity of any surface water bodies.

Approximately 1.5 miles west of the City is the area known as the Crater Slough, which includes Crater Lake and Babcock Ridge Lake, in addition to several other small wetlands, creeks, and freshwater ponds. South of the IWTP site is the USBR's West Canal, which supplies water to the northwestern portion of the Columbia Basin Irrigation Project. The IWTP site itself includes several treatment and storage lagoons, which are not considered surface water bodies.

Within the overall Quincy area are several man-made USBR wasteways and irrigation ditches. These irrigation wasteways do not follow natural water courses that existed prior to the Columbia Basin Irrigation Project, and are functionally manmade irrigation conveyance channels.

Treated water from the City's IWTP currently discharges into the USBR irrigation wasteway DW237. This wasteway is part of the USBR's irrigation return-flow collection system of the Columbia Basin Irrigation Project. The USBR wasteways flow into Potholes Reservoir, which is approximately 26 miles southeast of Quincy.

2) **Will the Project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.**

The sites of the Stage 1 IRWTP Project are not located near any surface water bodies. The proposed Project will not require any work in or adjacent to any surface water bodies, such as streams, lakes, and wetlands.

3) **Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.**

None.

4) **Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.**

No.

5) **Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.**

No. The Project sites are not located within any floodplains, according to the Flood Insurance Rate Maps (FIRM) maps for the Quincy area. The nearest 100-year floodplain is west of the City of Quincy, along Crater Lake and Babcock Ridge Lake.

6) **Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.**

No. The proposed Project will not discharge any waste materials into surface waters.

b. Ground Water:

1) **Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.**

No. The proposed Project will use potable water in accordance with the City's water rights. Water that will discharge to the ground will be at the MWRF percolation beds, in accordance with the existing state waste discharge permit.

2) **Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the**

number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

The treated water discharged at the MWRF percolation beds will meet Washington's Class A Reclaimed Water standards and Ecology's groundwater antidegradation standards. Water treated for groundwater recharge will receive additional tertiary treatment to meet groundwater quality standards, particularly the standards for total dissolved solids (TDS) concentration. Reducing concentrations of TDS in groundwater is anticipated to improve the overall groundwater quality of the Quincy area.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Runoff from the new and existing buildings will be collected by a gutter system, and percolated through pervious areas on the site. Runoff quantities are not expected to significantly increase from the current existing conditions.

2) Could waste materials enter ground or surface waters? If so, generally describe.

None is anticipated.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

During construction, best management practices (BMPs) will be designed, installed, and maintained. Construction BMPs will reduce or eliminate erosion, stormwater runoff, and construction-related pollutants.

B4. Plants

a. Check or circle types of vegetation found on the site:

- ☐ deciduous tree: alder, maple, aspen, other
- ☐ evergreen tree: fir, cedar, pine, other
- ☑ shrubs
- ☑ grass
- ☐ pasture
- ☐ crop or grain
- ☐ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
- ☐ water plants: water lily, eelgrass, milfoil, other
- ☐ other types of vegetation

Urban and agricultural uses have removed most native vegetation in the City of Quincy and surrounding areas.

The Project sites are in developed areas within the City of Quincy, and do not have any vegetation. The Project sites and immediate vicinity are not located near any wetlands or riparian areas.

b. What kind and amount of vegetation will be removed or altered?

Construction at the Project sites within the City of Quincy will occur within previously developed areas without vegetation.

c. List threatened or endangered species known to be on or near the site.
The Project sites have been previously disturbed for development, transportation, and agriculture, and little native vegetation remains. It is unlikely that threatened or endangered plants would have survived the previous alterations of habitat.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:
Landscaping and other measures are not proposed, because vegetation impacts will not occur.

B5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other:

The Project area has been previously developed by urban and agricultural uses, where little native habitat remains. Where the terrestrial habitat has been altered by development, wildlife species are those tolerant of human and agricultural activities.

