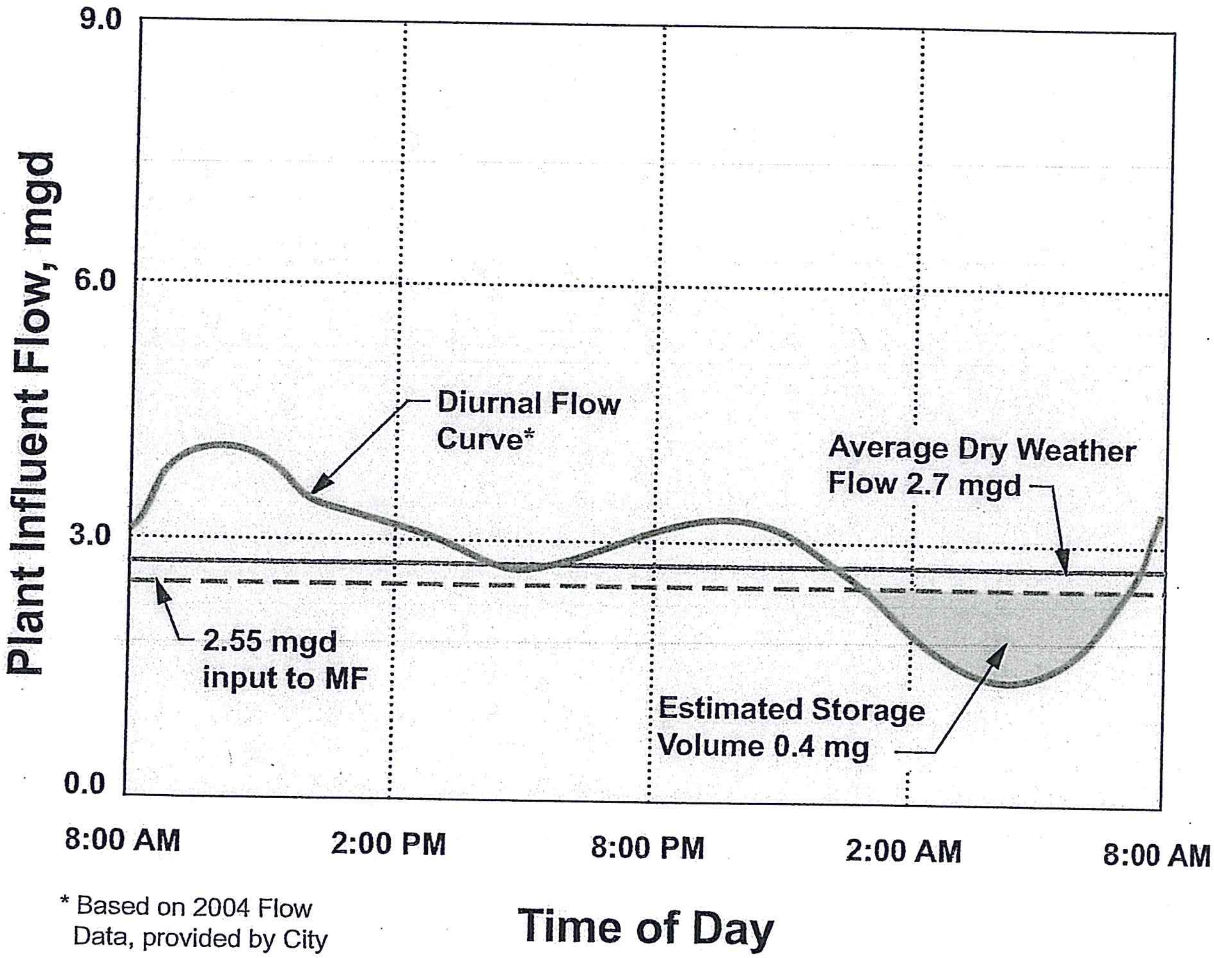


* Based on 2004 Flow Data, provided by City

**Figure 2-1**
Diurnal Storage Volume Required for 2.55 mgd Flow to MF

# Section 4
# Regulatory Compliance for RO Concentrate Disposal

## 4.1 Overview

The concentrate (or reject) stream from the RO facility will be blended with the remaining Benicia WWTP discharge to the Carquinez Strait. The levels of constituents in the RO concentrate stream will be fives times higher than levels in the secondary effluent that will feed the MF/RO treatment system. Figure 4-1 shows a simplified flow diagram through the City's Wastewater Treatment Plant (WWTP) and the proposed Water Reuse Treatment System.

