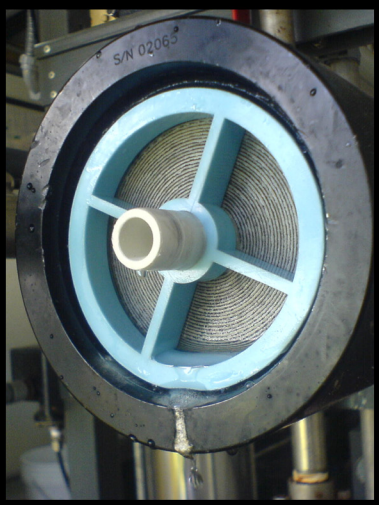
Manatee County

Erie Road RO Water Treatment Plant
Basis of Design Report
County Project 6020171

May 2008



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EXECUTIVE SUMMARY

Population and potable water demand projections prepared by Manatee County indicate the need to develop additional water supplies and treatment facilities to meet the County's anticipated potable water needs. The most recent projections indicate that approximately 9.1 million gallons per day (MGD) of new potable water supply will be required by 2030. The projections further indicate that without new water sources and associated treatment facilities, the County may see potable water demands approaching available supplies by 2014. A 3.0 MGD Reverse Osmosis (RO) Water Treatment Plant (WTP) is proposed to be commissioned by 2014 to meet the growing need for water supply in the area. The proposed WTP will be located adjacent to Buffalo Creek golf course, near the County's North Water Reclamation Facility (NWRF) and will produce potable water from groundwater sources located in the vicinity of the WTP. The plant will be designed to comply with the Florida Department of Environmental Protection Agency's primary and secondary water quality standards, along with County water quality goals.

The water source for the plant includes the Tampa/Suwannee limestone zone of the Upper Floridan and the Intermediate aquifer. In order to produce 3.0 MGD of finished water, approximately 3.95 MGD of raw water will be supplied to the WTP from five Upper Floridan aquifer wells and eight Intermediate aquifer wells. The number of proposed wells will also allow for expansion of the facility to 5.0 MGD in the future.

A pilot study was conducted in 2007 to assist with the preliminary design of the proposed WTP. The pilot study confirmed the use of low pressure RO membranes as an appropriate treatment technology for the primary treatment process. The membrane separation process will reduce the dissolved constituents in the source water to comply with the aforementioned regulations and goals for the finished water produced by the facility. The 3.0 MGD of finished water will be made up of approximately 2.1 MGD of RO membrane permeate, and approximately 0.9 MGD of

filtered raw water that will bypass the RO treatment process. It should be noted that the WTP will be designed to produce approximately 3.2 MGD of finished water; the additional 0.2 MGD of finished water will be utilized for plant water, filter backwashing and membrane cleaning.

Based on the data obtained during the pilot study, pretreatment using chemical oxidation and coagulation (sodium hypochlorite and ferric chloride) with multimedia pressure filtration is recommended for the 3.95 MGD of raw water to address ferrous sulfide precipitates. Chemicals will be added to the raw water upstream of the filters to assist with particulate removal. The filters will provide for extended cartridge filter life and will reduce the potential for membrane fouling and the frequency of membrane cleaning. An RO bypass stream will allow for the maximum amount of bypass water, thus improving the efficiency of resource utilization.

It is important to note that the County plans to construct the wells and raw water transmission main required for the WTP prior to design and construction of the main plant facilities. A part of this project will include water quality analyses on the source water from wells to determine the overall raw water quality anticipated for the full-scale plant. The water quality used for this report was obtained from one (1) Upper Floridan Aquifer well and may not be representative of the water quality from the proposed wells. As such, the proposed pretreatment system may need to be modified subsequent to obtaining the water quality for the proposed wells. If the water quality from the proposed wells is significantly better (lower TSS, lower SDIs, etc.) than the existing Upper Floridan well, it is feasible that the pretreatment system could be reduced to chemical treatment and cartridge filtration. Conversely, if the water is significantly worse (higher TSS, higher SDIs, etc.), the proposed facility may required a more robust pretreatment system that would likely consist of a micro or ultrafiltration system.

The concentrate from the proposed WTP will be transferred to a location near the NWRF's golf course reclaimed water storage pond, where it will be blended with the effluent stream from the

NWRF. The blended concentrate/reclaimed water stream will then be transferred into the NWRF's golf course reclaimed water storage pond for beneficial reuse.

The RO permeate and filtered bypass streams will be blended, chemically stabilized, disinfected and transferred to a combination contact chamber/ground storage tank. The finished water will be stored in the proposed 3.0 MG ground storage tank. High service pumps will transfer the finished water into the County's existing distribution system.

The WTP's main treatment processes, offices, and operational facilities will be housed within a proposed pre-engineered metal building that will be designed to accommodate additional skids and other components to allow for expansion to 5.0 MGD in the future. The RO building, along with other facilities required for the WTP will be located on the WTP site to minimize the site footprint, provide for future expansion, minimize environmental impacts, and to allow for ease of operation and maintenance.

It is anticipated that the proposed 3.0 MGD WTP will be constructed in two phases. The first phase will include the wells and raw water transmission main to provide raw water to the facility. The second phase would include the remaining components required for the facility. Both phases are scheduled to be designed and constructed so that the plant can be commissioned by 2014. The estimated project costs are presented in **Table ES-1.**

Table ES-1: Projected WTP Cost Summary

Design Capacity	3.0 MGD
Total Project Cost	$21,448,000.00
Capital Recovery @ 5%, 30 years	$1,396,000.00
Annual O&M Costs	$ 1,135,000
Total Annual Costs	$2,531,000.00
Cost of Treated Water ($/1,000 gallons)	$ 2.31

1.0 INTRODUCTION

Recent population and potable water demand projections prepared by the Manatee County Planning Department indicate that additional water supplies and treatment facilities will be required to meet the anticipated County potable water demands. The projections indicate that approximately 9.1 MGD of new potable water supplies and appropriate treatment facilities will be required by 2030. Near-term projections indicate that new supplies and treatment facilities will need to be operational by 2014 to meet the projected demands. The Erie Road 3.0 MGD Reverse Osmosis (RO) Water Treatment Plant (WTP) is proposed to meet the near-term increased demands projected by 2014. The proposed WTP will be located adjacent to Buffalo Creek golf course, near the County's North Water Reclamation Facility (NWRF) and will produce potable water from groundwater from both the Upper Floridan and Intermediate aquifers utilizing wells that will be located in the vicinity of the proposed WTP. The plant will be designed to comply with Florida Department of Environmental Protection (FDEP) primary and secondary water quality standards, along with the County's water quality goals.

1.1 Purpose

The purpose of this Basis of Design Report is to provide the preliminary design and estimated costs for the proposed 3.0 MGD Erie Road RO WTP. Preliminary design will include raw water supply wells and transmission mains, pretreatment components, chemical treatment, reverse osmosis process related components, blending and disinfection, finished water storage, high service pumping, site design considerations, concentrate disposal and permitting requirements required for the design of the proposed facility.

1.2 Background

A number of resources were utilized in the development of this report. These resources were utilized to assist with the proposed facility location, water quality characteristics, and future water demand projections. These items are described in detail in the following sections.

1.2.1 Site Selection

McKim & Creed prepared the *Preliminary Site Selection Study for Reverse Osmosis Facilities* (August 2005) to identify sites suitable for locating RO water treatment facilities. Twelve potential sites proposed by the County for possible location of RO WTPs were evaluated in the study.

Further evaluation of the 12 sites indicated that eight sites encompassed at least four or more acres of property, which was determined as the minimum area that would be required for the facility. These eight sites were screened utilizing criteria such as preliminary costs for infrastructure (i.e. wells, piping, pumps), locations of wells, hydrogeologic conditions, water use permitting issues, and proximity to landfills and petroleum contaminated sites. The final ranking of the sites is shown in **Table 1-1**.

Water quality testing was conducted for the Preliminary Site Selection Study. The results of the water quality testing indicated that the Erie Road site provided the highest quality raw water for treatment using RO membrane technology. Other factors including permitting, hydrogeologic conditions, potential well locations, etc. were evaluated and the Erie Road site was the highest ranked site in the site selection study and was selected by the County for the proposed RO WTP.

Table 1-1: Potential RO Facility Sites in Ranked Order

Site No.	Name	Land Use	Infrastr. Cost	Well Locations	Hydro. Cond.	WUP Issues	Landfill/ PCS	Total
10	Erie Rd Tank	3	2	1	2	3	1	12
6	Ellwood I	2	2	2	2	2	2	12
5	Ellwood II	2	2	3	2	2	1	12
12	Schroeder-Manatee	1	1	3	2	3	2	12
2	66th Street W.	3	2	1	1	2	1	10
4	NW GS Site	1	1	2	1	2	2	9
7	Tideview WTP Site	1	1	1	1	2	2	8
1	Bayshore	1	1	1	1	2	1	7

1.2.2 Water Supply Needs

The 2006 potable water production of approximately 45.5 MGD was provided by the Manatee County Utility Operations Department (MCUOD). Accounting for the projected population increase, the potable water demands are anticipated to increase to approximately 61.9 MGD by year 2030. The current annual average permitted water supply available to MCUOD is 52.85 MGD. This current permitted supply is sufficient to meet projected demands until approximately year 2014. New water supplies and treatment facilities will need to be developed by 2014 to meet near-term demands; a total of about 9.1 MGD of new water supply is needed to meet the projected demands through the year 2030.

1.2.3 Raw Water Source

The quality of the future raw water supply at the site was initially evaluated based on available information from existing wells in the vicinity of the proposed WTP site. Anticipated aquifer yield issues, Water Use Permitting concerns, and

the location of potential Aquifer Storage and Recovery facilities assisted in determining that an Upper Floridan Aquifer well be utilized for a Pilot Study to assist with the design basis of the treatment facility. An Upper Floridan Aquifer well was constructed at the pilot plant site in the general vicinity where construction of wells and infrastructure for the future facility is proposed. Raw water characteristics from this well are shown in **Table 1-2**. The results in the table are from sampling conducted during a 10-day aquifer performance test prior to pilot plant start-up. The water quality test results acquired during the pilot study are provided in **Appendix A**.

It is proposed that four (4) Upper Floridan wells and eight (8) Intermediate wells be constructed in addition to the existing Upper Floridan well that was utilized for the 2007 pilot study. These wells will be constructed and permitted to meet the facility's future capacity of 5.0 MGD. The number of proposed wells will allow for rotation and firm supply capacity should maintenance be required. It is anticipated that the Upper Floridan wells will each provide approximately 700 gpm of raw water, and the Intermediate Aquifer wells will each provide approximately 150 gpm of raw water. **Figure 1-1** shows a vicinity plan with the approximate locations of the thirteen (13) wells that will supply raw water to the proposed 3.0 MGD Erie Road RO WTP.

N

0 200 400
1" = 400'

LEGEND

- PROPOSED INTERMEDIATE AQUIFER WELL LOCATION
- PROPOSED UPPER FLORIDAN AQUIFER WELL LOCATION
- 12" PROPOSED RAW WATER TRANSMISSION MAIN AND PIPE SIZE

REV.NO.	DESCRIPTIONS	DATE
	REVISIONS	

SEAL

SEAL

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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIOS WATER TREATMENT PLANT
BASIS OF DESIGN

PROPOSED SITE VICINITY PLAN WITH WELLFIELD

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JRV
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

SCALE
HORIZONTAL: AS SHOWN
VERTICAL: NA

M&C FILE NUMBER

DRAWING NUMBER
1-1

STATUS: PRELIMINARY DESIGN

REVISION

Table 1-2: Raw Water Quality

Parameters	Units	Results	EPA (MCL)
Specific Conductance	umhos/cm	980	--
Water Temperature	C	27.6	--
pH	--	7.1	6.5 – 8.5*
Turbidity	NTU	0.7	--
Total Alkalinity as $CaCO_3$	mg/l	140	--
Ammonia Nitrogen	mg/l	0.22	--
Bromide	mg/l	0.03	--
Chloride	mg/l	38	250
Color	CU	5	15*
Fluoride	mg/l	0.81	2*
Hydrogen Sulfide (Unionized)	mg/l	0.01	--
Nitrate (as N)	mg/l	0.002	10
Sulfate	mg/l	320	250*
Total Dissolved Solids	mg/l	670	500*
Total Organic Carbon	mg/l	0.94	--
UV254 Absorbance	cm^{-1}	0.034	--
Aluminum	mg/l	0.1	0.05-0.2*
Barium	mg/l	0.028	2
Calcium	mg/l	110	--
Iron, Dissolved	mg/l	0.044	--
Iron	mg/l	0.041	0.3*
Potassium	mg/l	2.4	--
Magnesium	mg/l	48	--
Sodium	mg/l	16	--
Dissolved Silica as SiO_2	mg/l	21	--
Strontium	mg/l	11	--
Heterotrophic Plate Count	CFU/ml	164	--

**EPA Non-regulated cosmetic or aesthetic guideline*

2.0 DESIGN CONSIDERATIONS

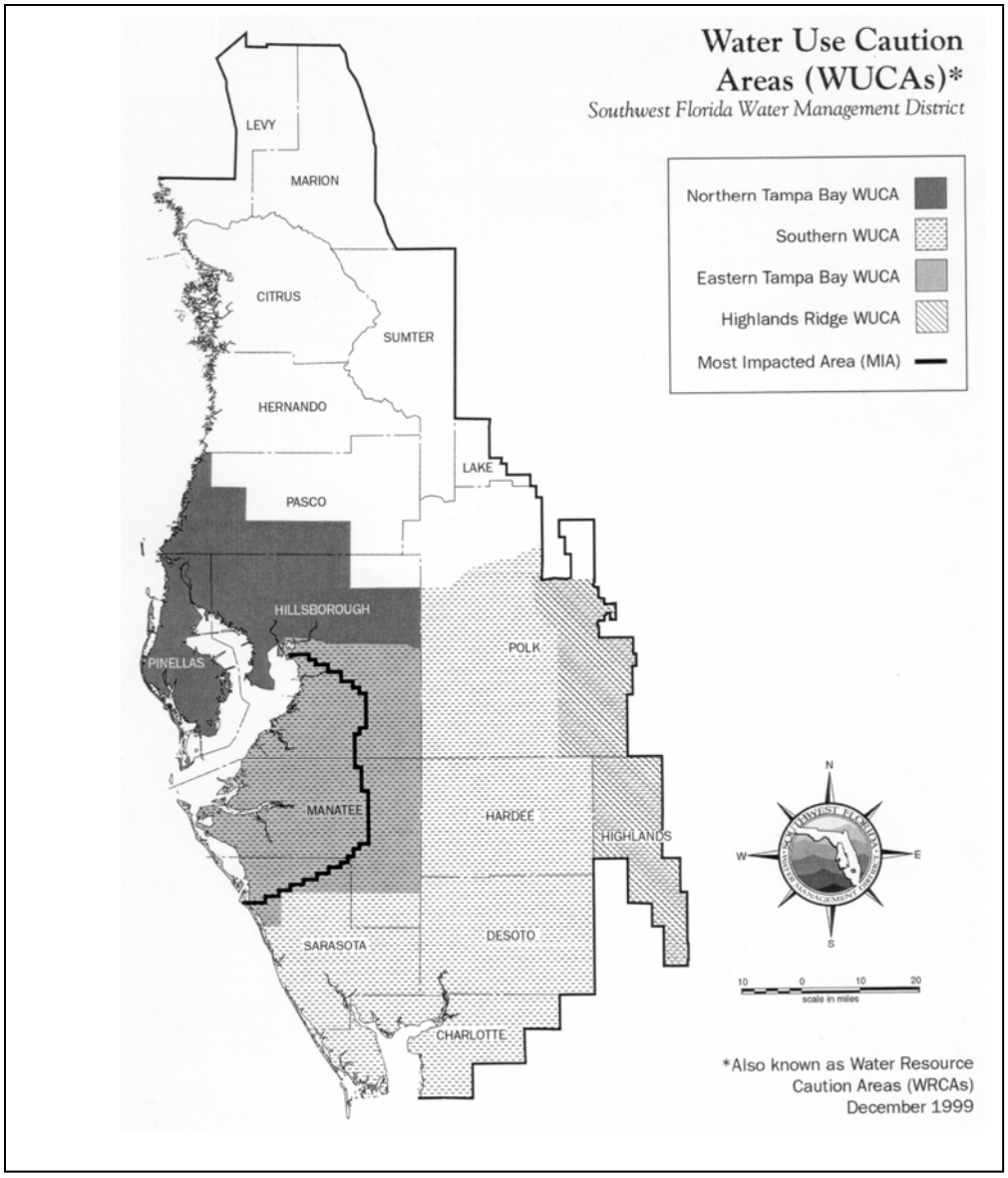
There are several design considerations that should be addressed for the design of the proposed WTP facility. These include meeting future County water supply needs, County water quality goals, integration with the existing Erie Road elevated storage tank, permitting, concentrate disposal and minimization of environmental impacts.

2.1 Environmental Considerations

In order to meet the increasing water supply needs associated with the County's projected growth, new water supply sources will need to be developed in a manner that considers environmental effects. Of particular concern is the effect of groundwater withdrawals from the Upper Floridan aquifer within areas identified as "water use caution areas" by the Southwest Florida Water Management District (SWFWMD). Manatee County is fully contained within the Southern Water Use Caution Area and the entire western portion of the County (including the proposed WTP site) is designated as part of the Most Impacted Area (MIA) relative to groundwater conditions defined by the SWFWMD. These areas are displayed in **Figure 2-1**.

Due in part to the items noted above, water use permitting for the proposed wells needed to supply groundwater for the WTP is expected to be challenging. Permit requirements will likely include groundwater modeling to predict the effect that groundwater pumping will have on the Upper Floridan and Intermediate aquifers, potential offsets through permit transfers or by providing reclaimed water to existing permit holders and a wellfield management plan consisting of water quality monitoring and rotation/resting of individual wells. The water use permit application for the proposed facility's groundwater sources is currently being prepared, concurrent with the preparation of this Report. The anticipated submittal is the second quarter of 2008. The permit is expected to be issued in 2009, before the completion of design and construction of the WTP.

Figure 2-1: Water Use Caution Areas



2.2 Permit Requirements

The constituents in the concentrate stream from the proposed facility will require a means of permittable and cost-effective concentrate disposal. The FDEP reuse regulations indicate that the RO concentrate can be blended with the County's reclaimed water system. It is proposed that the concentrate from the RO membrane treatment process be transferred into the County's Master Reuse System, via a connection to the effluent pipe at the NWRF, between the high service pumps and the NWRF's golf course

reclaimed water storage pond. The blended RO concentrate/NWRF effluent stream will then be incorporated into the County's Master Reuse System and will be utilized for beneficial reuse. A detailed description of concentrate management for the proposed RO WTP can be found in **Section 4.6.2**.