Most of the Project sites are in developed areas within the City of Quincy, with little habitat for birds and animals.

b. List any threatened or endangered species known to be on or near the site.
The Project sites have been previously disturbed for urban, transportation, and agricultural development, and little native habitat remains. It is unlikely that threatened or endangered wildlife would remain at the Project sites.

c. Is the site part of a migration route? If so, explain.
The Project sites are not part of any known migration route.

d. Proposed measures to preserve or enhance wildlife, if any:
Measures are not proposed, because wildlife impacts will not occur.

B6. Energy and natural resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed Project's energy needs? Describe whether it will be used for heating, manufacturing, etc.
The completed Project will use electricity to operate the pumps, mechanical equipment, and lighting. Construction activities will use energy for construction equipment and vehicles, which will temporarily use electricity, gasoline/diesel fuel, and possibly natural gas.

b. Would your Project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No. The proposed Project will not involve building new tall structures or vegetation that would block access to the sun for adjacent properties.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Construction activities will use reasonable mitigation measures to minimize energy consumption. New lighting and pumps for operation of the proposed Project will be energy-efficient where possible.

B7. Environmental health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

Chemicals for system operation will be stored at the IWTP, RFB, WSB and RO buildings. Chemicals include caustic or corrosive bases and acids for operation of the treatment system, dilute acids and bases for routine maintenance and scheduled cleaning, and chemical flocculants, coagulants, and polymers to facilitate filtration.

All chemicals will be stored and handled within dedicated chemical areas designed to contain spills without allowing leaks or discharge of spilled materials. Spill countermeasures and cleanup kits (adsorbents, containment barriers, etc.) will be stored onsite, and chemical areas will include measures for worker protection, such as safety showers and eyewashes. It is expected that Accidental Spill Prevention Plans (ASPPs) will be prepared and submitted as part of the operations permits for the facilities. The risk potential of spills or leaks from the proposed Project will be minor with the City's measures for spill prevention and emergency cleanup.

The only by-product of the long-term operation of the Project will be residuals or brine created by the reverse osmosis (RO) system. Brine is not considered a toxic chemical. These residuals will be managed at the evaporation ponds. The ultimate disposal methods for part or all of the brine will be developed, with the goal of minimizing disposal costs and possibly recovering renewable resources from the brine.

1) Describe special emergency services that might be required.

Possible spill response, fire, or medic services could be required for serious spills or fire.

2) Proposed measures to reduce or control environmental health hazards, if any:

Prior to any field work being conducted, a Field Health and Safety Plan will be developed that will include information on preventing accidents and where medical emergency centers are located, should an accident happen. Any potential releases of environmental health hazards during construction and maintenance would be contained and cleaned up immediately. Spills will be controlled under the spill prevention and emergency cleanup provisions for the City's wastewater treatment facilities.

b. Noise

1) What types of noise exist in the area which may affect your Project (for example: traffic, equipment, operation, other)?

The proposed Project will not be affected by noise in the Project area. Existing sources of noise in the surrounding areas include traffic on roadways, industrial operations, and farming activity.

2) What types and levels of noise would be created by or associated with the Project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Construction activities will intermittently generate noise on a short-term basis. Operation of the proposed Project will not be a major source of long-term noise. Most Project sites are located in the industrial areas without any nearby sensitive noise receptors. A residential area is near the RO and WSB site. Traffic noise will be minimal, limited to occasional maintenance vehicles.

3) Proposed measures to reduce or control noise impacts, if any:

Construction of the proposed Project will include reasonable mitigation measures, where required, to reduce short-term construction noise impacts.

B8. Land and shoreline use

a. What is the current use of the site and adjacent properties?