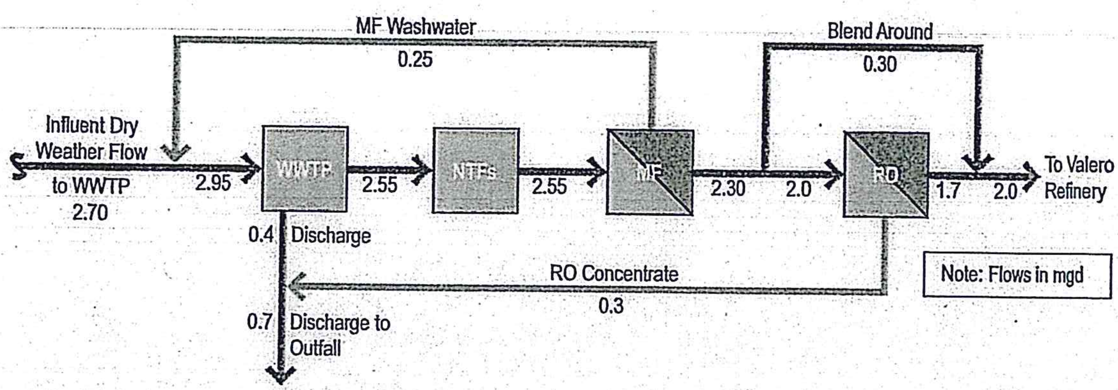


**Figure 4-1**
**Typical Flow Balance for 2.0 mgd Water Reuse Plant**

As shown in Figure 4-1, it was estimated that up to 0.3 mgd of concentrate could be produced from the full-scale RO facility when operating at maximum capacity. The RO concentrate will be blended and discharged with the remaining approximately 0.4 mgd (minimum) of secondary effluent (i.e. a 43% blend).

Desk top evaluations and pilot-scale tests and laboratory analyses were performed to investigate the feasibility of the blended discharge (RO concentrate and Benicia WWTP effluent) meeting current NPDES discharge requirements and to characterize the following:

- Conventional Water Quality Parameters (BOD, total suspended solids [TSS], pH, etc.)
- Trace Metals and other Priority Pollutants
- Acute and Chronic Toxicity

Several rounds of pilot tests were performed in order to generate RO permeate and concentrate streams using a pilot-scale RO treatment system. The RO treatment system was operated at high flux and high recovery rates to investigate the "worst case" scenario for the full-scale facility (i.e. to produce the highest concentration of constituents in the RO concentrate stream and thus make conservative toxicity analyses of the concentrate blended with available secondary effluent).

Mass balance equations were used to simulate a blend of 43% RO concentrate and 57% effluent to predict levels of contaminants in the blended discharge.

This section summarizes and compares the pilot-scale results and existing NPDES requirements for regulatory compliance.

## 4.2 Conventional Water Quality Parameters

From the results of the mass-balance analysis, it is anticipated that the actual combined concentrate and effluent blends of the full-scale facility will meet the following key treatment goals and limitations included in the current NPDES discharge permit for the conventional water quality parameters listed below:

- Discharge pH shall not exceed 9.0 nor be less than 6.0
- Average BOD and TSS removal must be 85% or greater each calendar month
- Fecal Coliform Bacteria:
    1. Must not exceed a Most Probable Number (MPN) of fecal coliform bacteria of 200 MPN/100 ml (calendar month geometric mean)
    2. No more than ten percent (10 %) of all samples collected within each calendar month shall exceed a fecal coliform bacteria level of 400 MPN/100 ml.
- Discharge limits as listed in Table 4-1.

***Table 4-1***
***Benicia WWTP NPDES Permit Discharge Limits***

| *Conventional Pollutants* | *Units* | *Monthly Average* | *Weekly Average* | *Daily Maximum* | *Instantaneous Maximum* |
|---|---|---|---|---|---|
| BOD | mg/L | 30 | 45 | 60 | -- |
| COD | mg/L | 25 | 40 | 50 | -- |
| TSS | mg/L | 30 | 45 | 60 | -- |
| Oil & Grease | mg/L | 10 | -- | 20 | -- |
| Settleable Matter | mL/L-hr | 0.1 | -- | 0.2 | -- |
| Chlorine Residual | mg/L | -- | -- | -- | 0.0 |

It is important to note that the pilot-scale results were obtained with direct RO treatment of the secondary effluent and that the full-scale facility will provide lower levels of conventional pollutants (e.g. BOD and TSS) by utilizing nitrifying trickling filters and micro-filtration prior to RO treatment. This is significant (and conservative) in that the toxicity testing, performed from the pilot tests, contained more conventional pollutants than will the full-scale system.