The following is a summary of the permits that will be required for the facility:

- Individual Water Use Permit Application, Use for Quantities of 500,000 Gallons Per Day or Greater WUP-3 Form #46.20-003 (SWFWMD)
- Water Use Permit Application Supplemental WUP-7 Form #46.20-007 (SWFWMD)
- Certification of Construction Completion and Request for Clearance to Place Permitted PWS Components into Operation Form #62-555.900(9) (entire project) (FDEP)
- Certification of Construction Completion and Request for Clearance to Place Permitted PWS Components into Operation Form #62-555.900(9) (RO skids and RO feed pumps) (FDEP)
- Certification of Construction Completion and Request for Clearance to Place Permitted PWS Components into Operation Form #62-555.900(9) (FDEP)
- Storage Tank Facility Registration Form #62-761.900(2) (FDEP)
- Containment and Integrity Plan Certification Form #62-761.890(10)(C) (FDEP)
- Industrial Wastewater Discharge Permit Application Form # 1352-0005
- Monitoring Plan per F.A.C. Chapter Rule 62-550.821
- State of Florida Permit Application to Construct, Repair, Modify, or Abandon a Well Form #41.10-410(1) (SWFWMD)
- Discharge of Produced Groundwater from any Non-Contaminated Site Activity (F.A.C. Chapter Rule 62-621.300(2) (FDEP)

- Notification/Application for Constructing a Domestic Wastewater Collection/Transmission System Form #62-604.300 (8)(a) (FDEP)
- Request for Approval to Place a Domestic Wastewater Collection/Transmission System into Operation Form #62-604..300(8)(b)
- Statement of Completion and Request for Transfer to Operation Entity Form #547.27/SOC
- Manatee County Planning Department Final Site Plan Approval
- Manatee County Building Department Permits for:
    - Buildings
    - Concrete pads
    - Fencing
    - Concrete Structures

2.3 Staffing Requirements

Per Rule 62-699.310 (F.A.C.), *Classification and Staffing of Domestic Wastewater or Water Treatment Plants and Water Distribution Systems*, the proposed facility is a Class B water treatment plant based on capacity and treatment processes. The rule stipulates that facility staffing must include a lead operator of a Class B certification or higher who is available (on-call) during all periods of operation. A Class C operator or higher is required at the WTP for 16 hours/day, 7 days per week.

The County may request a staff reduction after one year of service provided the facility is electronically controlled and monitored. Approval of the request is contingent on the facility meeting all water quality standards and applicable operation and maintenance requirements. After one year of successful operation, the staffing requirements could be reduced to a Class C or higher operator for 8 hours/day for 7 days per week. The lead operator staffing requirements would remain the same.

2.4 County Water Quality Goals and Treatment Technology

Finished water quality goals were established for parameters considered critical to the design of the facility. These goals include compliance with all federal and state drinking water quality standards (primary and secondary drinking water standards), as well as Manatee County goals that mainly address aesthetic/customer satisfaction concerns. A comparison of the County's water quality goals with the raw water quality obtained prior to pilot testing is presented in **Table 2-1**. As illustrated in **Table 2-1**, several of the raw water quality parameters exceed goals established by the County. These largely consist of dissolved constituents that low pressure RO membranes are highly suited for. In addition, the source water contains a signification amount of radionuclides, some of which can only be removed by membrane separation technology. Based on this information, along with the results of the pilot study, low pressure RO membranes are recommended for the main treatment process for the proposed WTP.

Table 2-1: Manatee County Water Quality Goals Compared to Raw Water Quality

Parameters	Units	Max.	Min.	Avg.	Raw Water Quality[1]
Chloride	mg/L	27.0	13.3	18.7	38.0
Sulfate	mg/L	144	71	95	320
TDS	mg/L	402	164	260	670
Total Alkalinity	mg $CaCO_3$/L	67.3	17.0	31.4	140
Total Hardness	mg $CaCO_3$/L	189	89	128	475
pH	S.U.	7.86	7.06	7.50	7.55[2]
Turbidity	S.U.	0.75	0.08	0.19	0.7
Conductivity	uS/cm	530	250	345	980

1) Data obtained during 10-day aquifer performance test.
2) Data obtained from water quality tests from pilot study.

2.5 Integration with Existing Erie Road Elevated Storage Tank

Connection to and operation with the County's existing potable water system also needs to be addressed. The County's potable water system includes a 1.0 MG elevated storage tank located adjacent to the proposed WTP site. The design considers finished water

delivery from the proposed WTP, along with the elevated storage tank and transmission system. The elevated storage tank will be used to meet ADF demands and will fill at night while system pressures are highest. Due to the increased pressures anticipated from the high service pump station at the proposed WTP, some modifications at the existing elevated storage tank will be necessary to ensure that the tank is "turned-over" on a regular basis to prevent water quality issues that could arise. The proposed modifications at the elevated tank site are provided in **Section 4.5.3**.

2.6 Community and Aesthetic Considerations

The location of this project requires consideration with respect to aesthetics and public impacts. Since the proposed facility site is located between the Buffalo Creek Golf Course and the Buffalo Creek Middle School on Erie Road, landscape buffers will be incorporated in the design. The wells will be surrounded by privacy landscaping with vinyl coated, galvanized steel chain link fence and green PVC privacy slats to blend with the surroundings.

3.0 PILOT STUDY

3.1 Purpose

A pilot study was conducted at the Erie Road site from May 2007 to October 2007. The purpose of the study was to evaluate the viability of new source water for potable use, as well as to assist with the development of the preliminary design for the proposed 3.0 MGD WTP.

The specific goals of the project included:

- Obtain site-specific raw-water quality data
- Pilot study using the raw water supply from the Upper Floridan well constructed near the site of the proposed WTP
- Documentation of findings and results of the Pilot Study
- Recommend criteria for the design basis for the proposed Erie Road WTP

3.2 Pilot Plant Operation

The Pilot Plant consisted of the Upper Floridan well, a 40 gpm submersible well pump, a sulfuric acid feed system, an antiscalant feed system, 5.0 micron cartridge filters, a high pressure pump, and the equivalent of three, 4-inch diameter pressure vessels, each capable of containing seven membrane elements. The pilot was a 2-1 array consisting of two pressure vessels in the first stage and one pressure vessel in the second stage. The membranes in the second stage pressure vessels treated the concentrate from the first stage to increase overall recovery of water from the system. This system was designed to provide representative flux and recovery settings consistent with a full-scale WTP design.

The Pilot Plant was used to treat approximately 27,800 gallons per day (gpd) of raw water from the Upper Floridan well and produced approximately 23,600 gpd of RO

permeate. Koch TFCS4920 membrane elements were utilized in the pressure vessels to treat the groundwater. Pretreatment for the system included the addition of sulfuric acid and antiscalant to the raw water using two metering pumps. The chemically treated water was then transferred through 5.0 micron cartridge filters before being pumped to the low pressure membranes. Permeate and concentrate flows were monitored via rotometers and the raw, permeate and concentrate pressures were monitored via pressure gauges.

The approximate operational conditions for the pilot are shown in **Table 3-1**. Data was collected twice per day for flow, pressure and temperature. Water quality analyses were performed once per day for total dissolved solids (TDS), pH and turbidity. Samples for more detailed laboratory analysis were taken several times during the pilot test period and are provided in **Appendix A**.

Table 3-1: Pilot Testing Operational Conditions

Setting	*Units*	*Pilot Operating Values*
System Flux	gfd	16.2
First Stage Flux	gfd	19.06
Second Stage Flux	gfd	10.49
Recovery	%	85
Acid dose	mg/L	90
Antiscalant dose	mg/L	2.25
pH	SU	6.2

3.3 Results

Results from pilot test indicated the potential for significant solids generation from the raw water. This phenomenon was observed primarily in the pretreatment system; specifically, within the 5 micron cartridge filters. Turbidity and SDI analyses conducted on the raw water were consistently within the range of source water that would not typically require a dedicated pretreatment system (e.g., multi-media filtration or micro/ultrafiltration). The unusual combination of data, field measurements, and visual

observations associated with the deposition of solids on the cartridge filters was the primary focus of operational analyses during the pilot testing.

Operation at a feedwater pH of 6.1 to 6.2 demonstrated that the pressure drop across the cartridge filter vessel did not increase significantly over approximately six weeks of operation, even though solids deposition on the cartridge filters was evident. When the solids deposition reached a critical point, pressures rose quickly and the cartridge filters were replaced. Visual observations showed that a significant solids layer had deposited over that time, black in color and of similar consistency to that seen during the initial pilot plant start-up.

The acid dose was lowered to increase pH in the feedwater to determine the effects on the pilot operation. After an operational change to pH 6.5, a marked increase in the rate of cartridge filter solids deposition occurred. Cartridge filter runs that had been lasting several weeks now lasted only 4-6 days. Increases in cartridge filter solids deposition occurred, and increases in cartridge filter pressure drops were observed within 1-2 days of new filter insertion. The obvious changes strongly suggested pH dependence for the solids precipitation observed.

With the change in deposition came an increase in the mass of solids available for sampling. The deposited solids were analyzed and the results showed that the solids consisted almost completely of iron and sulfur. Subsequent investigations indicated that the deposited solids were likely ferrous sulfide, a black solid which oxidizes once exposed to atmosphere to form ferric oxide solid.

The results of the pilot study indicated that low pressure RO membranes can successfully treat the new groundwater supply to meet the water goals of the County,

but will require some form of pretreatment to address the presence of ferrous sulfide solids. Specific conclusions are as follows:

- No significant membrane fouling was observed when the feedwater pH was maintained at 6.1-6.2.
- The addition of sulfuric acid and antiscalant in the RO feedwater stream is recommended in similar dosages as used during the pilot study.

Based on information obtained from the pilot study as well as discussions with the County, a pretreatment system is proposed to remove iron and hydrogen sulfide to protect the membranes. It should be noted that the pilot study derived source water from one Floridan Aquifer well, and this source water may not be indicative of the combined source water from the additional four Upper Floridan and eight future Intermediate aquifer wells proposed to supply raw water to the facility. It is recommended that the County conduct further water quality analyses after the 12 remaining wells are installed.

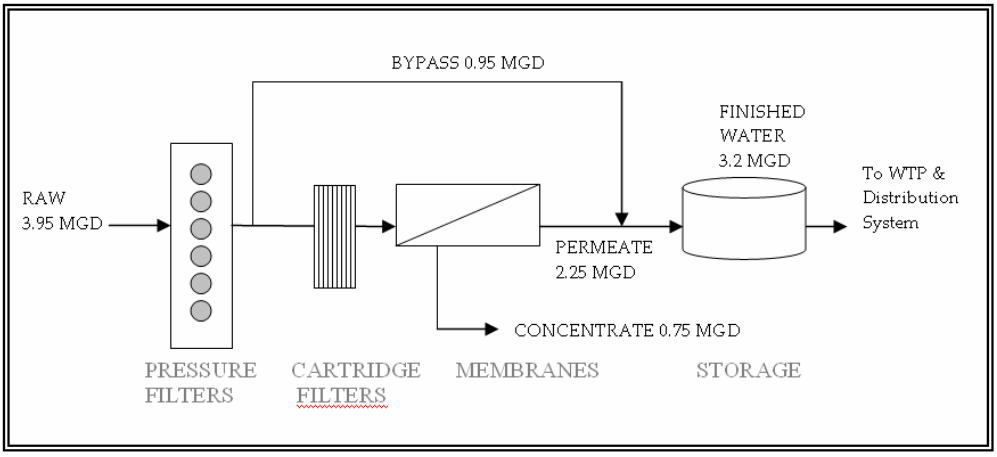
4.0 PROPOSED PROCESS DESIGN

The primary treatment process for the proposed WTP utilizes low pressure RO membranes. Low pressure RO membranes operate as a pressure driven separation process. Separation occurs due to the pressure difference between the feedwater and the permeate. Monovalent ions will pass through the membranes in the permeate stream, while divalent ions will be rejected and will become part of the concentrate stream. This process was identified as the most appropriate treatment process based on County water quality goals, pilot testing and available raw water data. In addition, this treatment process has the ability to remove other constituents, such as pesticides and herbicides, which may have additional regulatory requirements in the future. The following sections further detail the proposed treatment process and its associated components.

4.1 Process Description

The proposed treatment process will include a pretreatment system and a membrane treatment system as shown conceptually in **Figure 4-1**. The initial 3.2 MGD of production capacity is proposed to be accomplished utilizing three (3) membrane trains with a permeate production capacity of 0.75 MGD per train, along with a bypass flow of 0.95 MGD. This configuration will provide for 3.0 MGD of finished water capacity, along with approximately 0.2 MGD of water to be utilized for filter backwashing, plant water and membrane cleaning. It should be noted that throughout this Report, the facility will be referenced as a 3.0 MGD facility; however, the design calculations are based on the production capacity of 3.2 MGD.

Figure 4-1: Simplified Treatment System Flow Diagram



The design recovery rate of the proposed membrane separation process will be approximately 75%. In other words, 75% of the membrane feedwater will become permeate, while 25% of the feedwater will be rejected and becomes concentrate. *Permeate* is defined as the water that is produced by transferring the feedwater under pressure through the low pressure membranes. The majority of the dissolved solids are significantly reduced in this process. *Concentrate* is the portion of the raw water that is rejected by the low pressure membranes. The concentrate stream contains dissolved solids that have been removed from the feedwater stream. The system will also include a bypass stream that will: 1) Reduce groundwater withdrawals; 2) Minimize the quantity of concentrate to be disposed; and, 3) Stabilize the permeate stream and reduce chemical costs for the stabilization. The *Bypass* is a portion of the raw water that has received preliminary treatment in the form of chemical treatment and multi-media filtration that bypasses the membrane system. The bypass stream is then blended with the permeate to produce the 3.0 MGD design flow.

Based on water quality data obtained during the course of the pilot study, the limiting factor to meet the County's water quality goals for blending is hardness. Calculated plant flows based on target constituent limits are shown in **Appendix B.** Projected

water quality for these constituents, including hardness, is shown in **Table 4-1**. These projected results were approximated based on piloting data and projected flows.

Table 4-1: Approximate Water Quality Projections for Target Constituents

Constituent	Projected Concentration in Finished Water (mg/L)	Projected Concentration in Concentrate (mg/L)
Hardness	160	1,819
Chloride	46	164
Sulfate	104	1,166
TDS	287	2,337
Gross Alpha	6	80

4.2 Raw Water Supply System

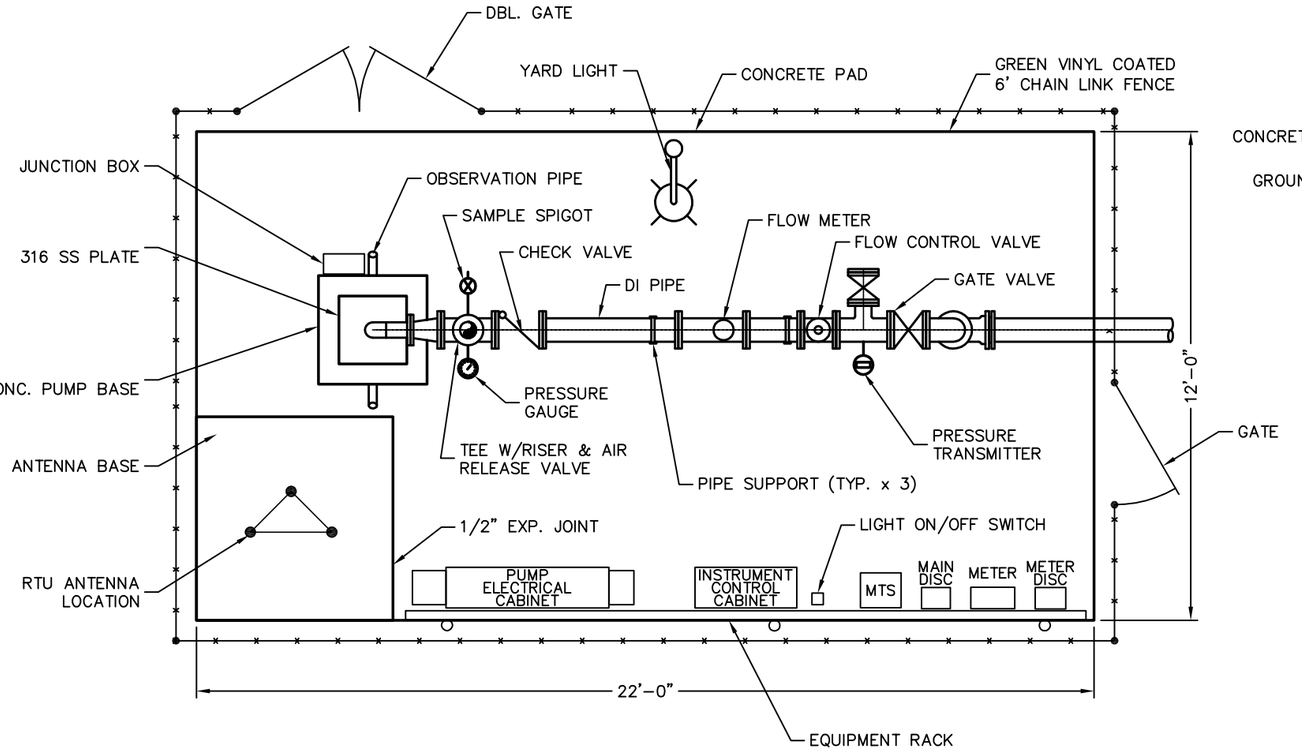
As previously mentioned, the source water for the proposed facility will be provided from a combination of Upper Floridan and Intermediate aquifer wells located within a one mile radius of the WTP site. The wells are located a minimum of 500-feet from reclaimed water storage ponds, in accordance with regulatory requirements. The proposed well layout plan and elevation is shown in **Figure 4-2**.

4.2.1 Upper Floridan and Intermediate Aquifer Wells

The proposed supply wells will include five (5) Upper Floridan wells (including the existing Upper Floridan aquifer well used for the pilot study) and eight (8) Intermediate aquifer wells. The well characteristics for each type of well are shown in **Table 4-2**.