The current uses of the Project sites are industrial. Adjacent properties are predominantly industrial. See Figures 2 and 3, above. The current uses of each site and adjacent properties are:

- **IWTP Headworks site:** This site is industrial and includes the former clearwells, Reuse Filter Building (RFB) and influent pump station. Adjacent land uses are industrial.
- **IWTP site:** This site is currently used for the City of Quincy industrial wastewater treatment plant (IWTP). Adjacent land uses include farmlands and the USBR's West Canal.
- **MWRF site:** This site is currently used for the City of Quincy municipal water reclamation facility (MWRF). Adjacent land uses are farmland and the Quincy Municipal Airport.
- **RO site:** This site is currently used for the City's RO, a salient features of the Industrial Reuse Water Treatment Plant (IRWTP), which is located in the northeast corner of the Microsoft Columbia Data Center. Adjacent land uses are industrial and residential. Residential areas are north and east of the site, and the nearest residence is approximately 100 feet to the north of the site across D Street NW.
- **WSB site:** This site is for the water softening infrastructure and is industrial. Adjacent land uses are industrial and agricultural.

b. Has the site been used for agriculture? If so, describe.

No. The various Project sites have not previously been used for agriculture.

c. Describe any structures on the site.

Refer to Figures 2 and 3 for photos and descriptions of the existing structures on the Project sites. Several Project sites have existing structures that reflect their industrial uses. The current structures of each site are:

- **IWTP Headworks site:** Influent pump station, abandoned clarifiers, RFB.
- **IWTP site:** The IWTP includes primary sludge handling equipment, an anaerobic lagoon, secondary treatment in two aerated sequencing batch reactors (SBRs), equalization and excess flow storage lagoons, and tertiary treatment, which includes a cooling tower, chlorination/dechlorination, and re-aeration.
- **MWRF site:** The MWRF site includes headwork screens, two SBRs, a flow equalization basin, a filter feed pump station, effluent filters, an ultraviolet (UV) disinfection system, and surface recharge basins (percolation beds).

- **RO site:** RO Building and Brine Lagoon ponds
- **WSB site:** WSB Building and parking area.

d. Will any structures be demolished? If so, what?
The proposed Project will have minimal impact of the structures of each site, as most of the work will include installing new treatment equipment within an existing building. See responses to A11 for a complete discussion of each Project site.

e. What is the current zoning classification of the site?
The current zoning classifications of each site are:

- **IWTP Headworks site:** Industrial (City of Quincy).
- **IWTP site:** Industrial (City of Quincy).
- **MWRF site:** Industrial (City of Quincy).
- **RO site:** Industrial (City of Quincy).
- **WSB site:** Industrial (City of Quincy).

f. What is the current comprehensive plan designation of the site?
The current comprehensive plan designations of each site are:

- **IWTP Headworks site:** Industrial (City of Quincy).
- **IWTP site:** Industrial (City of Quincy).
- **MWRF site:** Industrial (City of Quincy).
- **RO site:** Industrial (City of Quincy).
- **WSB site:** Industrial (City of Quincy).

g. If applicable, what is the current shoreline master program designation of the site?
Not applicable. The City of Quincy does not have any shoreline jurisdictional lands under the Washington Shoreline Management Act. The closest designated shorelines are located at Crater Lake and Babcock Ridge Lake, which are located west of Quincy.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.
No. No portion of the Project site has been classified as an “environmentally sensitive” area. The Project sites within the City of Quincy are not within any environmentally sensitive areas. The City of Quincy does not have any designated critical areas, as defined by the Washington Growth Management Act (GMA).

i. Approximately how many people would reside or work in the completed Project?
Two to four workers will operate the salient features of the IRWTP and rotate amongst the key Project sites. The proposed Project will not include any residential development.

j. Approximately how many people would the completed Project displace?
None.

k. Proposed measures to avoid or reduce displacement impacts, if any:
Measures are not proposed, because displacement impacts will not occur.

l. Proposed measures to ensure the proposal is compatible with existing and Projected land uses and plans, if any:

Measures are not proposed, because the upgraded wastewater treatment facilities will be compatible with the existing and Projected land uses for the sites.

B9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

None.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

None.

c. Proposed measures to reduce or control housing impacts, if any:

Measures are not proposed, because housing impacts will not occur.