## 4.3 Trace Metals and Organics

The toxic substances regulated in the effluent discharge include trace metals, cyanide and two organic pollutants. Table 4-2 lists effluent limits for toxic substances in the current Benicia NPDES permit.

*Table 4-2*
*Benicia WWTP NPDES Toxic Substance Effluent Limits*

| Constituent | Units | Daily Max | Monthly Average | Interim Daily Maximum | Interim Monthly Average |
|---|---|---|---|---|---|
| Cadmium | µg/L | 17.4 | 5.7 | -- | -- |
| Copper | µg/L | -- | -- | 32 | -- |
| Lead | µg/L | 45.7 | 17.3 | -- | -- |
| Mercury | µg/L | -- | -- | 1 | 0.087 |
| Nickel | µg/L | 70 | 30.2 | -- | -- |
| Selenium | µg/L | -- | -- | 31 | -- |
| Cyanide | µg/L | -- | -- | -- | 25 |
| Dieldrin | µg/L | 0.00028 | 0.00014 | -- | -- |
| 4,4-DDE | µg/L | 0.00119 | 0.00059 | -- | -- |

Extensive sampling and analyses were performed during the pilot-scale testing to characterize levels of trace metals and priority pollutants of concern in the RO concentrate, including the constituents listed above. Using the blend ratio described above, projections were made to compare the blended effluent with the permit limits.

The levels of most organics in the WWTP effluent are consistently below the detection limit. The results from the pilot-scale testing showed that the levels of these organics were still under the detection limit in the RO concentrate.

Results from the pilot-scale testing also showed that the levels of trace metals in the RO concentrate are not anticipated to exceed discharge limits, as summarized in Table 4-3. The values listed in Table 4-3 are based on measured concentrations for secondary effluent and RO concentrate (maximum of two values for each pollutant) from the Round 4 testing, which is considered the most representative of future conditions. Levels of three of the pollutants, i.e., copper, nickel and cyanide (Cu, Ni, Cn), in the blended effluent would trigger "reasonable potential" and require effluent limits to be included in the NPDES permit that may not otherwise be required. However, levels will be below the calculated effluent limits and no compliance difficulties are anticipated.

## 4.4 Toxicity

Representative samples of Benicia effluent and RO concentrate were collected to perform toxicity tests to demonstrate that the projected blend can meet NPDES discharge limits for acute and chronic toxicity. Two types of toxicity tests (acute and chronic) were performed on the blended discharge of RO concentrate and Benicia WWTP effluent.

# Section 6
# Summary of Preliminary Design of Recycled Water Treatment Facilities

## 6.1 Process Schematic Diagram

Figure 6-1 presents the process schematic diagram for the recycled water treatment system. As shown in the schematic, secondary effluent flow will be equalized in the multi-purpose basins and conveyed to the NTFs for ammonia reduction. From the NTFs the water will be pumped through micro-filtration and reverse osmosis with a 15% blend of MF filtrate around the RO process. Before pumping to Valero the recycled water will undergo UV disinfection to meet regulatory requirements for use of recycled water in cooling towers. The high-lift pump station will convey the recycled water to Valero.

## 6.2 Secondary Effluent Transfer and Equalization Systems

Secondary effluent will be obtained from the existing chlorine contact tanks and conveyed in buried pipes to a new Secondary Effluent Transfer Pump Station No. 1. The pump station will be composed of submersible pumps that will pump the secondary effluent into the existing Multi-Purpose Basins. Pump station output flow will be controlled by flow as sensed by the new secondary effluent flow meter, proposed to be installed on the existing secondary effluent line. This flow signal will allow the pump system to pump sufficient flow during daily high flow periods in order to put enough volume of SE into storage for equalization, as discussed in Section 5. It will also be important to restrain pumping during low flows so as to leave adequate flow for the Plant's existing No. 3 Water Pumping System. This system requires approximately 450 gpm (0.64 mgd)

From a process perspective it is important to take chlorinated secondary effluent so that the RO concentrate will have already been disinfected. Otherwise, it would be necessary to build a chlorine contact tank for the RO concentrate, which would add to project costs. Also, site limitations might preclude constructing such a structure.

Secondary effluent will be stored in the MPBs and will be withdrawn at a constant rate for feed water to the NTF process. The bottom of the MPBs is at Elevation 93.0, which is below the proposed working water elevation for the NTF recycle pump station. Therefore, a second secondary effluent pump station, Secondary Effluent Transfer Pump Station No. 2, is necessary. The pump station will be composed of submersible pumps that will pump the secondary effluent from the MPBs to the NTF Recycle Pump Station. Pump station output flow will be controlled by a manually set flow set point, generally 2.55 mgd as explained in Section 5. The flow set point will be overridden by low level in the MPBs.