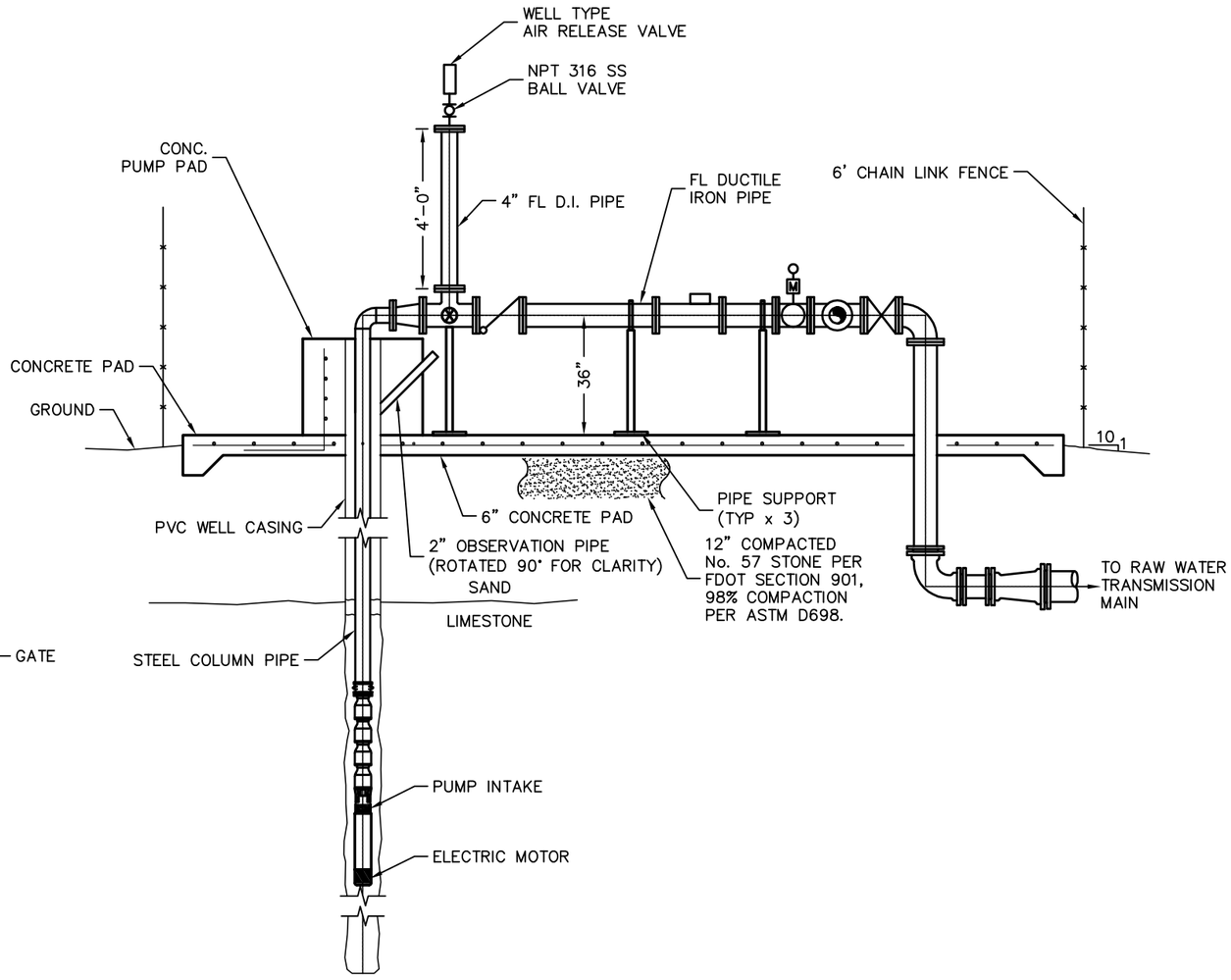
Table 4-2: Wellfield Characteristics

WELL DATA		
Source	Intermediate Aquifer	Floridan Aquifer
No. of Wells	8	5
Total Depth	275 feet	700 feet
Casing Depth	150 feet	325 feet
Casing Diameter	10 inch	16 inch
Design Capacity	150 gpm	700 gpm



PROPOSED WELL LAYOUT PLAN

1/4"=1'-0"



PROPOSED WELL ELEVATION

1/4"=1'-0"

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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS
WATER TREATMENT PLANT
BASIS OF DESIGN

PROPOSED WELL LAYOUT
PLAN AND PROFILE

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 4-2

4.2.2 Raw Water Transmission Main

The raw water will be transferred to the WTP site as shown in **Figure 1-1** using ductile iron piping. A hydraulic model was conducted to size the raw water mains, submersible pumps, and motors. Details from the modeling effort including modeling output results, candidate pump cut-sheets and pump curves are provided in **Appendix C**.

The modeled pumps are constant speed submersible pumps and are sized to meet the future plant capacity of 5.0 MGD. A V-port ball valve with an electric motor operator will be installed at each well site to provide control of the flow from each well under PLC control. Variable frequency drives (VFDs) are not the preferred control option since the motors are smaller in size (15 HP and 60 HP), the pump sites are spread out around the wellfield and the VFDs would require air conditioning at each well site. The resulting raw water pump data is provided in **Table 4-3**.

Table 4-3: Raw Water Pump Data

PUMP DATA		
Source	Intermediate Aquifer	Floridan Aquifer
HP	15	60
RPM	3,450	3,450
Stage	5	4
Design TDH, ft.	212	214
Design Flow, gpm	150	700

4.3 Pre-Treatment

Membrane fouling is largely dependent upon site-specific source water characteristics along with the type of pretreatment utilized. The rate of fouling can significantly impact the operation and useful life of the membranes, ultimately impacting plant operations and maintenance costs. Based on the results of the pilot study, a pretreatment system is

recommended for the proposed facility to reduce the potential for membrane fouling. In addition, the pretreatment system will extend the life of the cartridge filters and increase the amount of time between membrane cleaning. The addition of a chemical oxidant and chemical coagulant, along with multi-media pressure filters is proposed upstream of the membrane units; the bypass stream will also be treated in the same manner.

It is important to note that the water quality used for this Report was obtained from one (1) Upper Floridan Aquifer well and may not be representative of the water quality from the proposed wells. As such, the proposed pretreatment system may need to be modified subsequent to obtaining additional water quality for the proposed wells. If the water quality from the proposed wells is significantly better (lower TSS, lower SDIs, etc.) than the existing Upper Floridan well, it is feasible that the pretreatment system could be reduced to chemical treatment and cartridge filtration. Conversely, if the water is significantly worse (higher TSS, higher SDIs, etc.), the proposed facility may required a more robust pretreatment system that would likely consist of a micro or ultrafiltration system.

4.3.1 Pre-Treatment Chemical Systems

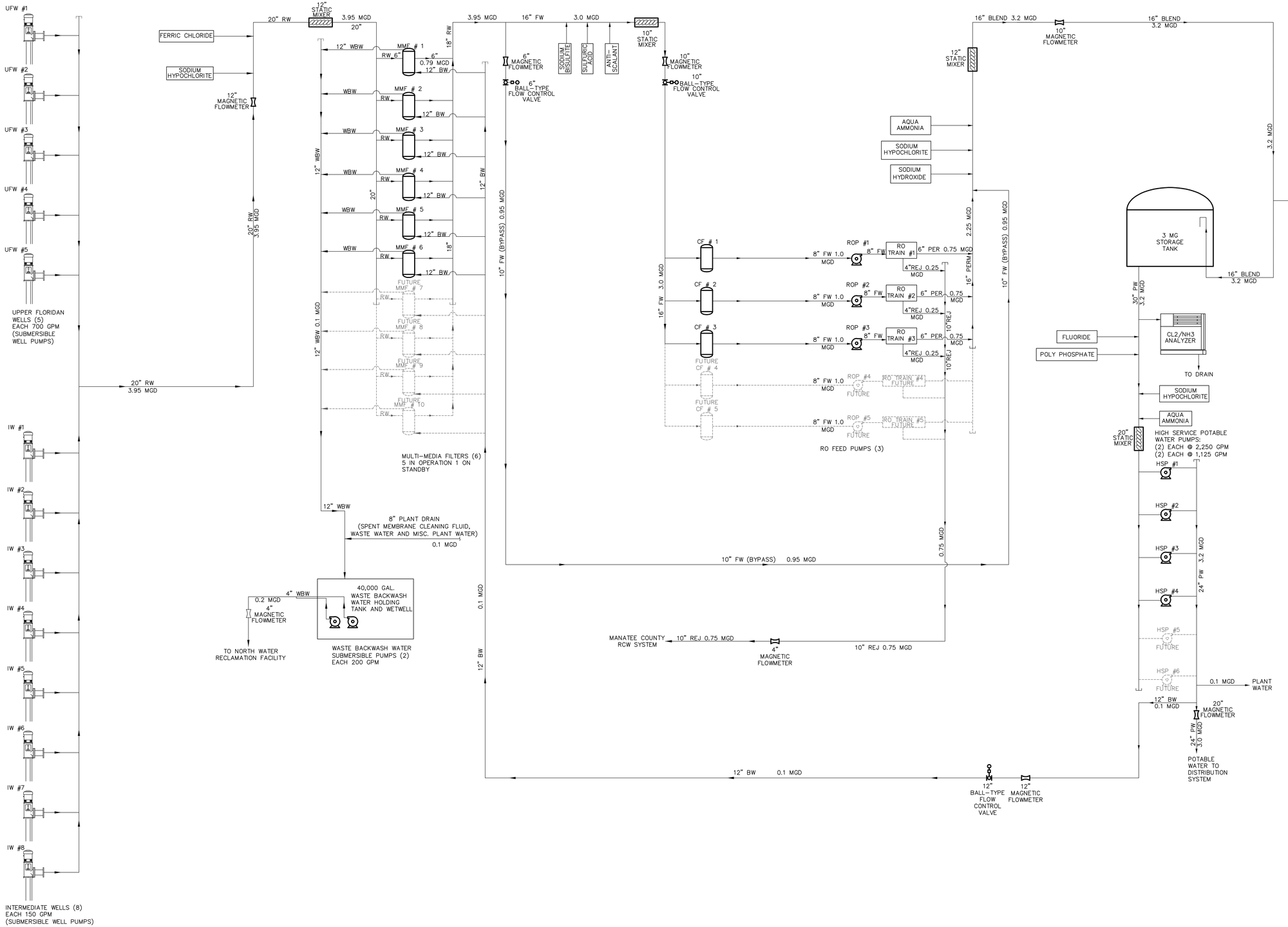
Findings from the pilot study indicate that precipitation of iron and sulfur constituents are the main source of particulates in the source water. These precipitates are either present in the groundwater or formed during pumping. Additionally, particle size distribution analyses conducted on the raw water indicate that the particles are predominately in the 2-3 μm range and precipitation generally becomes more prevalent at pH values greater than 6.2. To minimize the potential for membrane fouling, it is recommended that the constituents present in the raw water be filtered prior to the membrane units using chemical oxidation and coagulation to convert the compounds to their insoluble forms that can then be removed with multi-media pressure filters.

Since multi-media filters generally capture particulates 5.0 micron and greater, a coagulant will be added upstream of the filter units to increase particle size to ensure the precipitates are removed. The configuration of this process is provided in **Figure 4-3**.

Sodium hypochlorite is recommended to oxidize constituents prior to the pressure filters. Sodium hypochlorite is readily available, is easy to store, is a very effective oxidant and will also be utilized for disinfection. The pretreatment system needed for the facility will require chemical feed systems including: ferric chloride for coagulation, antiscalant, sulfuric acid for pH adjustment, as well as sodium bisulfite for dechlorination. The chemicals proposed for the pretreatment system are summarized in **Table 4-4**.

Table 4-4: Pretreatment System Chemicals

Chemical	Formula	Purpose	Injection Point	Concentration
Sodium Hypochlorite	NaOCl	Oxidant	Pre MM Filters	12.5%
Ferric Chloride	$FeCl_3$	Coagulant	Pre MM Filters	40%
Sulfuric Acid	H_2SO_4	pH Adjustment	Post MM Filters	93%
Sodium Bisulfite	$NaHSO_3$	Dechlorination	Post MM Filters	38%
Antiscalant	NA	Prevent membrane fouling	Post MM Filters	100%



REV.NO.	DESCRIPTIONS	DATE
	REVISIONS	

SEAL

SEAL

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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIOS WATER TREATMENT PLANT BASIS OF DESIGN

GENERAL PROCESS FLOW DIAGRAM

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JRV
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

SCALE
HORIZONTAL: AS SHOWN
VERTICAL: NA

M&C FILE NUMBER

DRAWING NUMBER
4-3

STATUS: PRELIMINARY DESIGN

REVISION

Chemical dosage calculations and storage requirements are provided in **Appendix D**. The dosages provided in the appendix are based on pilot study data. As additional water quality data is obtained from the combined raw water from the 13 supply wells, the dosages may need to be adjusted. It should also be noted that as wells are pumped over a period of time the water quality will change. Thus, chemical dosing is something that will need to be monitored on a regular basis when the plant is commissioned.

4.3.2 Pre-Treatment Filter Equipment

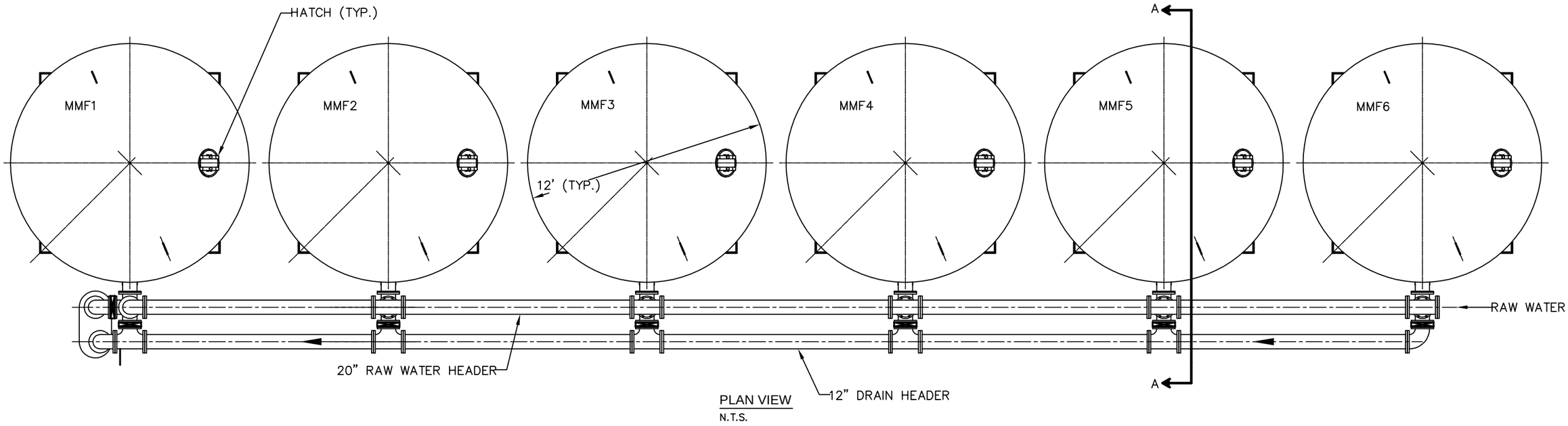
The multimedia pressure filters proposed for this facility will be constructed of steel in accordance with ASME code requirements and stamped with an ASME code stamp. Each tank will be equipped with the necessary flanges and connections for the main piping system and the top of the tank head will be equipped with a manhole for testing and maintenance. Each unit is to be supported on four structural legs welded to the side shell as shown in **Figure 4-4**.

The pretreatment system design is based on the design data shown in **Table 4-5**:

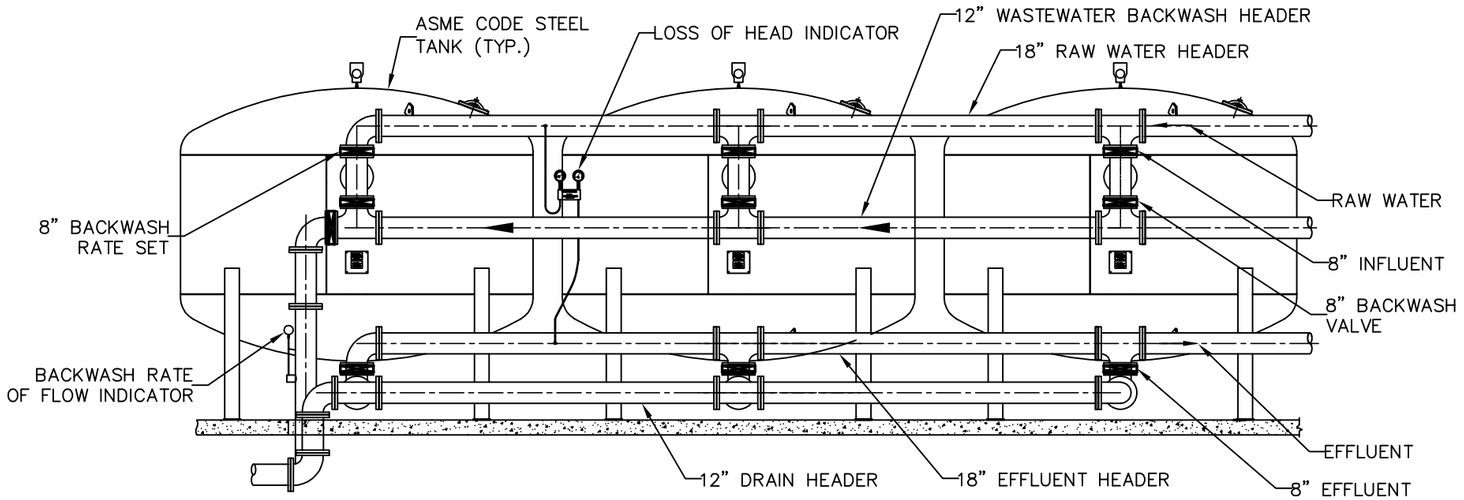
Table 4-5: Pressure Filter Specifications

Total Design Flow (gpm)	2,743
Number of Filters Required*	6
Filter Loading Rate (gpm/ft^2)*	4.86
Tank Diameter	12′-0″
Tank Straight Side Height	5′-0″
Tank Design Pressure**	100 psi

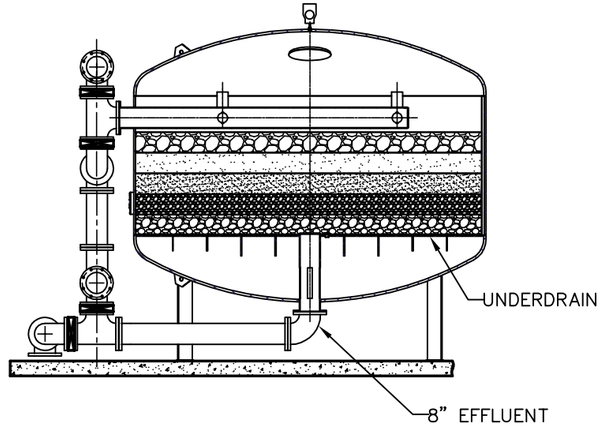
** Includes 1 filter off-line for maintenance or backwashing.*
*** Tank Hydrostatic pressure equals 130% of design pressure*



PLAN VIEW
N.T.S.



ELEVATION VIEW
N.T.S.



SECTION A-A
N.T.S.