B10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The only new building under the proposed Project will be for the coag-sed site system, which will include a chemical feed system, reactor clarifiers and associated equipment. It is currently in the predesign phase. The structures to be built for this part of the Project are not expected to be taller than any adjacent building on site. It is expected that the new building will be approximately 19 feet high, and its exterior building material will be steel or aluminum. The height and appearance of the new building will be similar to the surrounding industrial land uses.

b. What views in the immediate vicinity would be altered or obstructed?

The proposed Project will not substantially alter or obstruct public views. Most Project sites are located within areas used for industry, transportation, or wastewater treatment. Most of the new treatment equipment will be located within an existing building and will not be visible to nearby residences.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Measures are not proposed, because aesthetic impacts will not occur.

B11. Light and glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

The Project will not introduce any major long-term sources of light or glare. The proposed Project will include lighting for operational and safety purposes, where necessary. Any exterior lighting will be consistent with the surrounding industrial uses. Light from vehicles will be minimal, and limited to occasional maintenance vehicles. Construction activities could be short-term sources of light and glare, although most construction activities will occur during daytime hours.

b. Could light or glare from the finished Project be a safety hazard or interfere with views?

No. Light and glare from the finished Project will be minimal and consistent with the existing uses of the Project sites.

c. What existing off-site sources of light or glare may affect your proposal?
The proposed Project will not be affected by off-site sources of light or glare. Existing off-site sources of light and glare include traffic on roadways and industrial operations.

d. Proposed measures to reduce or control light and glare impacts, if any:
Measures are not proposed, because light and glare impacts will not occur.

B12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?
None.

b. Would the proposed Project displace any existing recreational uses? If so, describe.
No. The proposed Project will not adversely affect recreational resources.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the Project or applicant, if any:
Mitigation measures are not proposed, because impacts on recreation will not occur.

B13. Historic and cultural preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.
Properties listed on historic registers are not on or next to any of the Project sites. According to the Washington Information System for Architectural and Archaeological Records Data (WISAARD) database, there are three Historic Register Properties in the Quincy area, and these are outside the Project sites. The closest registered property is the Quincy Cemetery at the intersection of F Street SW and 7th Avenue SW, which is approximately 2,000 feet south of the Microsoft/IRWTP site.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.
The Project sites are located within developed areas of the City of Quincy. Most of the upgraded treatment facilities will be installed within existing structures or on previously disturbed sites, which are currently used for industrial, transportation and wastewater treatment. These Project sites do not have any historic or cultural resources. Previous cultural resource surveys indicate that the Quincy area has a moderately low risk for encountering cultural resources.

c. Proposed measures to reduce or control impacts, if any:
Measures to control impacts are not proposed, because impacts on historic and cultural sites will not occur.

B14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

Road accesses to the Project sites are provided by the existing street system.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Future operation of the proposed Project will not require public transit service. The City of Quincy currently does not have regular transit service with designated stops. The Grant County Transit Authority (GTA) provides local bus service between most Grant County communities. GTA Routes 54 and 55 serve Quincy, with stops at the Quincy Senior Center, Quincy Foods, and Con Agra.

c. How many parking spaces would the completed Project have? How many would the Project eliminate?

The proposed Project will not change the number of parking spaces at any site. Existing parking at each parking site will be sufficient.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

Roadway access to the upgraded facilities within the City of Quincy will be provided by the existing street system.

e. Will the Project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Operation of the proposed Project will not use water, rail, or air transportation.

f. How many vehicular trips per day would be generated by the completed Project? If known, indicate when peak volumes would occur.

Operation of the proposed Project will generate daily vehicle trips for routine operations and maintenance rounds. Vehicular trips are estimated to include one daily trip to the MWRF, IWTP, IRWTP, and filter building sites. Most trips will be between 6:00 a.m. and 3:00 p.m. The number of new vehicle trips will be relative low and will be accommodated by the existing transportation system. Construction activities will temporarily generate vehicle trips for workers and hauling materials.

g. Proposed measures to reduce or control transportation impacts, if any:

Construction activities will include mitigation measures to reduce short-term transportation impacts on affected roadways, rail, and adjacent properties. Vehicle access to affected farms and businesses will be maintained during the construction periods. Vehicular travel along local roadways also will be maintained.