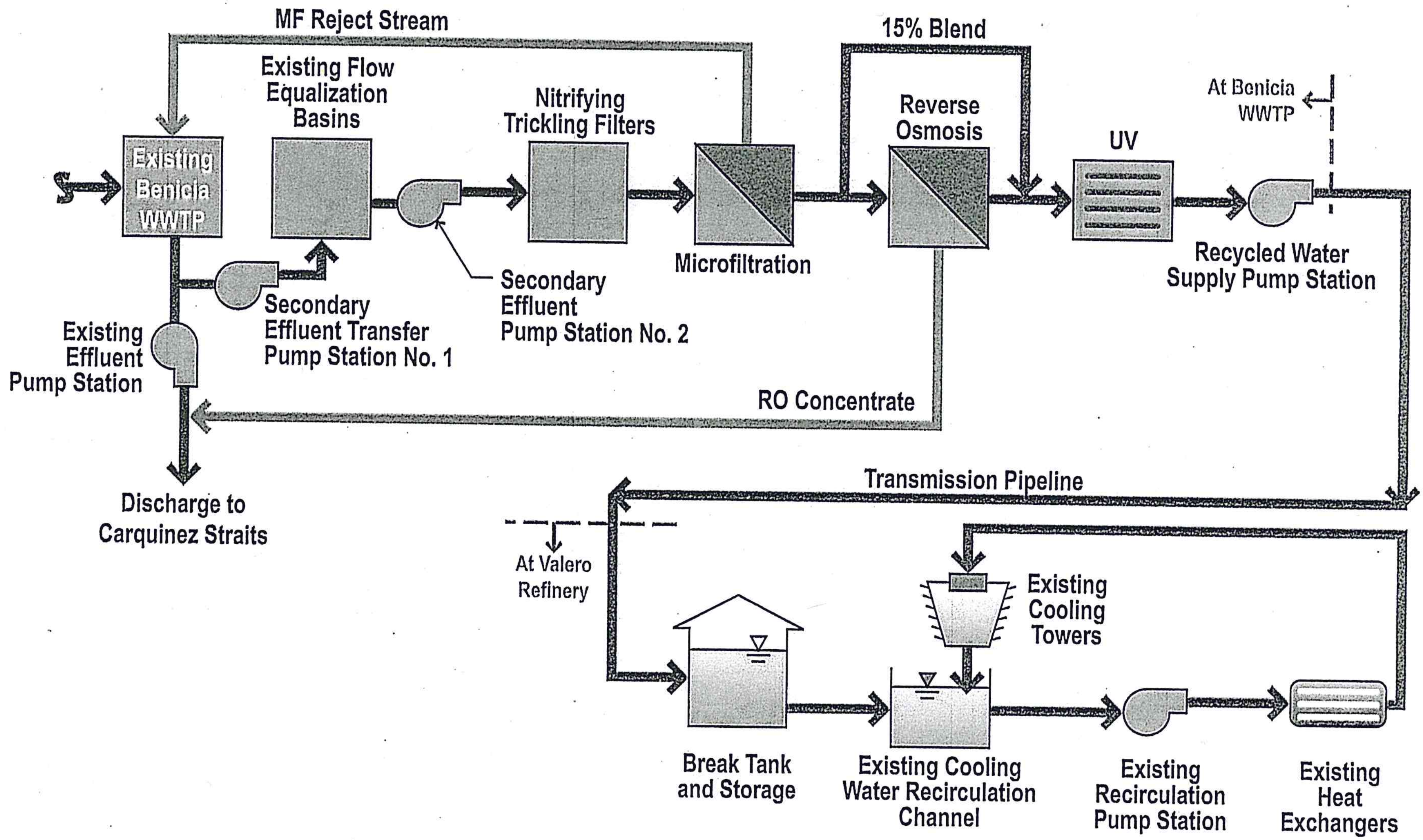


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**Figure 6-1**
Benicia Water Reuse Project - Process Schematic Diagram

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Table 6-1 contains the Design Criteria for the secondary effluent transfer and equalization systems. Figure PD-1 in Appendix A contains a process block diagram for these facilities.