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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED MULTI-MEDIA PRESSURE FILTERS

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 4-4

Filter Underdrain system: Each filter bottom will be equipped with an underdrain system consisting of a rigidly supported plate extending over the entire bottom of the filter area. The underdrain will be designed to reduce the water velocity, discharging the water horizontally without impeding flow, thereby preventing channeling in the filter bed. Underdrain nozzles will be NSF Standard 61 approved for use in drinking water.

Supporting Beds: Each filter will be provided with a 10" supporting bed consisting of the following graded layers of gravel:

Table 4-6: Supporting Bed Specifications

Layer & Depth	Passing Screen	Retained on Screen
Top 3″	1.6 mm	1.4 mm, 2.2 U.C.
Next 3"	3/8"	3/16″
Bottom 4"	3/4"	3/8"

Filter Media: The filter media will include a 30-inch deep Mixed Media separation bed composed of three materials:

Table 4-7: Filter Media Specifications

Depth	Material	Size Range
Top 10"	Anthracite Coal	1.0-1.1mm, 1.7 U.C
Next 10"	Silica Filter Sand	0.35-0.45mm, 1.4 U.C.
Next 10"	High Density Filter Sand	0.20-0.32mm, 2.2 U.C

Each layer will be composed of different size and specific gravity material, providing uniform void distribution from low to high specific gravity in the direction of flow. The media will meet the requirements of AWWA B100, latest revision, including provisions for air scour.

Influent Distribution and Washwater Collection: The raw water will flow through the filter units uniformly. The loading rate during backwashing of the filters will not exceed 15 gpm/ft^2 and the filters will be designed such that media will not be lost during backwashing cycle. The distance from the surface of the bed to the wash water collector (freeboard) will be not less than 50% of the depth of the filter bed. The bed is expected to expand to a maximum of 50% more than its depth. The raw water inlet will distribute the water uniformly over the bed of anthracite.

Piping and Valves: The internal pressure filter piping will be constructed of Schedule 10, 304 stainless steel and configured as shown in **Figure 4-4** to resist corrosion. All piping 3" in diameter and larger will be standard weight flanged stainless steel construction

Filter Backwash and Air Scour: The backwash cycle will be fully automated for the filter vessels. The backwash cycles will be initiated based on differential pressure across each filter bed with terminal headloss of 10 psig measured from the inlet header to the effluent header for a range in cycle periods as follows in **Table 4-8**:

Table 4-8: Backwash and Air Scour Cycle Periods for Each Filter Vessel

Backwash	0-30 min
Adjustable Air Scour	0-10 min

See Appendix D for Additional Information for Filter Backwashing

Compressed Air Supply for Pneumatic Filter Valves: Air will be supplied for the scour cycle by two (2) single stage automatic air compressors with one ASME code, 60 gallon horizontal receiver, and motor. One compressor will operate on standby as backup. The Compressor pack will have a piston displacement of 5.0 cfm FAD and be driven by 1.0 hp, 230 volt, 3 phase, 60 Hz drive motors.

Air Scour Blower: Air for the air scour will be provided by a rotary, positive displacement blower designed to deliver 3 cubic feet per minute per square foot of one filter vessel area at a pressure of 5 psig.

In-Bed Air Wash Grids: Each filter cell will include an in-bed air wash distributor system to be placed at the interface between the supporting gravel bed and the filter media. The air wash grids will provide even distribution of air throughout the entire filter bed when air is applied at a rate of 3 cfm/sq. ft. of bed area.

Sampling Cocks: Sampling cocks will be provided at the following points to monitor water quality:

1 – Raw Water Intake

6 – Filter Effluent (each filter)

1 – Plant Effluent

In-line Monitoring: Two monitors will be installed downstream of the pressure filters: (1) A turbidimeter will be installed downstream of the pressure filters to monitor filter performance and (2) chlorine will be monitored to protect the membranes to ensure there is no chlorine residual.

4.3.3 Cartridge Filters

Cartridge filters will be provided upstream of the membrane feed pumps as additional protection to remove particles that might pass through the media filters. This component will include three cartridge pressure vessels to be operated, one for each RO membrane skid. The cartridge filter/cartridge filter vessel design parameters are provided in **Table 4-9**.

Table 4-9: Cartridge Filter Vessel Design Parameters

Quantity	3
Hydraulic Loading, each filter vessel	1.0 mgd (694 gpm)
Feedwater pH	5.9-6.1
Max. Clean Element Headloss	1 psi
Max. Fouled Element Headloss	10 psi
Cartridge Filter Material	Continuously Wound Polypropylene
Typical Cartridge Filter Dimensions	30″ length x 1″ I.D. x 2 7/16″ O.D.
Cartridge Filter Vessel Material	304 SS
Cartridge Filter Vessel Pressure Rating	150 psig @ 100°F per ASME Boiler and Pressure Vessel Code, Section VIII, Division 1

4.4 Reverse Osmosis (RO) System Components

4.4.1 Raw Feed Water Configuration

The effluent from the multimedia pressure filters will be divided into two streams prior to the cartridge filters: one stream will bypass the membrane system and the second stream will provide the feedwater to the cartridge filters, RO feed pumps, and membrane units. The membrane feed piping will include an automated inlet valve, flow sensor, and pressure transmitter. Additionally, the piping will include isolation valves for skid shut down for maintenance and cleaning; sample ports will be provided to monitor feedwater quality.

4.4.2 RO Feed Pumps

One RO feed pump will be provided for each RO skid (total of 2 RO feed pumps). Each RO feed pump will have a design capacity of 700 gpm at a design head of 280 feet (121 psi) in order to feed the RO membranes. Multistage, centrifugal, vertical turbine pumps are recommended for the RO feed pumps. The materials of construction for the wetted parts, bowls, impellers, columns,

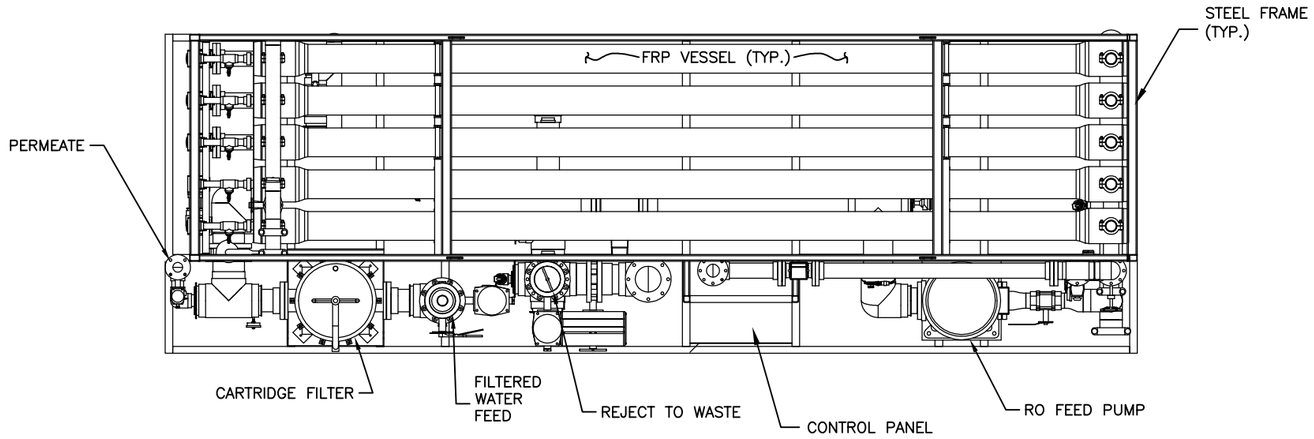
shafts, discharge heads, pump cans, of each RO feed pump will be 316 stainless steel. Each pump suction pipe will be 10-inch diameter 316 stainless steel, Schedule 10S. Each pump discharge pipe will be 8-inch diameter 316 stainless steel, Schedule 10S. Each pump will be driven by a 75 horsepower electric motor, inverter duty, premium efficiency, operating off of a 480 volt, 60 hertz, 3-phase electric power source. Each vertical turbine pump will be driven by a variable frequency drive in order to adjust RO feed flow rates and pressures.

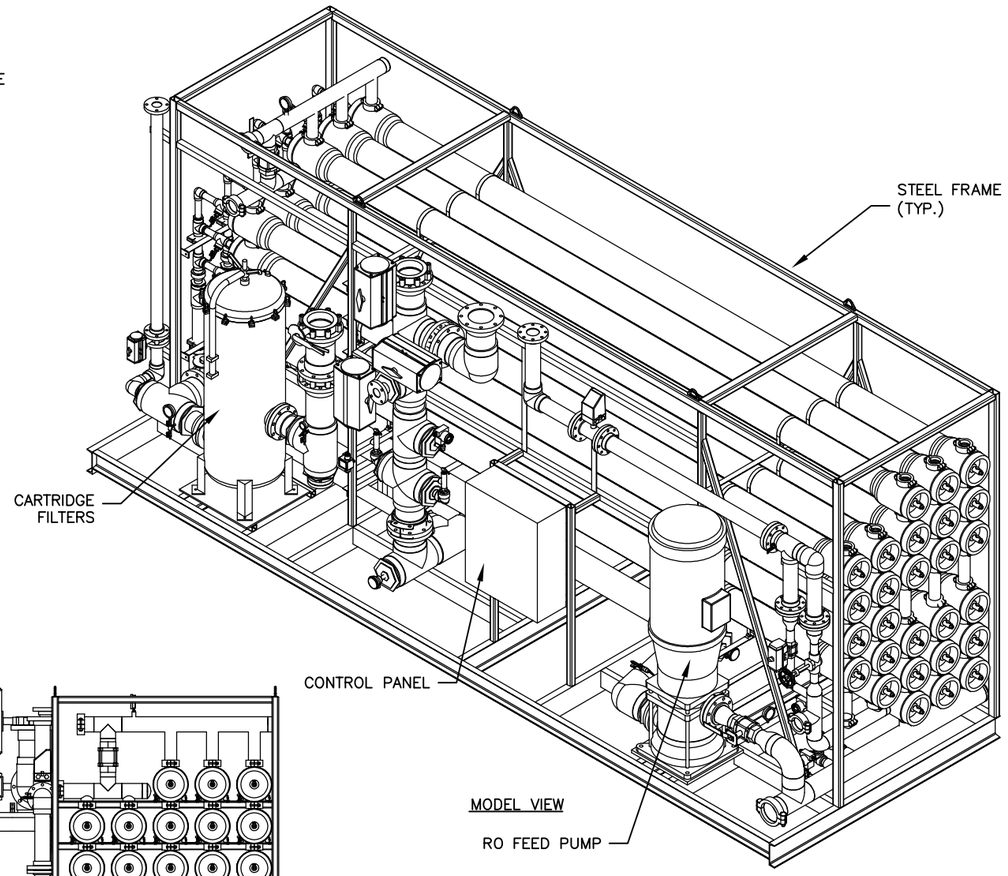
4.4.3 Skid Configuration

Three (3) RO membrane skids will be provided, each with a raw water feed capacity of 1.0 MGD, a permeate discharge of 0.75 MGD, and a concentrate discharge 0.25 MGD. The three RO skids together will provide for a feedwater capacity of 3.0 MGD, and will produce permeate and concentrate flows of 2.25 MGD and 0.75 MGD, respectively. The membrane skid configuration is shown in **Figure 4-5**.

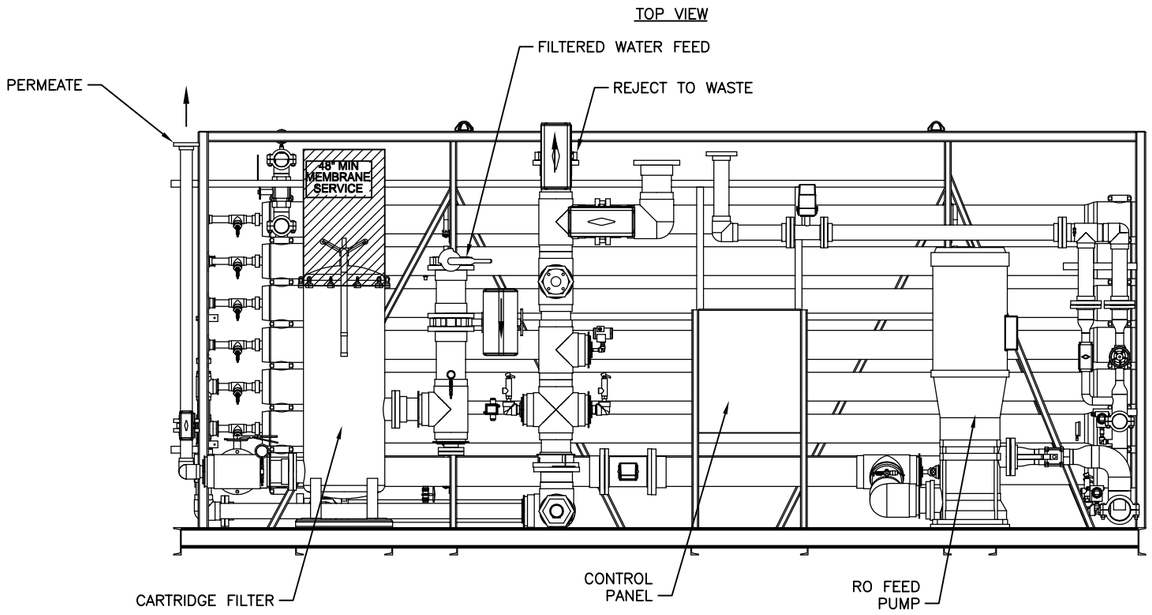
Each membrane skid will have approximate dimensions of 30 feet in length, 10 feet in width and 12 feet in height. Each skid will consist of 21 fiberglass pressure vessels; each 8-inches in diameter, with membrane elements inside of them will be arrayed on a structural frame consisting of epoxy coated carbon steel. The pressure vessels will be supported by the structural frame.

The typical array of pressure vessels for this project would have two stages of membrane elements/pressure vessels. Fourteen (14) of the membrane elements/pressure vessels would be in the first stage and seven (7) in the second stage. The first stage concentrate will flow into the second stage membrane elements to increase the overall efficiency.

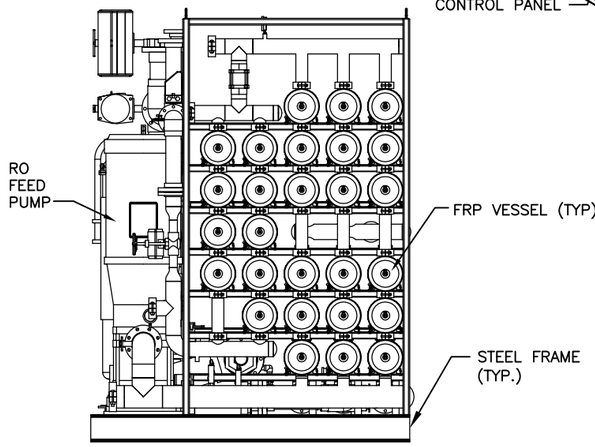




MODEL VIEW



FRONT VIEW



RIGHT SIDE VIEW

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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED REVERSE OSMOSIS MEMBRANE SKID SYSTEM

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 4-5

The feedwater and concentrate piping on the skid will be fabricated from 316 stainless steel. The permeate piping on the skid will be fabricated from Schedule 80 PVC pipe. Each permeate connection from each pressure vessel will be equipped with a sampling connection that will be piped to a sampling panel.

4.4.4 Membranes

The proposed low pressure membranes for the skids are fabricated from polyamide, spiral wound, with a fiberglass outer wrap. Each membrane measures 40 inches in length by 8-inches in diameter with a membrane surface area of 400 square feet. Design permeate unit production (flux) is 14.87 gfd.

Typical operating pressures for the membranes range from 80-120 psi, although they can withstand a maximum liquid pressure of 300 psi. The maximum liquid temperature during regular operation or cleaning cannot go above 113° F without damaging the membranes. Exposure of the membranes to free chlorine or other oxidizing agents such as permanganate ozone, bromine and iodine can damage the membranes. Sodium bisulfite will be injected into the raw water feed upstream of the membranes to ensure the absence of free chlorine. The membranes are resistant to liquids with pH values between 4 and 11 during normal operation and 2.5 to 11 during short-term operations. The maximum pressure differential allowed per membrane element is 10 psi and the maximum allowed per pressure vessel is 60 psi. The turbidity of the raw water feed must be less than 1 NTU, and the SDI must be less than 5.

4.4.5 Membrane Cleaning System

The most common problem with RO membranes is fouling that is caused by scale buildup, biological growth, or deposition of colloidal material. Fouling leads to an increased resistance to flow through the membranes, which decrease the performance of the system. Scaling is caused by a concentration of salts in excess of their saturation point, which precipitates salt deposits on the membrane surface. Fouling reduces permeate flow, increases pressure losses across the membranes, and affects the permeate quality.

When the low pressure membrane system becomes fouled, the membranes must be chemically cleaned in order to accomplish the following:

- Dissolve and remove inorganic scales.
- Flush out particulate material.
- Breakdown bacterial slimes.
- Eliminate bacteria and other microorganisms.

Most cleaning systems consist of the following items:

- Mixing Tank with cover.
- Mixer.
- Immersion Heater.
- Recirculation Pump.
- Cartridge Filter.
- Recirculation Piping.

The cleaning fluid is heated to a specific temperature in the mixing tank before it is pumped through the membranes on a skid in the normal direction of flow. Temporary piping connections allow the cleaning fluid to be returned to the

mixing tanks and re-circulated back through the membranes a number of times. The cartridge filter removes solid matter from the cleaning fluid.

Concentrated cleaning fluids are mixed with water in the mixing tank to obtain the correct dilution ration. Cleaning fluids used on the membranes include:

- Enzymes to breakdown bacterial slimes.
- Detergents to suspend particulates and dissolve organic matter.
- Biocides to kill bacteria.
- Chelators to remove scale.
- Acids to dissolve inorganic matter.
- Caustics to dissolve organic matter and silica.

Many of the cleaning fluids are proprietary; membrane manufacturers typically provide recommended cleaning fluid lists for specific membranes. Membrane cleaning normally occurs every four to six months.

4.5 Post Membrane Treatment

4.5.1 Permeate Stabilization and Blending

The three RO skids will produce 2.25 MGD of permeate, which will have only a small percentage of dissolved solids in comparison to the RO feed. The permeate is relatively corrosive and unstable; it's projected 6.0 pH can change rapidly. In addition, most of the minerals necessary for the human body have been removed by the membrane separation process to negligible levels. In order to provide buffering capacity and acceptable levels of minerals, 0.95 MGD of bypass water will be mixed with the permeate. The bypass water has been treated by the multi-media filters for removal of suspended solids. The bypass

water will have a considerable amount of dissolved solids, dissolved minerals and buffering capacity. After the permeate and bypass water are combined, sodium hydroxide will be added to adjust the pH of the blended water to approximately 7.5, which will match the County's goal for pH within the distribution system.