B15. Public services

a. Would the Project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

General operation of the Project will not increase the need for public services. Any spills, fires, or accidents during construction, maintenance, and operation of the proposed Project could require responses from emergency service providers.

b. Proposed measures to reduce or control direct impacts on public services, if any.
Because public services will not be substantially affected, mitigation measures will not be required.

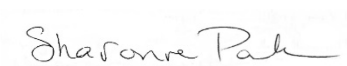
B16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.
Most Project sites are located within the City of Quincy, and have available utilities such as electricity, water, refuse service, telephone, storm drainage, industrial sewer and sanitary sewer. Quincy receives electricity from the Grant County Public Utility District (PUD), which operates two large hydroelectric power plants on the Columbia River. The Grant County PUD is developing a Fiber Optic Network throughout the Grant County communities for business, industrial and residential use. In Quincy, Cascade Natural Gas provides natural gas, and Consolidated Disposal Service, Inc. handles the refuse disposal service within the City limits. The City of Quincy provides drinking water, and its water supply system consists of five wells, all located within the City.

b. Describe the utilities that are proposed for the Project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.
Operation of the Project will use electricity for operating pumps, mechanical equipment, and lighting. Electrical power at the Project sites will be provided by Grant County PUD. Potential interference with utility lines on or near the Project sites will be evaluated during the design phase of the proposed Project. If construction activities were to affect utilities, construction methods would be coordinated with the utility providers to avoid disruptions.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: 
Date Submitted: 10/30/2016

This document supplements Standard Form (SF) 299 for the City of Quincy's responses for selected block questions within the Application for Transportation and Utility Systems and Facilities on Federal Lands. Additionally, the following is a list of attachments to the SF 299 application, as referenced throughout SF 299:

- **Attachment A**: City of Quincy Q1W Plan, Updated August 2016
- **Attachment B:** Industrial Non-contact Cooling Water Feasibility Study, August 2008
- **Attachment C:** Feasibility Study Update: 2010 Parameters and Economic Climate Impacts, May 2010
- **Attachment D:** IWTP New Discharge Alternatives Initial Assessment, July 2011
- **Attachment E:** Capacity Evaluation Scope of Work – Memorandum of Understanding, August 2016
- **Attachment F:** IWTP Discharge Monitoring Reports from January 2015 through May 2016
- **Attachment G:** Copies of bonds or grants for Q1W projects
- **Attachment H:** 2014 Water Comp Plan
- **Attachment I:** NEPAs

Block 7 response:

The project is the City of Quincy existing Industrial Wastewater Treatment Plant (IWTP) with outfall to DW237. The project discharges a peak daily flow of treated wastewater of up to 3.23 million gallons per day (mgd), or 5 cubic feet per second (cfs). The water quality is governed by a National Pollution Discharge Elimination System (NPDES) permit issued by the Department of Ecology. The discharge is planned to continue and the NPDES permit to remain active until the City funds and completes the Industrial Reuse Water Treatment Plant (IRWTP) that will allow water reuse and aquifer recharge to eliminate DW237 discharge. The discharge rates are planned to decrease by 25 to 30 percent in late 2017 as the first stage of the IRWTP is put in service.

The IWTP and IRWTP will be become part of the Quincy 1Water Utility (Q1W). A description of the Q1W Utility projects can be found in the Q1W Plan report, updated in August 2016, provided as Attachment A. The Q1W Plan describes the IWTP and staged buildout of the IRWTP.