**Table 6-1**
**Design Criteria for Secondary Effluent Transfer and Equalization Facilities**

| | |
|---|---|
| **Secondary Effluent Transfer Pump Station No. 1** | |
| Pumping Range, mgd | 1.0 TO 3.5 |
| Pumps, 2 duty, 1standby, capacity, mgd each | 1.75 |
| Variable Speed Control from new Final Effluent Flow Meter | |
| | |
| **Flow Equalization** | |
| Existing Multi-Purpose Basins (3, 4 & 5) Storage Capacity, milligram (mg) | 0.4 |
| | |
| **Secondary Effluent Transfer Pump Station No. 2** | |
| Design Flow, mgd | 2.55 |
| Pumps, duty/standby, capacity, mgd each | 2.55 |
| Pump Type | Submersible |
| Fixed set point control; variable frequency drives (VFDs) for flexibility | |

## 6.3 Nitrifying Trickling Filters

Secondary effluent will be pumped at a continuous flow rate (2.55 mgd) from the MPBs to the NTF's pump station wet well. The NTF pumps will be vertical mixed-flow type mounted on a concrete deck over a wet-well in between the two NTFs. Pump motors and discharge heads will be enclosed with special noise attenuation enclosures to adequately reduce noise levels to meet the City's requirements at the WWTP fence line.

The NTFs will be founded on a concrete deck at proposed El 101.0 Under the NTFs will be a plenum that serves to collect the process water and to house process air supply distribution piping. The water coming off the filters will flow into open channels, one per filter. Those channels will discharge into the pump station wetwell.

Some locations with operating NTFs have reported that small snails may grow in the media and slough off into the processed water. Motor operated, self-cleaning screens will be installed in the recycle flow return channels and will remove them and convey them into a covered container for haul off and disposal.

Within the NTF recycle pump station the nitrified water, not returned (recycled) by the pumps to the media via the distributor, will flow over a weir and into a pipe which will convey the nitrified flow to the MF process.

Since the nitrification process consumes about 7 mg of alkalinity per mg of ammonia converted to nitrate, sodium hydroxide will be fed at the inlet to the NTF's to maintain alkalinity at the proper level. Sodium hydroxide will be stored in a fiberglass tank, mounted on a concrete pad outside. Full secondary containment will be provided as discussed in Section 8.

Table 6-2 contains a summary of the design criteria for the NTFs including the mechanical equipment required for the process. Figure PD-2 in Appendix A contains a process block diagram for the NTF system.

***Table 6-2***
***Nitrifying Trickling Filters Design Criteria and Mechanical Equipment***

| | |
|---|---|
| **Biological Nitrification System** | |
| Design Flow, mgd | 2.55 |
| **Process Units** | |
| Nitrifying Trickling Filters, number | 2 |
| Size, diameter x media depth, ft/ft | 42/12 |
| Media Type | Cross Flow |
| Media Specific Surface Area, sf/cf | 45 |
| **Rotary Distributors** | |
| Pneumatic Driven, variable speed | |
| Flow Range, gpm | 900 to 1,800 |
| Speed Range, rpm | 0.025 to 0.5 |
| **Process Air Supply** | |
| Centrifugal Fans, number per NTF | 4 |
| Fan Capacity, scfm (each) | 1,500 |
| **NTF Recycle Pumping System** | |
| Recycle Ratio Range, % | 20-100 |
| Design Flow, mgd (includes influent + recycle) | 5.1 |
| Pump Type | Vertical, Mix Flow |
| Number of Pumps, duty/standby | 2/1 |
| Pump Capacity, flow in gpm x head in ft | 1,800 x 35 |
| Motor Horsepower, hp each | 25 |
| **Recycle Flow Screening** | |
| In-Channel Type Automatic Cleaning | 1 per recycle channel |
| Mesh Opening, inches | Approximately 1/16 TBD |
| **NTF Alkalinity Supply System** | |
| Chemical Type | Sodium Hydroxide |
| Chemical Strength, % | 30 |
| Commercial Bulk Density at 30%, lbs Na(OH)/gal | 3.4 |
| Bio-Kinetic Replacement, lbs alkalinity per lbs ammonia | 7.2 |
| Estimated Caustic Dose, mg/L | 52 |
| Estimated Volume Caustic, gal/day | 330 |
| Estimated Storage Volume, gal | 4,000 |

## 6.4 Micro-Filtration

Nitrified secondary effluent will flow by gravity from the NTF Recycle Pump Station to the MF Feed Pump System, which will be located in the MF/RO Building. The pumps will pump the feed water through motor operated strainers and thence into the MF membrane modules, mounted in three parallel racks, also known as banks. The MF Feed Pumps will be vertical turbine type equipped with variable frequency drives (VFDs). The feed pressure to the membranes will be maintained by adjusting the speed of the pumps. A dedicated control system will be supplied by the MF vendor, since each vendor designs and controls his system differently.