4.5.2 Disinfection

Current regulations require that water treatment facilities utilizing groundwater *not* under the direct influence of a surface water achieve a 4-log inactivation and/or removal of viruses. Conventional filtration utilizing chemical treatment and multi-media filters provides for 2-log inactivation and/or removal of viruses. The remaining 2-log removal must be provided by disinfection. Sodium hypochlorite and aqua ammonia will be injected into the blended water to produce a combined concentration of 2.1 mg/L in the 3.0 MG storage tank. The chemically treated blended water will be thoroughly mixed by a 12-inch static mixer before being transferred into the ground storage tank.

CT is the product of the disinfectant concentration (C) in mg/L times the detention time (T) in minutes. Past studies of CT values for inactivation of viruses using chloramine indicates that a 2-log inactivation is achieved with a CT value of 321 at a temperature of 20^{o}C. Assuming that the 3.0 MG storage tank is half full (1,500,000 gallons) the detention time for peak demands of 6.4 MGD (4,444 gpm) is 338 minutes. The combination of the chloramine concentration with the detention time during peak flows provides for a CT of 710 (2.1 mg/L x 338 minutes), which is more than sufficient to inactivate viruses and provides for an approximate 3.75 log inactivation of viruses credit for the disinfection system.

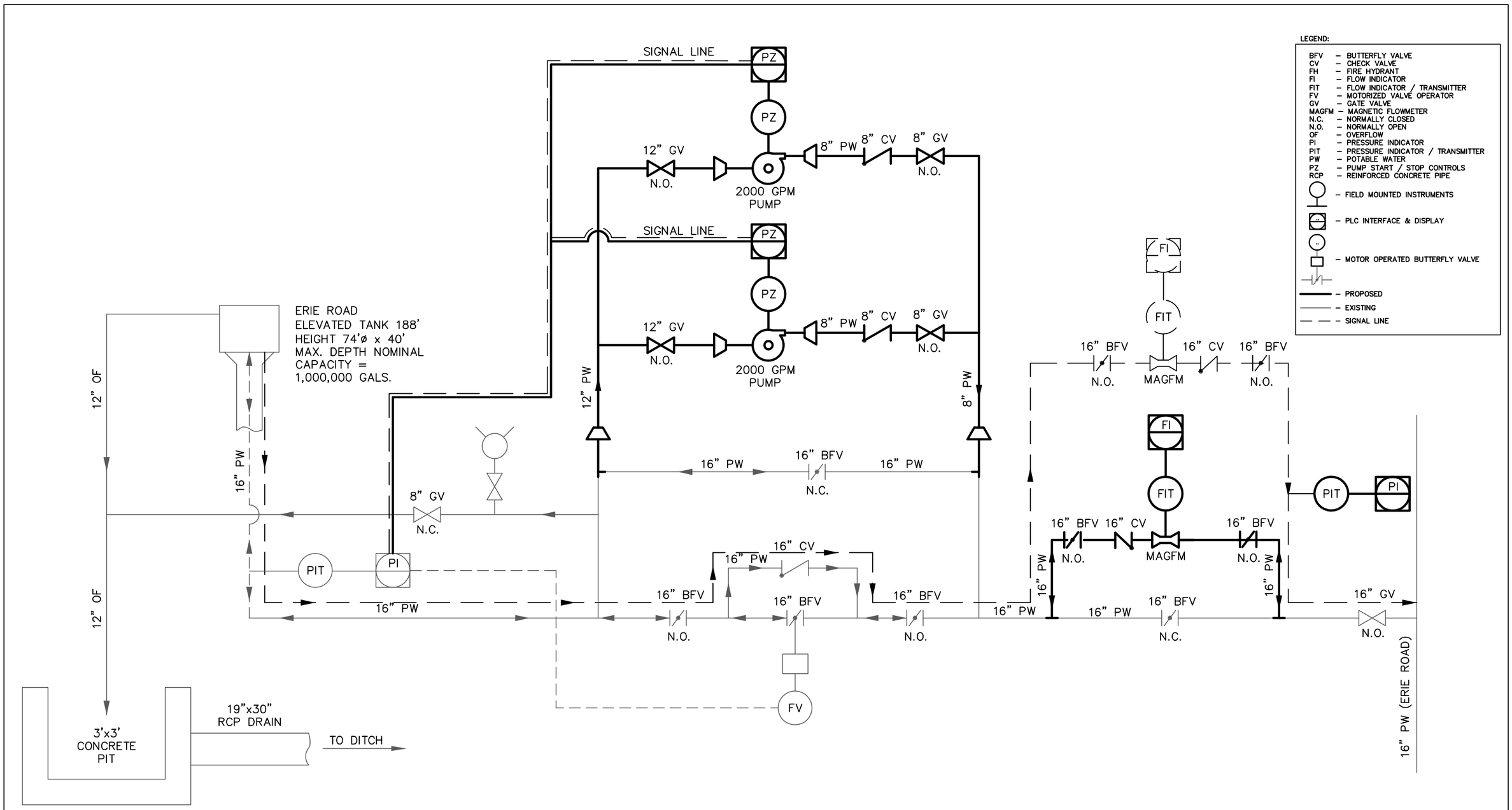
The potable water discharged from the 3.0 MG storage tank will be monitored for combined chlorine concentration using an on-line analyzer. If the combined chlorine concentration falls below a specified value, sodium hypochlorite and aqua ammonia will be metered into the finished water piping to raise the combined chlorine residual of the potable water entering the distribution system to the appropriate levels.

4.5.3 Finished Water Storage and Pumping

A high service pump station is proposed to pump the potable water from the 3.0 MG storage tank into the County's distribution system. The high service pumps will be designed to provide a peak hourly flow of two times the plant's production capacity of 3.2 MGD, for a peak flow of 6.4 MGD.

Proposed are four split-case centrifugal pumps, two of which that will be rated at 2,250 gpm and two of which that will be rated at 1,125 gpm. Both of the smaller pumps will be constant speed pumps, while one of the larger pumps will utilize a variable frequency drive to better meet varying system demands and pressures. Each pump will be capable of pumping the water at a design head of 185 feet (80 psi), which is sufficient to fill the nearby Erie Road elevated water storage tank, and to supply finished water into the County's distribution system. The two larger pumps will have 150 horsepower motors, while the two smaller pumps will have 75 horsepower motors. Two large pumps will be capable of meeting peak demands with the two small pumps out of service; and two small pumps and one large pump will be capable of meeting peak demands with one large pump out of service.

Some modifications at the existing elevated 1.0 MG storage tank will be necessary to ensure the tank will drain and refill regularly to maintain water quality and to utilize the storage capacity of the tank. These modifications will include the installation of a pump rated at 2,000 gpm, new piping, gate valves, a check valve, and a flow meter as shown in **Figure 4-6**. The pump and associated piping and valves will be housed on the ground floor inside of the steel support structure for the elevated tank. The pump will be capable of transferring the volume of potable water from the tank to the distribution system in approximated 8-1/2 hours. A PLC will be programmed to activate the pump on a regular daily timed basis to empty the elevated storage tank.



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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

ERIE ROAD ELEVATED STORAGE TANK PIPING SCHEMATIC

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 4-6

4.6 Concentrate Management

When membrane separation processes are utilized for water treatment, concentrate disposal is typically one of the biggest challenges due to permitting requirements and costs. Several different options were explored to dispose of the 0.75 MGD of concentrate from the RO treatment process. During the course of pilot testing, additional water quality testing was conducted for the Upper Floridan and Intermediate aquifers, the first and second stage permeate streams and the first and second stage concentrate streams. The anticipated constituent concentrations in the concentrate stream were utilized to determine the most cost effective and permittable approach for concentrate disposal for the proposed RO facility.

4.6.1 Concentrate Flows and Quality

Mass-flow balance calculations conducted for the proposed WTP indicate that the constituent levels in the RO concentrate will be within those levels identified in the County's Sewer Use Ordinance (SUO). The concentrate flows are estimated at 0.75 MGD; the characteristics of the constituents of primary concern for the concentrate are listed in **Table 4-10**.

Table 4-10: Concentrate Characteristics

Parameter	*Concentrate Stream*	*Local Limits*
Hardness	1,819	--
Chloride	164 mg/L	287 mg/L
Sulfate	1,166	--
TDS	2,337	--
Gross Alpha	80	--
pH	6.8	--
Arsenic	--	2.51 mg/L
BOD_5	--	7,290 mg/L
Cadmium	--	0.73 mg/L
Copper	--	28.48 mg/L

Parameter	*Concentrate Stream*	*Local Limits*
Cyanide	--	4.70 mg/L
Lead	--	1.87 mg/L
Mercury	--	0.38 mg/L
Molybdenum	--	1.26 mg/L
Nickel	--	11.28 mg/L
Selenium	--	2.11 mg/L
Silver	--	16.06 mg/L
TSS	--	1,830 mg/L
Zinc	--	4.78 mg/L

4.6.2 Concentrate Management

The option of transferring the concentrate directly into the County's Master Reuse system was explored to determine its feasibility for concentrate disposal. Rule 62-610.865 (F.A.C.) addresses the requirements for blending concentrate with reclaimed water. Rule 62-610.865 of the F.A.C. indicates that the concentrate can be blended with the County's reclaimed water system. The rule requires that the RO concentrate, reclaimed water and the blended concentrate/reclaimed water streams must be continuously monitored. The concentrate will be transferred to a location directly upstream of the golf course storage pond, where it will tie-in to the existing pipe that transfers reclaimed water from the NWRF into the reclaimed water storage pond. This is the most cost effective option for concentrate disposal and also provides for beneficial reuse of the concentrate stream via the County's reclaimed water system. A summary of the blended RO concentrate and RCW quality characteristics is provided in **Table 4-11.**

Table 4-11: Projected Blended RO Concentrate and RCW Quality

Constituents	Flow Locations	
	Membrane Concentrate	
--------	Flow (gpd)	Concentration (mg/L)
Sulfate	750,000	1,166
TDS	750,000	2,337
Chloride	750,000	164
Sodium	750,000	NA
--------	*North Water Reclamation Facility Effluent*	
Sulfate	5,000,000	116
TDS	5,000,000	668
Chloride	5,000,000	104
Sodium	5,000,000	76
--------	*Blended Concentrate/NWRF Effluent Stream*	
Sulfate	5,750,000	**253**
TDS	5,750,000	**886**
Chloride	5,750,000	**112**
Sodium	5,750,000	**66**

4.6.3 Concentrate Piping and Disposal

The concentrate will be transferred using approximately 2,750 feet of 8-inch high density polyethylene pipe. It is recommended that the pipe be installed via directional bore beneath Buffalo Creek golf course. This approach will reduce the length of concentrate piping required from approximately 13,000 feet (open-cut following Erie Road and NWRF entrance road) to 2,750 feet (directional bore), providing the opportunity for substantial cost savings to the County.

4.7 Plant Wastewater Management

4.7.1 Plant Wastewater

The County's Comprehensive Plan requires an infrastructure standard of 95 gallons of wastewater treatment per day (average daily flow) per capita and a

peak factor of 1.31 times the average daily flow. The wastewater flows for the proposed RO facility have been determined based on this information. A conservative estimate of 1,250 gpd was used for sizing of system components. The plant wastewater will be drained to the backwash tank and pumped, along with the filter backwash, to the Manatee County NWRF.

4.7.2 Filter Backwash

Finished water will be pumped to the pressure filters for backwashing at a maximum rate of approximately 1,400 gpm. The total volume of water used during the backwash and rinse to waste cycle will be approximately 17,600 gallons. Backwash water from the pre-treatment filters will be drained to the backwash tank and wetwell onsite. The backwash tank and wetwell will be sized to accommodate two complete filter backwashes. It is anticipated that each on-line multi-media filter will need to be backwashed every other day. Refer to **Appendix D** for additional information on the proposed filter backwashing cycle.

4.7.3 Plant Backwash Tank and Wetwell

The proposed backwash tank and wetwell will be 25′ x 25′ x 9′ high (Sidewater depth) with a functional volume of 42,075 gallons. The waste backwash pumps will be designed to transfer the contents of the backwash tank to the headworks at the NWRF, and will each be designed for flows of 200 gpm at 100′ TDH. The submersible pumps will be located in the backwash tank and wetwell. The waste backwash pumps will pump the backwash water, along with the plant wastewater, to the Manatee County NWRF via a 4″ diameter forcemain.

5.0 PROPOSED FACILITY DESIGN

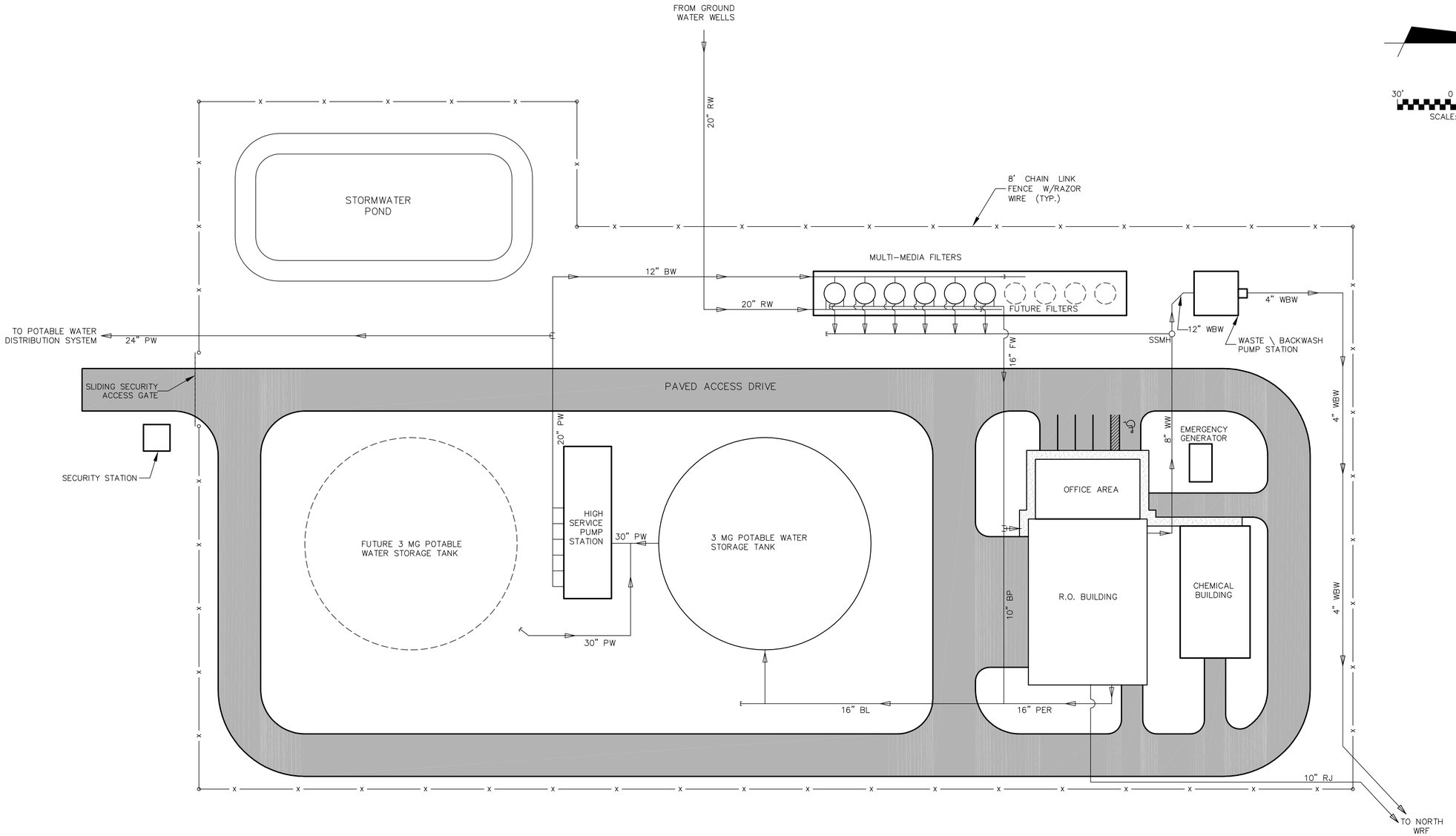
5.1 Site Layout

The major site components for the proposed Erie Road WTP include the following:

- Six (6) Multi-Media Filters
- RO Building containing three RO skids (includes cartridge filter vessels, RO feed pumps, control panels, etc.) CIP system, workshop, control room, offices, electrical room, etc.
- Three Million (3,000,000) gallon ground storage tank
- High service pump station
- Filter backwash holding tank and pump station
- Emergency generator and fuel storage tank
- Chemical building
- Stormwater detention pond
- Access roadway and parking

The proposed layout of the site is shown in **Figure 5-1**. The proposed site is located to the north of the existing Erie Road Elevated Storage Tank site, to the west of Buffalo Creek Golf Course and approximately 1,600 feet southwest of the North Water Reclamation Facility.

Access will be provided to the proposed water treatment plant by connecting to the existing access road for Buffalo Creek Golf Course. The proposed access road will be a 24-foot wide asphalt-paved drive that provides access to the WTP. An on-site access road will also be constructed to provide access to the WTP's facilities.