The objectives of the Q1W are to manage industrial and municipal wastewater treatment capacity to ensure a sufficient level of service for current and future customers, reduce reliance on groundwater supplies by maximizing the use of reclaimed and industrial reuse water, and replenishing groundwater supplies through recharge and ASR. This approach will increase the interdependency of the City's utilities, eventually creating a nearly closed-loop regional water cycle.

The multiple activities needed to develop the Q1W include modifying and expanding components of the IWTP and IRWTP, constructing a conveyance system to deliver reclaimed water to a new crop production area north of the city and installing an aquifer storage and recovery (ASR) well. Refer to Section 2 of the Q1W Plan (Attachment A) for descriptions of each major Q1W project.

Block 12 response:

With its elected officials, staff and consultants, the City of Quincy has the technical and financial capability to construct, operate and maintain the Q1W Utility. Refer to Section 2 of the Q1W Plan (Attachment A) for brief technical descriptions of each Q1W project. To help demonstrate the technical and financial capabilities of the City's development of the Q1W Utility, refer to the following reports within the following attachments:

- **Attachment B:** *Industrial Non-contact Cooling Water Feasibility Study, August 2008.* This report was the initial feasibility study evaluating the use of reclaimed water and industrial reuse water for industrial cooling use.
- **Attachment C:** *Feasibility Study Update: 2010 Parameters and Economic Climate Impacts, May 2010.* This report was a revision of initial industrial cooling water demand projections.
- **Attachment D:** *IWTP New Discharge Alternatives Initial Assessment, July 2011.* This report was developed to present an evaluation of discharge alternatives for IWTP including surface discharge, groundwater percolation, groundwater direct injection, industrial reuse, and irrigation.
- **Attachment E:** *IWTP Capacity Evaluation: Final Memorandum of Understanding, August 2016.* This memorandum of understanding (MOU) provides a summary of the scope of work agreed upon between the City and USBR to conduct an evaluation of the hydraulic capacity of USBR irrigation infrastructure to receive Quincy IWTP effluent. An evaluation of the IWTP footprint is also conducted. The IWTP capacity will be evaluated to determine the storage capacity time of the IWTP based on varying effluent flow rates.
- **Attachment F:** IWTP Discharge Monitoring Reports (DMRs) from January 2015 through May 2016. Per the City's IWTP NPDES permit, water quality and flow samples are collected and reported monthly within the DMRs and submitted to Ecology and USBR. Copies of these DMRs from January 2015 to May 2016 are provided to demonstrate the water quality and flow rates representative of the IWTP effluent. The reports represent the condition of operation through IRWTP Stage 1 completion. The values can be scaled down by 25 to 30 percent during Stage 1 operation.
- **Attachment G:** Summary of financial assistance information awarded to the City for developing elements of the Q1W Utility. A table is provided that summarizes the various contracts awarded to the City since 2011 for developing the Q1W. Financial Assistance Award letters are also provided. [Note that the City is continuing to research and apply for funding to develop the Q1W Utility. A WaterSmart grant is currently providing a substantial amount of the funds for key components of the IRWTP components. Additional Q1W projects will be conducted as funding is available.]
- **Attachment H:** *City of Quincy Water System Plan, May 2014.* This report establishes the basis of design, design criteria and conceptual design of the coagulation-sedimentation system, a required step for the production of reuse water.
- **Attachment I:** NEPA documents provided by USBR for project related activities are provided for reference.

As discussed the Q1W Plan (Attachment A), Engineering Reports (ER) will be developed for each major Q1W project. These ERs will comply with Section 173-240-130 of the Washington Administrative Code (WAC) and provide sufficient details such that plans and specifications can be developed from it. These ERs will be provided to the Washington State Department of Ecology for their review and comments prior to developing Final versions.

On the first Wednesday of every month, the City conducts a Q1W Technical Meeting with USBR, Ecology, QCBID, ConAgra and Quincy Foods, as well as other interested stakeholders to discuss the status of the Q1W Utility development, including the technical components of the projects. Ecology's permit writers are included within this meeting in order to keep them abreast of the ongoing activities of the City's planning and to discuss any issues that may impact the project. These monthly meetings are an open forum for discussing Q1W-technical related issues and include a PowerPoint presentation that provides a summary of the Q1W status, including project schedules and which allows for questions and general discussions. After each meeting, meeting minutes and copies of the PowerPoint presentation are provided to all meeting attendees.