The filters are backed washed (sometimes referred to as "refiltration") every 20 minutes for approximately two minutes. Typically, the backwashing is done sequentially without much interruption in between each rack. Once per day, membrane cleaning is performed using a 300-500 mg/L solution of sodium hypochlorite. Each rack of membranes is off-line for approximately 40 minutes during its daily cleaning. Pall calls the daily cleaning, "Enhanced Flux Maintenance." The wash water from the cleaning cycled will be discharged to the plant drain system and returned to the head works.

Approximately quarterly (depending on the decrease in flux rate over time) a clean-in-place (CIP) chemical cleaning is performed. Each rack will be off-line for approximately 6 hours or about the duration of one operation shift for the CIP. Typically, the CIP is performed on successive days until all racks have been cleaned. Two chemical solution tanks are provided for the CIP process, one for citric acid and the other for caustic (sodium hydroxide). The cleaning cycle for each rack consists of soaking the membranes first with citric acid for approximately 1 to 2 hours, although each manufacturer has a different duration. The citric acid solution is returned to the solution tank, the rack is drained and the caustic solution is applied in the same manner and for similar duration. The caustic solution is returned to the solution tank and the rack is flushed with MF filtrate. The wash water is sent to a neutralization tank for eventual return to the WWTP headworks.

After each rack has been cleaned, the citric acid solution and the caustic solution are pumped to a neutralization tank. Before these waste waters are returned to the plant headworks, they are neutralized using either acid or caustic as necessary.

A break tank is required to store filtrate for the backwash cycles (2 minutes each rack) and for one daily cleaning cycle. The filtrate in the tank will also be used for the CIP acid and caustic solutions. The purpose of the tank is to allow the RO system to continue to operate on a continuous basis at basically its constant design flow rate of 1.7 mgd on the input side.

Table 6-3 below contains process and equipment information for the MF system. Figure PD-3 Appendix A contains a process block diagram for the MF system.

| *Table 6-3*<br>*Micro-Filtration System Design Criteria and Mechanical Equipment* | |
|---|---|
| MF System Design Output Flow Rate, mgd | 2.3 |
| Turbidity Process Performance, NTU | 0.2 no > 5% in 24-hr |
| Reject Rate and Average Reject Flow, %/mgd | 10/0.25 |
| Reject Flow Disposal | Plant Head Works |
| MF System Type | Pressure |
| Motor Operated Strainers | 3 at 2 hp each |
| MF Feed Pumps | vertical turbine type |
| MF Feed Pumps, number(duty/standby)/capacity, gpm | 3(2/1) at 900 each |
| MF Feed Pumps, rating, psi/hp | 50/35 |
| Air Supply System: 15 hp compressor and receiver tank | |
| MF Membrane Type: Polypropylene or polyvinyldene fluoride (PVDF) | |
| Number of MF Modules | 192[1] |
| Surface Area, sf/module | 538[1] |
| MF Flux Rate, gfd | 25 to 40[1] |
| MF Banks (aka racks) | 3[1] |
| Break Tank, capacity gallons | 10,000 |
| Chemical Clean-in-Place System for MF Membranes: Citric acid, caustic & hypochlorite feed pumps and storage with containment | |
| Potential Manufacturers To Be Considered Include: Pall, Norit and US Filter. | |

[1] Preliminary sizing based on Pall.

## 6.5 Reverse Osmosis

The RO System consists of feed pumps, cartridge filters and two RO racks, or skids, and energy recovery turbines. As shown in Figure 6-1, 15% of the MF filtrate (0.3 mgd) will bypass the RO process; the remaining 2.0 mgd will be processed by the two RO racks. Based on the pilot plant work performed earlier in the project development phase as well as projections by the membrane manufacturers, it is expected that the recovery rate of the membranes will be approximately 85%. Therefore, approximately, 1.7 mgd of permeate will be produced and 0.3 mgd of RO concentrate will be rejected. (For a discussion of disposal of the RO concentrate, please refer to Sections 4 & 5.)

Each of the RO racks will be rated for 0.85 mgd of permeate. Low pressure RO Transfer Pumps, supplied from the MF break tank, will supply the initial pressure for the cartridge filters, which will protect the membranes. Anti-scalant will be added to prevent mineral scalant formation on the surface of the membranes. The anti-scalant is a chemical mixture that is proprietary to each RO system manufacture. The RO Feed Pumps will then boost the pressure to 125 psig. Each RO rack will contain two stages. Tentatively there will be 24 modules in Stage 1 and 12 modules in Stage 2. An energy recovery turbine will be included between stages to recover approximately 50 percent of the residual energy on the reject side of Stage 2 and apply that energy to boosting the inlet pressure for Stage 2.