PIPING LEGEND

BL	BLENDED WATER
BP	BYPASS WATER
BW	BACKWASH WATER
	FEED
FW	FILTERED WATER
PER	PERMEATE WATER
PW	POTABLE WATER
RJ	REJECT WATER
	(CONCENTRATE)
RW	RAW WATER
SSMH	SANITARY SEWER MANHOLE
WBW	WASTE BACKWASH WATER
WW	WASTEWATER

REV.NO.	DESCRIPTIONS	DATE
	REVISIONS	

SEAL

SEAL

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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIOS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED RO PLANT LAYOUT PLAN

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JRV
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

SCALE
HORIZONTAL: AS SHOWN
VERTICAL: NA

M&C FILE NUMBER

DRAWING NUMBER
5-1

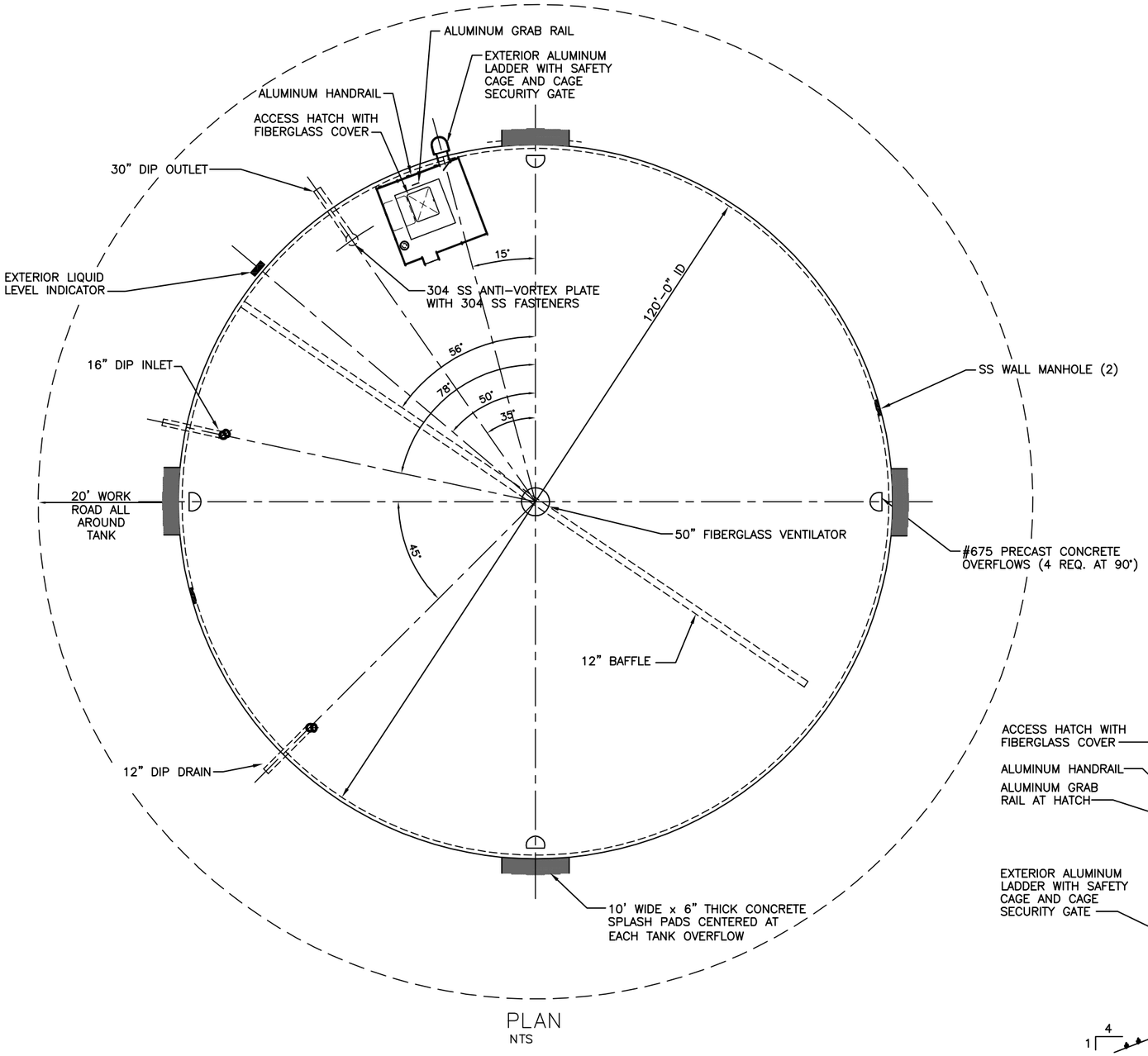
STATUS: PRELIMINARY DESIGN

REVISION

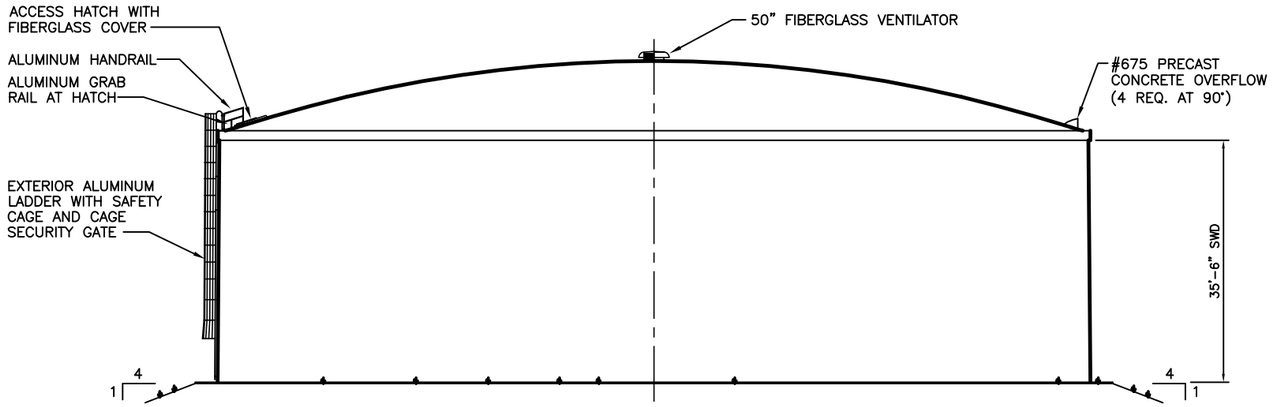
The proposed 3.0 MG storage tank is located to screen off the Water Treatment Plant site from the golf course to the east and the proposed community center to the south. The proposed 3.0 MG storage tank is shown in **Figure 5-2**. Space is provided to install an additional 3.0 MG storage tank in the future. In addition, provisions are provided to expand the water treatment plant from a capacity of 3.0 to 5.0 MGD in the future. Specific units that will need additional space in the future include the Multi-Media filters and High Service Pump Station (additional pumps). Space has been provided between major units for the installation of pipelines, electrical duct banks, and control system conduits.

Major header piping to the treatment systems will be sized for the future 5.0 MGD capacity water treatment plant. The piping shown on the site plan will accommodate the future 5.0 MGD plant. The 20-inch raw water main will enter the WTP site from the west and is then routed to the multi-media filters located at the northwest area of the site. Space will be provided to construct 4 additional multi-media filters to provide for expansion of the facility to 5.0 MGD.

The effluent from the multi-media filters will be conveyed via an 18-inch pipeline to the proposed RO building located on the northeast section of the site. When the pipeline splits for the bypass water pipeline, it will be reduced to 16-inches in diameter to serve the proposed and future RO skids and associated cartridge filters and RO feed pumps. Space is provided on the north end of the RO building in order to provide for 2 additional RO skids in the future.



PLAN
NTS



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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED 3 MG GROUND STORAGE TANK

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 5-2

The RO permeate will be combined with the filtered bypass flow and conveyed to the 3.0 MG storage tank via a 16-inch pipeline entering the bottom of the tank. Space will be provided to the south of the proposed storage tank for a future 3.0 MG tank.

A 30-inch finished water pipe will transfer water from the 3.0 MG storage tank to the proposed High Service Pump Station. The High Service Pumps will discharge into a 24-inch header constructed in a southerly direction to connect into the existing 16-inch potable water transmission main running along Erie Road. It is important to note that hydraulic modeling is being conducted for the County at the time of this Report's preparation to help determine piping modifications that may be required along Erie Road. Space will be provided at the High Service Pump Station for additional pumps when the treatment plant is expanded to 5.0 MGD in the future.

A 42,000 gallon Waste Backwash Holding Tank will be constructed to the north of the multi-media filters for the collection and pumping of the waste backwash from the multi-media filters and the sanitary wastewater from the RO building. The waste backwash will be pumped via a 4-inch force main to the County's NWRF.

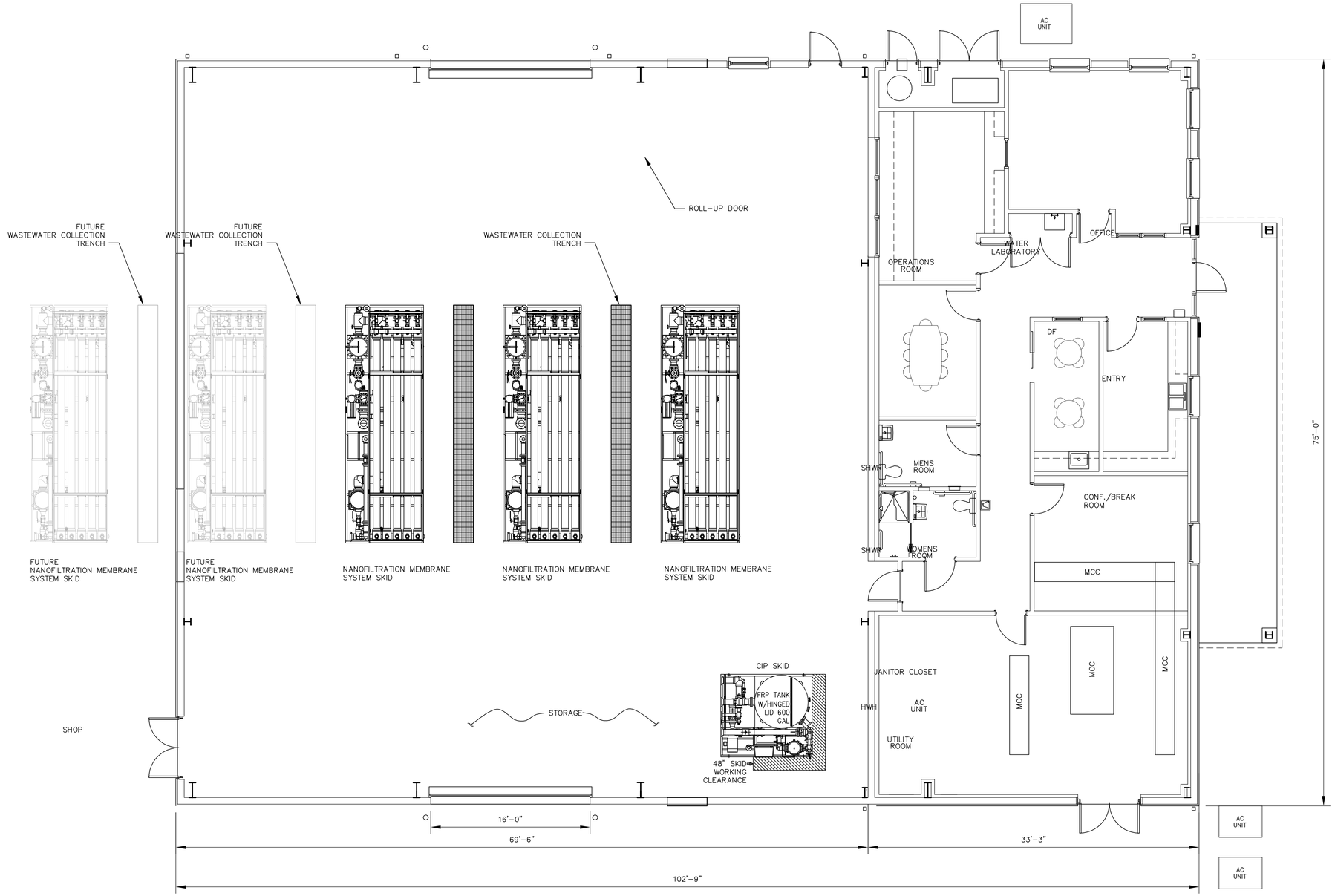
The chemical storage facility will be constructed to the north of the RO Building. Chemicals will be fed into the raw water main upstream of the Multi-media filters, the RO feedwater and permeate, the combined RO permeate/bypass blend stream, and upstream of the High Service Pump Station. The chemical building will be located as near as possible to all of these locations so that chemical piping runs will be relatively short. Chemical piping will be double-wall for containment, and will include provisions for monitoring for and locating leaks.

The tank-mounted emergency generator will be located to the north of the RO building in order to supply emergency electrical power to the RO WTP. A stormwater detention pond will be located in the southwest corner of the site to provide treatment and attenuation from runoff from the plant's impervious areas.

The treatment plant site will be enclosed with an 8-foot chain-link security fence with an electric motor operated rolling gate. The fencing design will take into consideration the nearby school, existing athletic facility and existing golf course in order to provide an aesthetically pleasing view of the plant site. Landscaping buffers will be provided between the fence and the aforementioned areas to comply with County land development codes.

5.2 RO Building Layout

The Reverse Osmosis Building will be a pre-engineered metal building with a floor area of about 8,500 square feet. The building will be split into two main sections; one for the office/administration/operations and the second for the treatment process area. The office area will occupy about one third of the total area and will include a utility room, operations room, Chief Plant Operator's office, conference room, break room, water laboratory, restrooms, operator's office and electrical room. **Figure 5-3** presents the proposed layout for the RO building.



FLOOR PLAN SCALE=3/16"=1'

REV.NO.	DESCRIPTIONS	DATE
	REVISIONS	

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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIOS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED WTP BUILDING LAYOUT

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JRV
DESIGNED	NJS
CHECKED	NJS
PROJ. MGR.	PJL

SCALE
HORIZONTAL: AS SHOWN
VERTICAL: NA

M&C FILE NUMBER

DRAWING NUMBER
5-3

STATUS: PRELIMINARY DESIGN

REVISION

The operations room will contain computers and monitor screens necessary for the plant operators to monitor and operate the facility. The operations room will have work stations, seating and a viewing window out to the process equipment area. The electrical room will contain the main 480 volt electric service entrance, circuit breaker panels, automatic transfer switch, starter panels, variable frequency drives, control panels, lighting panels and air conditioning units. The laboratory will include test equipment, counter space, and storage for conducting process control analyses.

The building will have steel panels with baked on epoxy paint applied at the manufacturer's factory in order to minimize corrosion. The building will include partial height, CMU walls to provide additional durability and impact resistance. The RO section of the proposed building will contain three RO skids, one clean-in-place skid, piping trenches, process piping, control panels, electric power and instrumentation conduits, and remote instrumentation units. Space will be provided in the Shop area to store membranes, cartridge filters, and membrane cleaning chemicals.

5.3 Chemical Storage Area

A chemical storage facility is proposed for the facility that will contain the treatment chemicals and associated duplex chemical metering pumps. The chemical storage will include secondary containment that will be constructed as part of the concrete foundation and will include concrete containment areas surrounding the chemical storage tanks. These containment areas will be sized to contain the volume of one of the two tanks for each respective chemical. Coatings that are resistant to the respective chemicals stored will be applied to the floor and walls of each containment area. The two tanks for each chemical will be sized to provide for a 30-day storage capacity within a chemical building. The storage tanks will be fabricated with the appropriate material for maximum chemical resistance.

The proposed chemical storage area will be a CMU block structure with a raised roofing system that will provide protection of the chemicals from direct sunlight. Chemicals to be stored in the building include:

- Antiscalent – used to prevent scale buildup on membranes
- Aqua Ammonia – used to form chloramine for disinfection
- Ferric chloride – used as a coagulant to remove iron, manganese and arsenic with Multi-Media filters
- Sodium Bisulfite – used to neutralize chlorine from filtered water prior to flowing through membranes
- Sodium Hydroxide – used to raise the pH of the blended water to meet the County's goals and EPA regulations
- Sodium Hypochlorite – used as an oxidizing agent prior to multi-media filtration; used for disinfection of blended water and potable water
- Sulfuric Acid – used to lower the pH of the RO feed water stream.
- Fluoride – used to prevent tooth decay
- Polyphosphate – used as an approved potable water system corrosion inhibitor

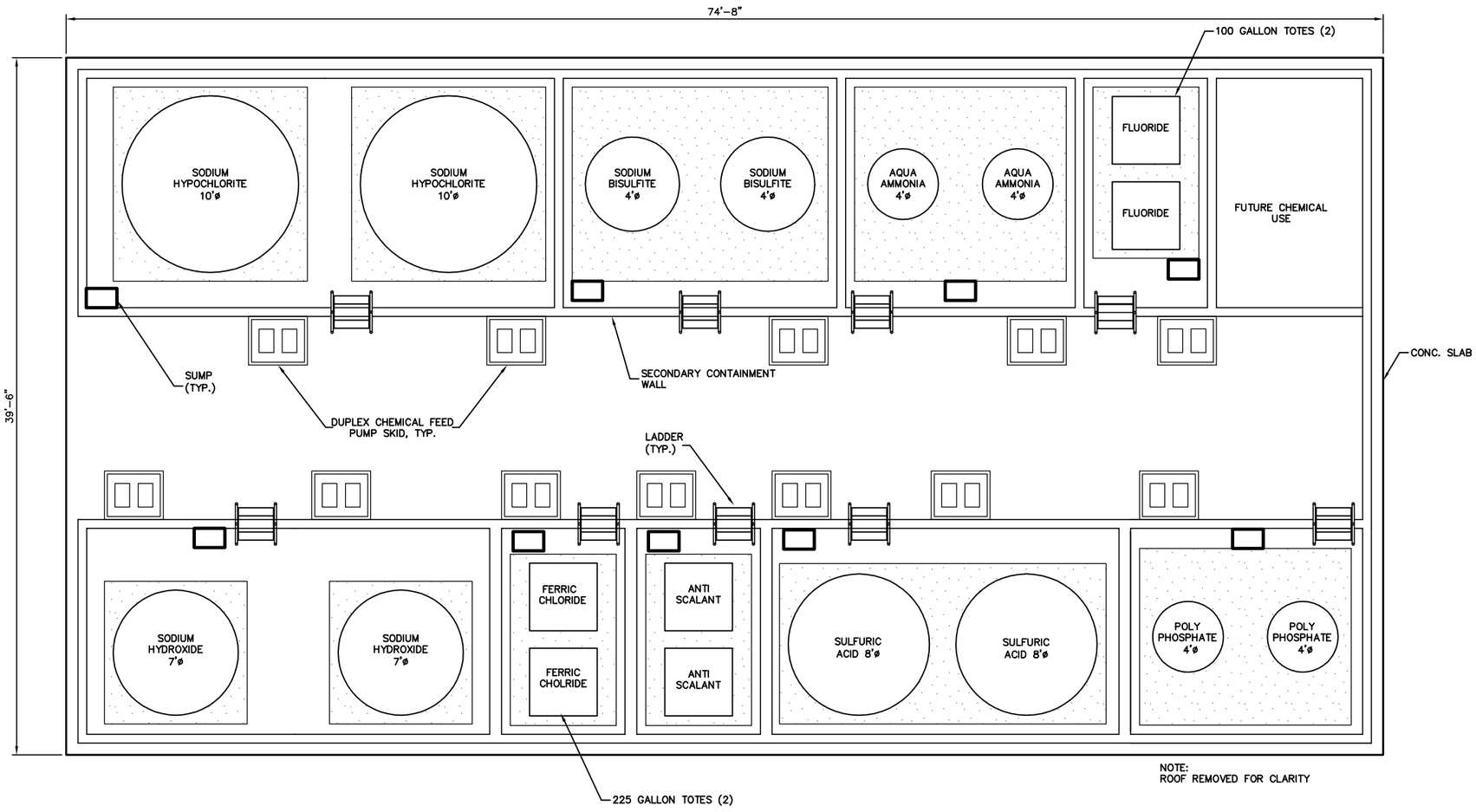
Table 5-1 provides a summary of the proposed chemical storage capacities for the WTP. **Figure 5-4** presents the proposed layout for the chemical storage and pumping facility).