Block 13a response:

Alternative evaluations for removing the IWTP discharge out of the drainage wasteway have been conducted since 2008. Refer to the Industrial Non-contact Cooling Water Feasibility Study, August 2008 (Attachment B) and The Feasibility Study Update: 2010 Parameters and Economic Climate Impacts, May 2010 (Attachment C) for a comprehensive discussion of the alternatives evaluations conducted prior to the development of the current Q1W Plan.

Block 13b response:

As presented in the aforementioned reports (Attachments B and C), the alternatives selected were those that provided increased water supply benefit at lower costs to the City.

Block 13c response:

This project does not cross USBR land. The project proposes to temporarily continue to use an existing USBR facility, the DW237. As described in responses provided for Blocks 13a and 13b, alternative evaluations have been conducted since 2008. These alternative evaluations have been conducted in conjunction with on-going discussions with stakeholders and have set the foundation for the current Q1W Plan (Attachment A). As described in Block 7 response, Section 2 of the Q1W Plan provides brief descriptions of each major Q1W project.

Block 15 response:

The continued use of the IWTP and its existing outfall to the DW237 is needed until the Q1W utility is fully functional.

The Q1W Utility is a 1Water Utility, integrating residential and industrial water management for sustainable water supplies in the Quincy Basin. This integrated utility management approach will allow the City to prosper. The Q1W will optimize water supply for the City's two dominant economic clusters: food processing and cloud computing. By managing the Quincy Basin's overall water supplies holistically, including municipal and industrial wastewater, potable water supply, and reclaimed/reuse water, the City preserves limited potable water supplies for residential and other beneficial uses. By having sustainable water supplies from the Q1W Utility, the City is in a better situation to endure global warming situations easier by having a sustainable water system in place.

As described in Section 2 of the Q1W Plan (Attachment A), all of the wastewater produced by the City's residents, from municipal and industrial sources, will be treated to Class A Reclaimed Water standards. Currently the water that is discharged from the IWTP into DW237 meets NPDES water quality standards. As part of the Q1W Plan, this water will be treated to a greater level using high level technology, including reverse osmosis, ultrafiltration and coagulation-sedimentation to treat the water for subsequent reuse. By keeping the water in the basin, instead of discharging it into the wasteway, the City will be able to use it for developing additional crop production areas, industrial reuse, and for augmenting the City's water supply. The City's public citizens will benefit from these activities because more jobs can be created.

Block 16 response:

The probable effects on the population in the area, specifically the social and economic aspects and the rural lifestyles, as describes in Block 15 response, is positive. The development of the Q1W Utility will ensure that the City will have a water supply that is sufficient for its present and future population. The Crop Production Water Supply project for example, as described in the Q1W Plan (Attachment A) will bring more jobs to the City. The ASR project, also described in the Q1W Plan, will allow the City to have an abundant source of water to offset its potable water needs. Current industries in the City, such as food processors and cloud computing, will be able to expand easier knowing that reuse water is easily accessible. The City's growth is expected to continue, as discussed in the City's 2014 Water System Plan, as provided in Attachment H. The City is currently conducting upgrades at their Municipal Water Reclamation Facility (MWRF) to accommodate increased growth. The upgrades at the IWTP and IRWTP will also allow the City to continue to expand and provide the same level of service to its customers. As stated previously, the Q1W Utility will be treating all wastewater to Class A Reclaimed Water standards, which is an example of sound environmental stewardship.