Table 6-4 below contains a summary of design criteria and mechanical equipment for the RO System. Figure PD-4 in Appendix A contains a process block diagram for the RO System.

**Table 6-4**
**Reverse Osmosis Design Criteria and Mechanical Equipment**

| | |
|---|---|
| Design Output Capacity Flow Rate, mgd | 1.7 |
| MF Blend Around Flow Rate, mgd | 0.3 |
| Blend Tank, gallons | 5,000 |
| Reject Rate and Flow, %/mgd | 15/0.3 |
| Reject Flow Disposal | Existing WWTP Outfall |
| Cartridge Filters, number/size, inch | 2/40 |
| Average Design Flux Rate, gfd | 8 |
| RO Membrane Type | Polyamide |
| Total Number of RO Elements | 504 |
| Surface Area, sf/element | 400 |
| Number of RO Racks | 2 |
| Number of Elements/Rack | 252 |
| **Low Pressure RO Transfer Pump System** | |
| Type of Pumps | Horizontal, Dry-Pit |
| Number of Pumps, duty/standby | 1/1 |
| Design Pressure, psi | 35 |
| Motor Horsepower, hp ea | 40 |
| **High Pressure RO Feed Pump System** | |
| Type of Pumps | Horizontal, Dry-Pit |
| Number of Pumps, duty/standby | 1/1 |
| Design Pressure, psi | 125 |
| Motor Horsepower, hp ea | 150 |
| Chemical Anti-Scalant Feed System | |
| Sulfuric Acid Feed System | |

## 6.6 UV Disinfection and Break Point Chlorination

### 6.6.1 UV Disinfection

The UV process will be of the open-channel type. The channel will be constructed of reinforced concrete and coated on the interior to prevent the potential growth of bacteria and pathogens on the walls of the channel. The UV channel will be covered with checkered plate to prevent the escape of the UV light, which is a hazard to eyesight. A control gate will be provided at the downstream end of the channel to ensure that the proper water depth will be maintained in the channel.

Three UV banks (2 duty and 1 standby) will be provided to comply with the National Water Research Institute (NWRI) Guidelines for Recycled Water. UV transmittance monitors will provide input to the UV control system which will vary the dose to match the actual UV dosage with the design dose requirements. The electrical transformers and other equipment related to power and control will be located in the MF/RO Building.

### 6.6.2 Break Point Chlorination

Chlorine will be added just downstream of the RW Pump Station. A static, in-line mixer will provide adequate mixing and the detention time of the RW in the pipeline will provide more than adequate time for the chemical reaction to reduce the remaining ammonia to the target criterion of less than 0.2 mg/L. The chlorine will also provide a small residual (~2 mg/L) to prevent slime growth in the pipeline.

Table 6-5 below contains a summary of design criteria and mechanical equipment for the UV and break point chlorination systems. Figure PD-5 in Appendix A contains a process block diagram for the UV and break point chlorination systems.

***Table 6-5***
***Design Criteria and Mechanical Equipment for UV and Break Point Chlorination***

| | |
|---|---|
| **UV Disinfection System** | |
| Type of UV System Low Pressure, High Intensity | |
| Number of Channels | 1 |
| Total Number of Banks, duty/standby | 2/1 |
| Modules per Bank | 5 |
| Lamps per Module | 8 |
| Total No. of Lamps | 120 |
| Number of Duty Lamps | 80 |
| Number of Stand-By Lamps | 40 |
| Power Draw per Lamp | 250 Watts |
| Max Power Draw Duty Lamps | 20 kW |
| Average Power Draw | 17kW |
| UV Channel Dimensions, LxWxD, ft/in/in | 75/21/60 |
| *Potential Manufacturers to be Considered: Trojan, IDI/Ondeo and Wedeco* | |
| **Breakpoint Chlorination System** | |
| Blended RO/MF Ammonia Concentration, mg/L | 0.64 |
| Target Recycled Water Ammonia Concentration, mg/L | 0.1 |
| Stoiciometric Reduction of Ammonia by Chlorine, mg/mg | 7.5 |
| Desired Chlorine Residual, mg/L | 2 |
| Estimated Chlorine Dose, mg/L | 7 |
| Form of Chlorine Chemical: Sodium Hypochlorite | |
| Commercial Strength of Sodium Hypochlorite, % | 12.5 |
| Full Chemical Strength of Sodium Hypochlorite at 12.5% is one lb of chlorine per gal | |
| Estimated Volume of Hypochlorite, gal/day | 117 |
| Estimated Hypochlorite Storage Volume Required, gal | 3,500[(1)] |
| Hypochlorite Feed Pumps, duty/standby | 1/1 |
| Hypochlorite Feed Pump Capacity, gal/hr | 2 to 5 |
| Hydraulic Reaction Time Required, min | 10 |
| Reaction Time will be provided in the RW transmission line | 14,000 |

[(1)] Includes storage for breakpoint, residual and MF cleaning.