Table 5-1: Chemical Storage Capacity and Material

Chemical	Onsite Storage Capacity	Storage Material
Sodium Hypochlorite	14,000 gal	Fiberglass
Ferric Chloride	450 gal	HDPE tote
Sulfuric Acid	5,600 gal	Carbon Steel
Sodium Bisulfite	1,200 gal	Fiberglass
Sodium Hydroxide	6,400 gal	Fiberglass
Aqua Ammonia	1,500 gal	Fiberglass
Antiscalant	400 gal	HDPE tote
Polyphosphate	1,100 gal	Fiberglass
Fluoride	200 gal	HDPE tote

N

SCALE: 1/8"=1'-0"



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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED CHEMICAL FEED / STORAGE FACILITY

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 5-4

5.4 Effluent/Finished Water Storage

The permeate from the RO skids and the filtered bypass water will be combined before receiving chemical treatment using sodium hydroxide for pH adjustment and sodium hypochlorite and aqua ammonia for disinfection. The bypass water stabilizes and provides minerals to the permeate. A static mixer will be provided to mix the chemicals into their respective injection points. The blended water flows to the proposed 3.0 MG storage tank. A baffle will be installed through the center of the tank to prevent short circuiting between the inlet and the outlet. As previously mentioned, the storage tank will provide sufficient detention time for disinfection of the water. The 3.0 MG storage tank will be a pre-stressed concrete tank, 120 feet in diameter by 35 feet 6 inches in sidewater depth. The proposed storage tank will have a 16-inch inlet pipe and a 30-inch outlet pipe. The water level in the tank will be monitored using an ultrasonic level sensor.

5.5 High Service Pump Station

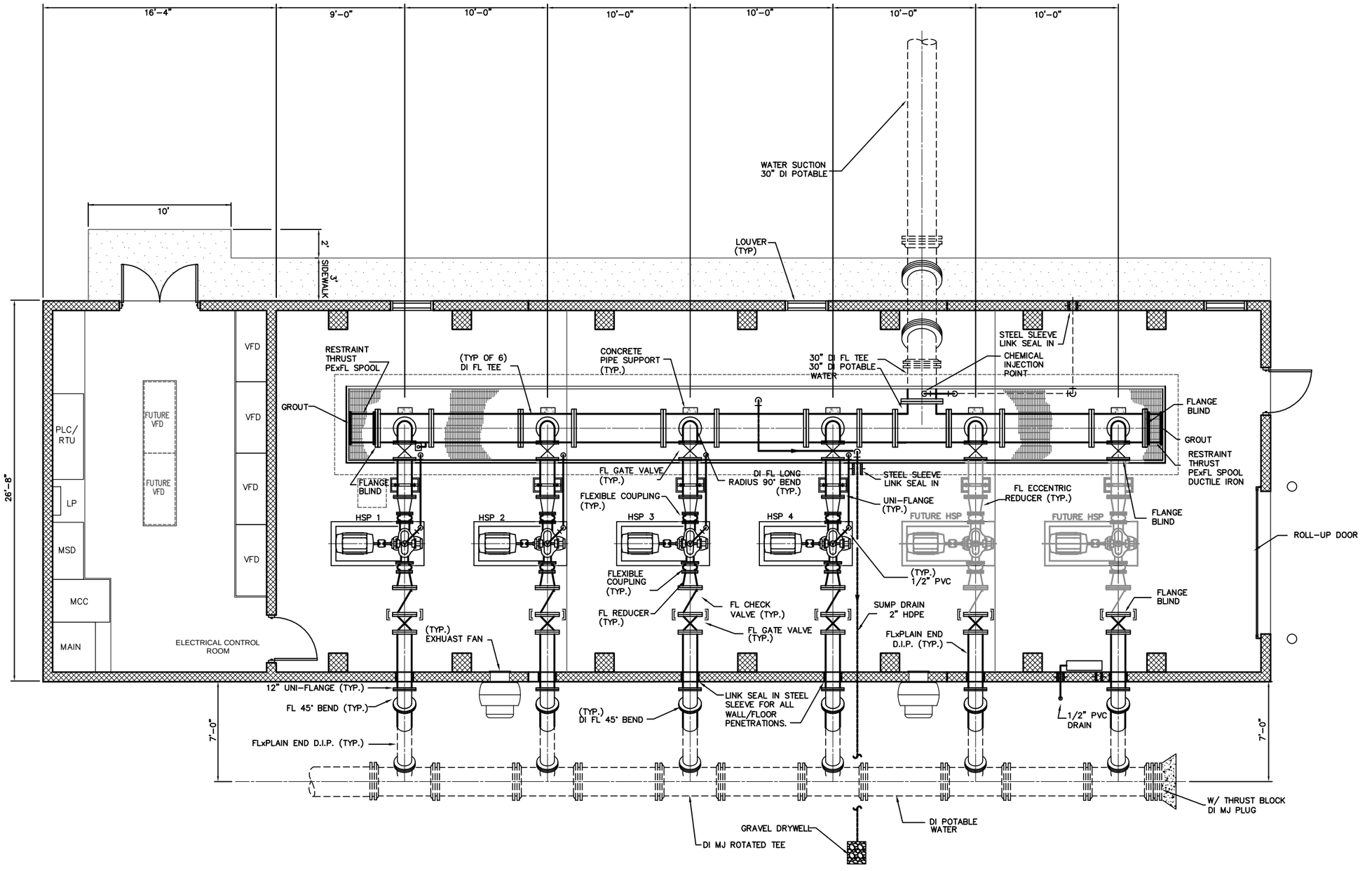
The high service pump station will transfer the water stored in the 3.0 MG tank into the County's potable water distribution system. The high service pumps have been sized to meet a peak hourly demand of two times the design capacity or 6.4 MGD at a pressure of 80 psi. Computer modeling of the distribution system conducted by the County has shown that an 80 psi discharge pressure is needed at the pumps to integrate the finished water into the County's distribution system and nearby elevated storage tank.

Proposed are four split-case centrifugal pumps, two of which that will be rated at 2,250 gpm and two of which that will be rated at 1,125 gpm. Both of the smaller pumps will be constant speed pumps, while one of the larger pumps will utilize a variable frequency drive to better meet varying system demands and pressures. Each pump will be capable of pumping the water at a design head of 185 feet (80 psi), which is sufficient to fill the nearby Erie Road elevated water storage tank. The two larger pumps will

have 150 horsepower motors, while the two smaller pumps will have 75 horsepower motors. Two large pumps will be capable of meeting peak demands with the two small pumps out of service; and two small pumps and one large pump will be capable of meeting peak demands with one large pump out of service.

The potable water header pipe between the 3.0 MG storage tank and the high service pump station will be 30-inches in diameter in order to meet the future water demands. The high service pump station discharge pipe will be 24-inches in diameter in order to meet the future demands.

The proposed high service pump station building will be constructed from split-face CMU block. The building will be large enough to house six high service pumps, (four initially and two for the expanded facility). One end of the pump station building will be separated from the pump room in order to house the requisite electrical equipment, including circuit breakers, motor control centers, lighting panels, PLCs and VFDs. The layout of the high-service pump station is provided in **Figure 5-5**.



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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED HIGH SERVICE PUMP STATION MECHANICAL PLAN

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

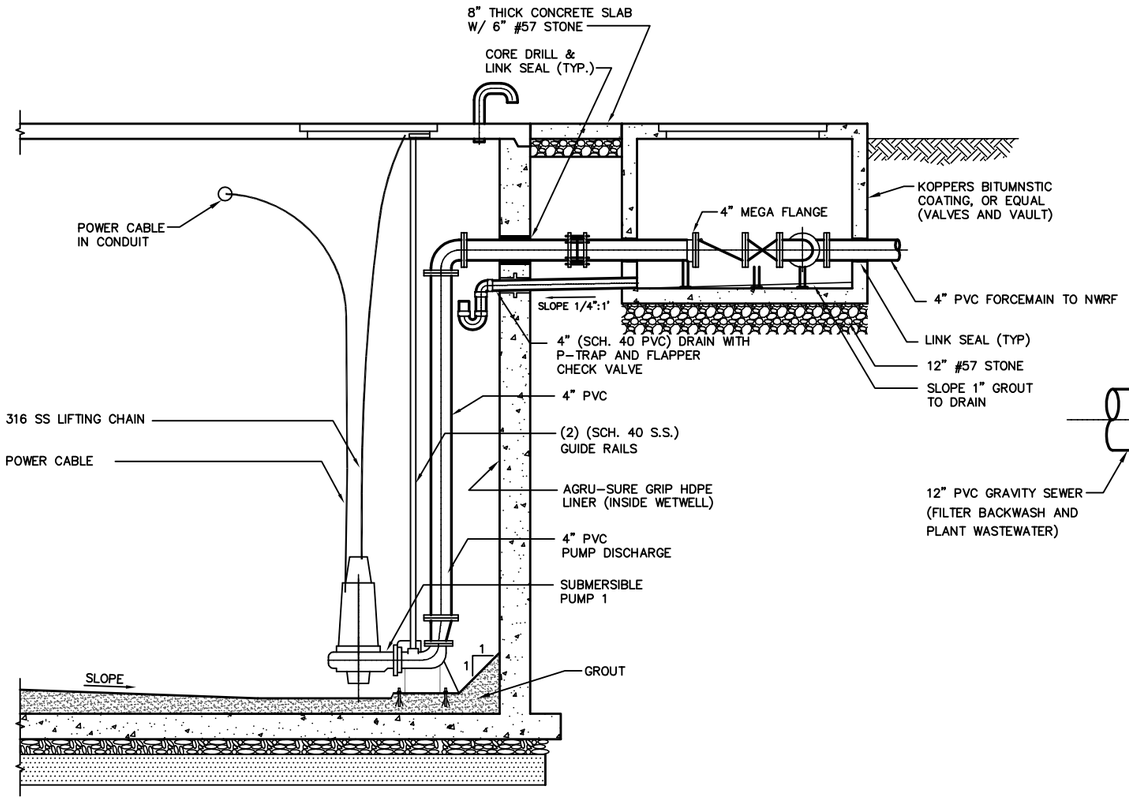
FIG. 5-5

5.6 Waste Backwash Storage Tank and Lift Station

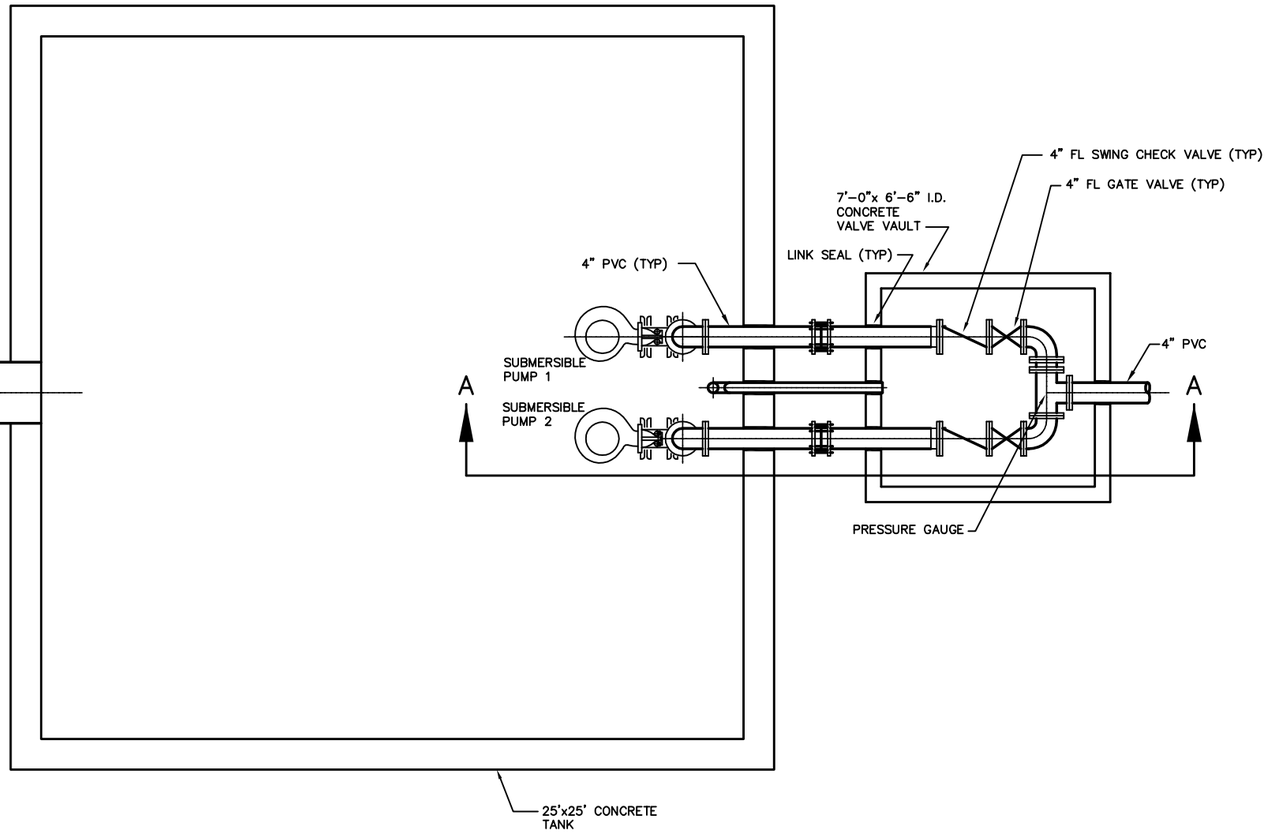
During normal plant operation, the multi-media filters will eventually become partially clogged with solid particles and will need to be backwashed. The major components of the waste backwash resulting from the backwash cycle are described in **Appendix D.**

The waste backwash and rinse will contain the majority of the particles collected in the anthracite and sand beds during the filtration cycle. The waste backwash water must be pumped to the NWRF for treatment.

Proposed facilities for handling the waste backwash water include a storage tank/wetwell with submersible pumps (See **Figure 5-6**). The storage tank will have a volume of approximately 42,000 gallons in order to store two backwash cycles. The tanks will be installed in the ground at an elevation at least several vertical feet below the multi-media filter bottom drain in order to drain the filter tanks by gravity. The waste backwash storage tanks will have dimension of 25′ L x 25′ W X 9′ SWD. Overall height of the tanks will be 12 feet with freeboard taken into account.



SECTION A-A
NTS



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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED WASTE BACKWASH TANK AND PUMPS

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 5-6

In order to make as little impact as possible on the NWRF, the waste backwash water will be collected in the tank then pumped to the treatment plant at a rate of 200 gpm over a period of approximately two hours for every 20,000 gallons. The proposed waste backwash pumps will be two submersible wastewater pumps installed at one end of the tank, each pump with a capacity of 200 gpm, and each 15 HP. One pump will be in operation and the other on standby. The pumps will pump into a 4-inch force main installed from the waste backwash tank directly to the NWRF headworks; or installed from the waste backwash tank to an existing domestic wastewater force main discharging to the NWRF headworks. A weatherproof stainless steel NEMA 4X control panel will be installed adjacent to the submersible pumps to control their operation. An ultrasonic level sensor will be installed to monitor wastewater levels in the storage tank. In addition to the waste backwash, the waste backwash storage tanks will receive domestic sewage from the RO building which will be pumped to the NWRF. The maximum quantity of domestic wastewater collected is expected to be less than 1,250 GPD or less than 1 gpm.

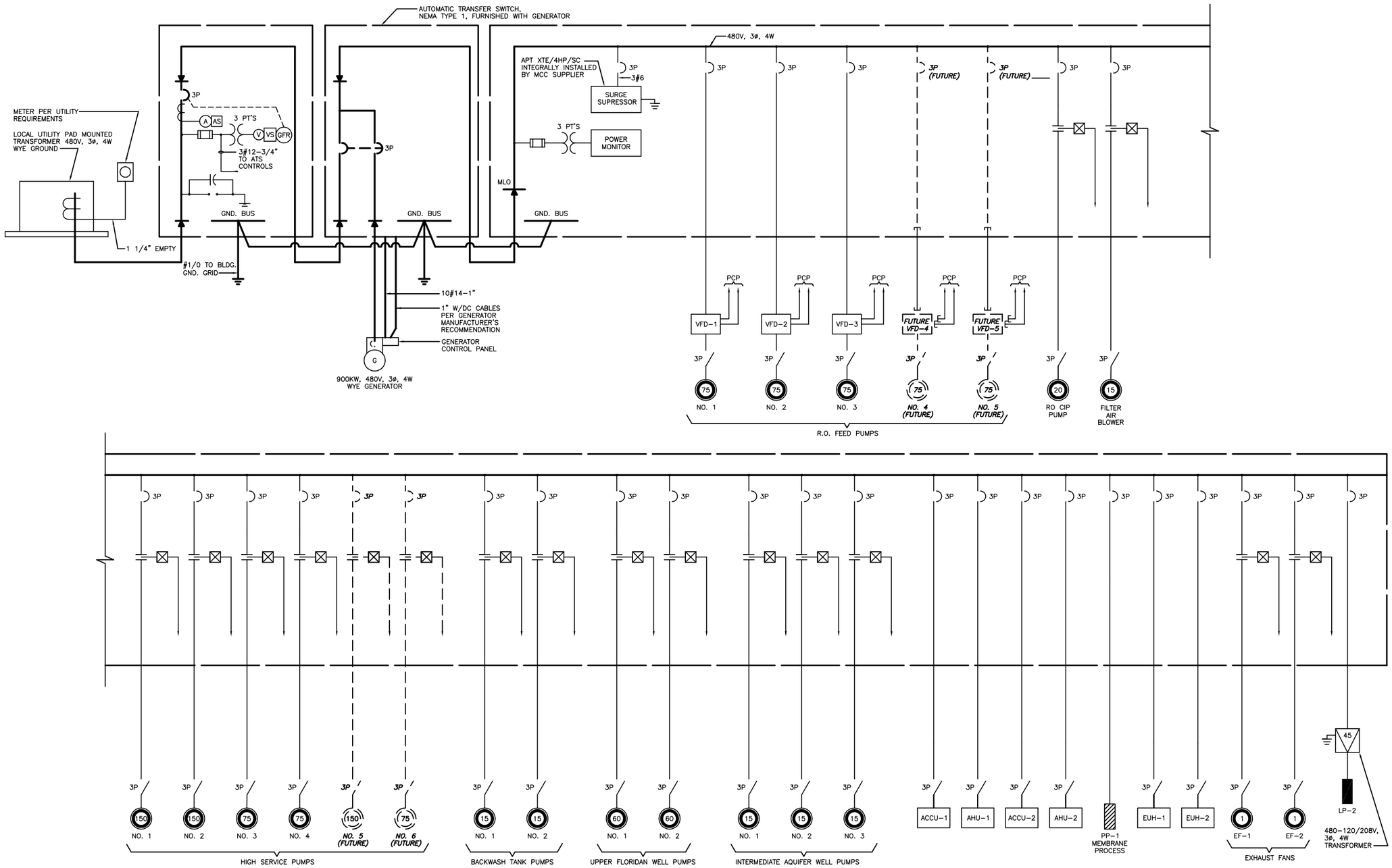
5.7 Plant Electrical Systems

The membrane process equipment will be served by a 480 volt, 60 Hertz, 3 phase, 4 wire service from the local power utility. A simple radial distribution system will be provided. A single-ended 1600-amp switchboard will distribute the incoming power to a motor control center (MCC) and variable frequency drives located in the main electrical room. The switchboard and MCC will provide power feeds to all process related equipment including the membrane feed pumps, five of the thirteen nearest well pumps, high service pumps, waste backwash water pumps, the clean-in-place skid, chemical feed pumps, air compressors, instrumentation, controls, exhaust fans and other miscellaneous electrical equipment. The new electrical equipment will be located in an electrical room incorporated into the RO Building. It is noted that he remaining raw

water well pumps and the pumps at the Erie Road elevated tank site will have individual electric services from the local power utility.