Block 17 response:

The Q1W project development has identified no negative environmental effects on air quality, visual impact, surface and groundwater quality and quantity, existing noise levels, and the surface of the land including vegetation, permafrost, soil and soil stability. The project development has identified no negative impacts on streams or other water bodies. Refer to Attachment I for copies of the NEPAs provided by USBR for the following Q1W-related activities:

- **7/30/2015 USBR Memorandum:** Recommendation for Categorical Exclusion for the City of Quincy Consent-to-Use 2-Year Extension. The City of Quincy requested that USBR provide a two-year extension to the 50-year consent-to-use permit that allows for industrial waste water discharge into the DW237 drain. Based on USBRs evaluation, they concluded that the proposed permit qualifies as a Categorical Exclusion from NEPA compliance. The Categorical Exclusion Checklist addressing the permit is attached.
- **8/25/2015 USBR Memorandum:** Recommendation for Categorical Exclusion, City of Quincy Consent-to-use Renewal. The USBR is proposing to renew a current consent to use agreement with the City of Quincy for the primary wastewater discharge pipeline. Based on USBRs evaluation, they concluded that the proposed permit qualifies as a Categorical Exclusion from NEPA compliance. The Categorical Exclusion Checklist addressing the permit is attached.

There are 3 major Q1W projects, as described in the Q1W Plan (Attachment A). The following describes likely environmental effects that the proposed project will have on a) air quality, b) visual impact, c) surface and groundwater quality and quantity, d) the control or structural change on any stream or other body of water, e) existing noise levels, and f) the surface of the land, including vegetation, permafrost, soil and soil stability.

1. **IRWTP project:**
    a. No impact to air quality
    b. No visual impact: the proposed project activities will be conducted on land and buildings already owned by the City.
    c. No impact to surface and groundwater quality and quantity. The IRWTP will treat water to meet Class A Reclaimed Water standards. The treated water will be used by industrial customers, the Crop Production Water Supply customers and for injection into the deeper aquifer via the ASR well.
    d. There is no control or structural change on any stream or other body of water. The City's ultimate exit out of the wasteway will reduce the amount of IWTP wastewater entering USBR drainage infrastructure, however this is not considered as an impact.
    e. No impact to noise level
    f. There is no impact to the surface of the land, including vegetation, permafrost, soil and soil stability is negligible. All construction activities will be conducted on land and buildings already owned by the City.

2. **The Crop Production Water Supply project:**
    a. No impact to air quality
    b. No visual impact: the irrigation pipeline will be underground and the EQ Pond will be predominantly below ground surface with mounded edges lower than 4 feet high.
    c. No impact to surface and groundwater quality and quantity. The water used for irrigation will be treated to Class A Reclaimed Water standards and will adhere to approved agronomic rates.

d. There is no control or structural change on any stream or other body of water. The City's ultimate exit out of the wasteway will reduce the amount of IWTP wastewater entering USBR drainage infrastructure, however this is not considered as an impact.
e. No impact to noise level
f. The impact to the surface of the land, including vegetation, permafrost, soil and soil stability is negligible. The irrigation pipeline will be installed in the City's right-of-way, which has already been disturbed. The EQ Pond will be installed on the City's private property, which has minimal vegetation. Preliminary studies on the soil and soil stability show that the proposed project will have no negligible impact.

3. Aquifer Storage and Recovery Project:
   a. No impact to air quality
   b. There visual impact is considered negligible. A small ASR well house may be built to surround the ASR well-head. This project is in the preliminary phases, and no design of pipe routing has yet to be developed. Once a design has been developed, a State Environmental Policy Act (SEPA) checklist will be completed and submitted to the City for review and approval before any construction activity takes place.
   c. No impact to surface and groundwater quality and quantity. The ASR well will be used for injecting Class A Reclaimed Water into the deep Grande Ronde aquifer.
   d. There is no control or structural change on any stream or other body of water. The City's ultimate exit out of the wasteway will reduce the amount of IWTP wastewater entering USBR drainage infrastructure, however this is not considered as an impact.
   e. No impact to noise level.
   f. There is negligible impact to the surface of the land, including vegetation, permafrost, soil and soil stability.