# 6.7 Chemical Storage and Containment System Design Criteria

## 6.7.1 Applicable Codes:

The chemical storage and containment system will be designed in conformance with the most recently adopted editions of the following codes and regulations:

- California Building Code
- California Building Code Standards
- California Fire Code (CFC)
- California Fire Code Standards

## 6.7.2 Chemicals Storage Requirements

Table 6-6 shows the types of chemicals to be used, estimated consumption rates, chemical strengths and proposed storage volumes.

**Table 6-6**
**Estimated Chemical Storage Requirements**

| Chemical | Estimated Vol/day | Estimated Vol/month | Chemical Strength | Storage Type & Location | Storage Volume |
|---|---|---|---|---|---|
| | gal | gal | % | | gal |
| Caustic | 126 | 3,800 | 25% | Tank-outside | 4,000 |
| Sodium Hypochlorite | 133 | 4,000 | 12.5% | Tank-outside | 4,000 |
| Sulfuric Acid | 33 | 1,000 | 93% | Tank-outside | 1,000 |
| Citric Acid | na | 100 | 50% | Totes - inside | 100 |
| Antiscalant | 10 | 300 | 100% | 55-gal drums or tote - inside | ~ 200 |

## 6.7.3 Chemicals Stored Outside

The chemical storage and containment system contains sodium hypochlorite (NaOCI), caustic soda (NaOH) and sulfuric acid (H2SO4). All three chemicals will be stored outdoors, within secondary containment areas. Secondary containment volumes will be sized to accommodate 100 percent of the storage tank volume plus a 24-hr rainfall, as determined by a 25-year storm, in accordance with CFC requirements (Paragraph 2704.2).

An automatic level detection system, which will be tied to the Plant SCADA system, capable of detecting hazardous and corrosive chemical leakage, will be provided for each secondary containment area. (Refer to Sheet PD-6 in Appendix A.)

Each area will be equipped with an emergency eyewash and shower, which will be tied to the Plant SCADA system, plant water service for flushing the chemical feed pumps and piping system, hose bib for housekeeping, 120V-1ph-60Hz convenience receptacle installed near a drainage sump, which will be located at the low point of the floor. The sump will collect both rainfall and any leakage within the secondary containment area. Prior to pumping out, sump contents will have to be sampled if the collected liquid has to be neutralized before its removal by means of a plug-in submersible pump. After neutralization (if required) spilled chemicals will be pumped back to the headworks through the Industrial Influent Sewer and returned to the main plant process flow.

All surfaces of the concrete secondary containment will be painted with a protective coating.

Chemical material safety data sheets (MSDS) suggest that NaOCI storage tanks should be protected from exposure to direct sunlight. Special resins and coatings can be used to reduce degradation of fiberglass storage tanks. Another option is to provide a canopy over such tanks. It is noted that the existing hypochlorite tank at the WWTP is not covered and the tan has provided excellent service.. The design approach for the NaOCl tank will be determined during final design.

Another issue associated with chemical storage relates to chemical incompatibility. All three chemicals that will be stored outside are incompatible with each other. The California Fire Code requires 20 feet of separation, unless full height separation walls are provided. Hence, as noted on the preliminary site plans, the hypochlorite tank has been separated from the other two tanks, and those tanks are separated by 20 feet.

Chemical feed pressurized piping will be corrosion-resistant, double containment type. Outdoor, exposed piping for caustic and hypochlorite will be heat traced to prevent "freezing" (crystallization). Heating tracing is provided for existing piping for these chemicals at the City's WWTP.

Flexible hoses as the chemical carrier pipes is an option to consider during final design. This approach, used at a few treatment plants, consists of installing flexible hose as the carrier pipe inside a rigid pipe that provides double containment. The flexible hose is pulled in/out of the containment pipes in a similar fashion to electrical wires inside conduits. Bends in this type of double contained piping system need to have a long radius so that the flexible hoses can be pulled. This type of piping system is generally simpler to install and maintain as there are no joints in the hose within a piping run. The ends of the flexible hose can be provided with compression-by-threaded fittings for connecting to the rest of the feed system.

## 6.8 Process Implications of Power Supply Interruption, Resultant Operating Procedures and Need for Standby Power

Should there be a power interruption resulting from PG&E failure and/or other causes, certain portions of the Water Reuse Facilities (WRF) could be negatively