The RO Building electrical room will be designed with extra available space for electrical equipment required when the plant is expanded from 3.0 to 5.0 MGD capacity. The Electrical Room will contain motor control centers, motor starters, variable frequency drives, circuit breakers, automatic lighting panels, control panels and air conditioning units to keep the ambient air temperature at 70 degrees Fahrenheit.

An emergency generator and fuel storage tank will be installed to the north of the RO Building. The generator will provide emergency electric power for the water treatment plant and the five closest wells that will provide raw water to the facility. **Figure 5-7** presents the proposed electrical single-line diagram for the facility.



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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED ELECTRICAL SINGLE LINE DIAGRAM

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 5-7

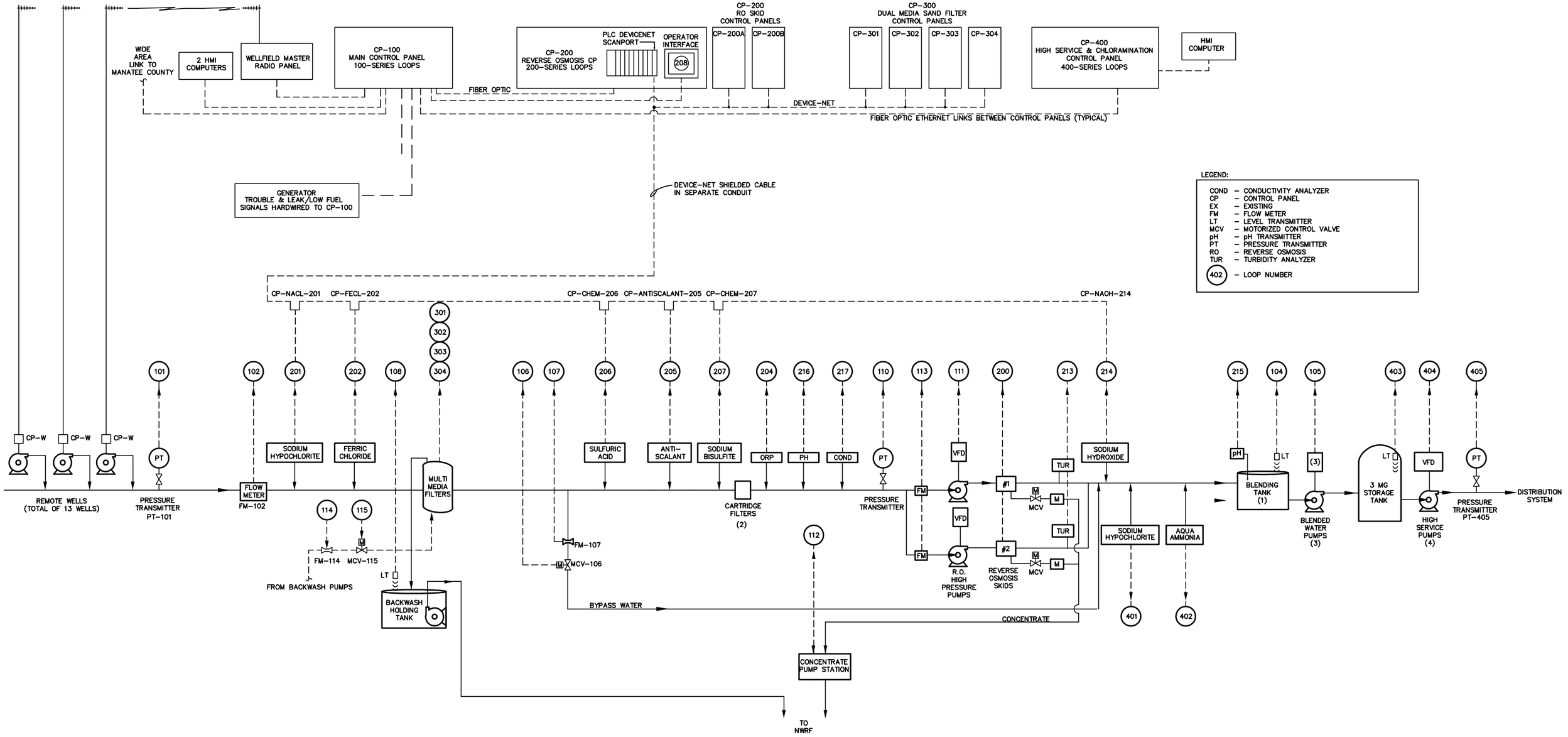
5.8 Plant Instrumentation System

The proposed instrumentation control system will be designed to operate the proposed RO treatment plant and its associated raw water supply wells on a completely automated basis, except when equipment requires maintenance, repairs and/or replacement. The control system will also be capable of operating in a semi-automated mode and a manual mode. The proposed system will be designed in accordance with County standard operation and communication systems and software. **Figure 5-8** presents the proposed process and instrumentation diagram for the facility.

The instrumentation system will be designed for operation from the control room in the RO building at the WTP. The design will provide a high degree of reliability and flexibility and will allow for future expansion. The control room of the RO building will be provided with touch-screens to monitor and control the RO treatment plant and raw water wells. Two-way communications will be provided with the PLCs at the raw water wells and pump stations, as well as the PLCs located at WTP site. The operators in the control room will be able to monitor and control the following:

- Raw water wells
- Multi-media filters
- RO skids
- High service pump station
- Waste backwash pump station
- Emergency generator and transfer switch
- Chemical feed pumps

A lap-top computer will be provided for programming and reprogramming the PLCs. Operator interfaces will be provided at each major equipment location.



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MANATEE COUNTY, FLORIDA

ERIE ROAD 3 MGD REVERSE OSMOSIS WATER TREATMENT PLANT BASIS OF DESIGN

PROPOSED PROCESS AND INSTRUMENTATION DIAGRAM

DATE:	MAY 08
MCE PROJ. #	1024-0080
DRAWN	JZM
DESIGNED	NJS
CHECKED	PJL
PROJ. MGR.	PJL

FIG. 5-8

Flow control valves will be included in the system in the following locations:

- Raw water feed (each multi-media filter)
- Multi-media filters' Backwash
- Rinse Cycle (each multi-media filter)
- Bypass water
- RO feed water
- RO permeate (each RO skid)
- RO reject (each skid)
- Well pump discharge lines

The proposed RO system will include instrumentation to control and monitor the system and report back to the master PLC. Major instruments including a list of locations consist of the following:

<u>Flowmeters and Transmitters</u>

- Raw water wells (each well)
- Treatment plant raw water inlet
- RO skid feed
- Bypass water
- RO skid inlet (each skid)
- RO skid permeate outlet (each skid)
- Blended water
- High service pump station discharge
- Multi-media backwash water
- Chemical feed pump discharges

Pressure Sensor/Transmitters

- Raw water wells (each well)
- Treatment plant raw water inlet
- RO skid inlet upstream of RO feed pump (each skid)
- RO skid inlet downstream of RO feed pump
- RO skid permeate outlet (each skid)
- High service pumps discharge
- Cartridge filter vessel differential pressure

Level Sensor/Transmitters

- 3.0 MG Storage Tank
- Waste backwash pump station wetwell
- Bulk storage tanks for chemicals

Chlorine Residual

- Multi-media filter inlet
- Multi-media filter discharge header
- RO skid inlet (each skid)
- Blended water header (prior to blended water clearwell)
- Inlet to 3.0 MG storage tank
- Outlet from 3.0 MG storage tank

pH/ORP Sensor/Transmitter

- Raw water inlet to treatment plant
- Multi-media filter discharge header
- RO skid inlet (each skid)
- RO skid permeate (each skid)
- Blended water header prior to blended water clearwell
- High service pump station discharge header

Turbidity and Conductivity Sensors/Transmitters

- Raw water inlet to treatment plant
- Multi-media filter discharge header
- Blended water pumps discharge header
- High service pump station discharge header

6.0 CONSTRUCTION COST ESTIMATE

Capital costs were updated from previous estimates provided in the Manatee County Water Supply Facilities Work Plan that was submitted to Manatee County in December 2007. Several modifications were made in the cost estimate to include seven (7) additional wells, a 3.0 MG storage tank, multi-media pressure filters for pre-treatment, additional costs for concentrate disposal, and modifications required at the existing Erie Road elevated storage tank. These updates are provided in the total project cost summary shown in **Table 6-1**.

Table 6-1: Estimated Total Project Cost

ITEM NO.	DESCRIPTION	UNIT	QTY.	UNIT PRICE	AMOUNT
	MOBILIZATION & SITE WORK				
1	Mobilization	LS	1	$450,000.00	$450,000.00
2	Site Work, Fencing & Security Gate	LS	1	$ 950,000.00	$950,000.00
3	Yard Piping	LS	1	$ 150,000.00	$150,000.00
	BUILDINGS & STRUCTURES				
4	Membrane Building	SF	8,500	$200.00	$1,700,000.00
5	Chemical Building, Storage Tanks, Chemical Feed Pumps	LS	1	$275,000.00	$275,000.00
	TREATMENT UNITS				
6	Multimedia Filters	LS	1	$ 1,500,000.00	$1,500,000.00
7	RO Membrane Skids, Pumps, Cartridge Filter Vessles, and CIP Skid	LS	1	$2,000,000.00	$2,000,000.00
8	Electrical @10% of Filters and Membrane Equipment	LS	1	$720,000.00	$720,000.00
9	Instrumentation @10% of Filters and Membrane Equipment	LS	1	$720,000.00	$720,000.00
10	Generator	LS	1	$350,000.00	$350,000.00
11	Stainless Steel Piping & Fittings	LS	1	$125,000.00	$125,000.00
12	Backwash Pump Station Mechanical Components	LS	1	$75,000.00	$75,000.00
	RAW WATER WELLS AND TRANSMISSION MAIN				
12	6-inch DI Raw Water Main	LF	6,000	$65.00	$390,000.00
13	8-inch DI Raw Water Main	LF	5,250	$75.00	$393,750.00
14	10-inch DI Raw Water Main	LF	600	$90.00	$54,000.00
15	12-inch DI Raw Water Main	LF	3,500	$100.00	$350,000.00
16	16-inch DI Raw Water Main	LF	1,800	$90.00	$162,000.00
17	20-inch DI Raw Water Main	LF	850	$105.00	$89,250.00
18	Upper Floridan Wells, Well Pumps & Piping	EA	4	$250,000.00	$1,000,000.00
19	Intermediate Aquifer Wells, Well Pumps & Piping	EA	8	$150,000.00	$1,200,000.00
	FINISHED WATER STORAGE AND PUMPING				
13	3 MG Ground Storage Tank	LS	1	$ 1,250,000.00	$1,250,000.00
14	24-inch DI Pipe (Storage Tank to Distribution System)	LF	2,500	$125.00	$312,500.00
15	Pumps, Piping & Valves for Modifications at Erie Rd. Elevated Tank	LS	1	$250,000.00	$250,000.00
16	High Service Pump Station and Building	LS	1	$500,000.00	$500,000.00
	CONCENTRATE DISPOSAL				
17	8-inch HDPE Directional Drill (to RCW System)	LF	2,800	$125.00	$350,000.00
	SUBTOTAL CONSTRUCTION COST				**$15,320,000.00**
18	Contingency (@ 20%)	LS	1		$3,064,000.00
19	**TOTAL CONSTRUCTION COST**				**$18,384,000.00**
20	Engineering, Legal & Administrative (@ 20%)	LS	1		$3,064,000.00
21	**TOTAL PROJECT COST**				**$21,448,000.00**

Operation and maintenance (O&M) costs were projected to include power, chemical consumption, equipment replacement, and labor costs. Energy costs contribute the largest fraction of operation and maintenance projections due to the energy demand required for pumping. The estimated annual O & M costs, capital recovery, and cost per 1,000 gallons are provided in **Table 6-2**:

Table 6-2: Projected WTP Cost Summary

Design Capacity	3.0 MGD
Total Project Cost	$21,448,000.00
Capital Recovery @ 5%, 30 years	$1,396,000.00
Annual O&M Costs	$ 1,135,000
Total Annual Costs	$2,531,000.00
Cost of Treated Water ($/1,000 gallons)	$ 2.31

7.0 CONCLUSION

Based on projected County potable water demands, a 3.0 MGD Reverse Osmosis Water Treatment Plant (WTP) is proposed at the Erie Road site to supplement the existing water supply, and to meet near-term demands.

The proposed 3.0 MGD Erie Road WTP will:

- Augment the County's existing potable water supply with 3.0 MGD of high quality drinking water by 2014.
- Allow for expansion to produce up to 5.0 MGD in the future.
- Produce high quality drinking water that meets FDEP primary and secondary standards, as well as County water quality goals.

The raw water for the proposed facility will be supplied by a total of 13 production wells [eight Intermediate Aquifer wells (150 gpm capacity each) and five Upper Floridan wells (700 gpm capacity each)]. Water quality testing of the combined well water will be conducted prior to detailed design of the facility, as the design criteria provided in this report is based on water quality derived from the existing Upper Floridan well. Based on the results of the water quality analyses, the proposed pretreatment system may need to be modified to ensure proper operation of the facility.

The 3.95 MGD of raw water supply will be transferred to six multi-media pressure filters. The filtered flow will then be split into a bypass stream (0.95 MGD) and a RO feedwater stream (3.0 MGD). The membranes will operate at approximately 75% recovery, resulting in a 0.75 MGD concentrate stream. The 2.25 MGD of RO permeate will combine with the bypass stream to provide 3.2 MGD of finished water; 0.2 MGD of which will be used for filter backwashing and plant water.

Pretreatment using chemical oxidation and coagulation (sodium hypochlorite and ferric chloride) with multimedia pressure filtration is recommended for the 3.95 MGD of raw water to address ferrous sulfide precipitates, as identified in the pilot study. The filters will be sized for a maximum hydraulic loading of 4.86 gpm/ft^2 with one unit out of service for backwashing or other maintenance.

The proposed RO treatment system will include 3 skids, each with a feed rate of 1.0 MGD; permeate flow of 0.75 MGD, and 21 vessels with 6 membrane elements per skid. The membranes will be low pressure water softening membranes. Provisions will be made to accommodate two additional membrane skids for future expansion to 5.0 MGD.

The RO concentrate will be transferred to a location near the NWRF's golf course reclaimed water storage pond, where it will be blended with reclaimed water from the NWRF. The blended concentrate/reclaimed water stream will then be transferred into the reclaimed water storage.

The RO permeate and filtered bypass streams will be blended, chemically stabilized, and disinfected. The finished water will be stored in a proposed 3.0 MG ground storage tank. High service pumps will transfer the finished water through a proposed 24-inch finished water main that will tie into the County's existing distribution system. The finished water leaving the storage tank will be monitored for flow, pressure, and residual disinfectant. Chemical metering pumps will be provided to meter additional disinfectant into the finished water when needed.

The WTP's main treatment processes, offices, and operational facilities will be housed within a proposed 8,500 ft^2 pre-engineered building that will be designed to allow for future expansion to 5.0 MGD. The layout of the RO building and associated facilities required for the WTP is configured to minimize the site footprint, provide for future expansion, minimize environmental impacts, and to allow for ease of operation and maintenance. The WTP site will

include the requisite site facilities; including but not limited to: stormwater, parking, landscaping, fencing, buffers and setbacks. All site facilities will be designed to comply with the latest edition of the Florida Building code as well as Manatee Building codes that may apply.

The total capital cost for the facility (including design fees and contingency) is estimated at $21.45 M. The estimated annual O&M cost for the facility is estimated at $1.14M (year 2008 dollars). Using an estimated 30-year lifespan, with a 5% inflation factor equates to a capital recovery of $1.4 M for the facility. This results in a cost of $2.31 per 1,000 gallons of finished water.

APPENDIX A

Pilot Study Report

MANATEE COUNTY, FLORIDA

PILOT STUDY REPORT
COUNTY PROJECT NO. 6020171
McKIM & CREED W.A. NO. EOR-58

PREPARED FOR:
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REISS ENVIRONMENTAL
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1.0 INTRODUCTION

Manatee County (County) is evaluating the development of additional water supply from groundwater sources to augment existing supplies during increased seasonal demand conditions, provide water supply and treatment redundancy, and provide additional capacity to meet future demands. The McKim & Creed (M&C) Team, which includes Reiss Environmental, Inc. (REI), was retained by Manatee County to conduct a Pilot Study to evaluate the viability of membrane technology for treatment of a new source water for potable use, as well as to develop preliminary design criteria for the proposed 3.0 MGD Erie Road Water Treatment Plant (WTP).

This Pilot Study Report has been prepared to present the results of pilot testing, and to present the resulting criteria to be used in the preliminary design of the proposed facility. The following subsections provide background on the project as well as additional details regarding the scope associated with the pilot study.

1.1 Background

Manatee County is currently exploring the development of ground water resources to augment potable water supply to ensure continued quality of service to existing and future customers. The first phase of this study included a *Preliminary Site Selection Study for Reverse Osmosis Facilities* (McKim & Creed, August 2005), which consisted of groundwater source identification, a water treatability evaluation, a concentrate management evaluation and an assessment of infrastructure requirements. The results of this study suggested that one specific location, designated as Site 10 (at the County's Erie Road Elevated Storage Tank), provided the highest quality water for treatment using membrane technology, and resulted in the lowest projected capital and annual operating & maintenance costs.

An important limitation of this study was the lack of actual site-specific water quality data. For example, data used to develop membrane-system projections for Site 10 were based on water quality measurements from a test well several miles away. The assumption was also made that pretreatment for the removal of turbidity (solids) would not be necessary, as is the case in many groundwater membrane treatment facilities throughout Florida, which thus created an additional uncertainty regarding the projected costs (and feasibility) associated with Site 10.

The proposed potable water treatment facility will have a 3.0 MGD initial capacity, and will be designed to allow for a future expansion to 5.0 MGD. A prior assessment of lime softening, ion exchange and membrane softening treatment processes led to selection of membrane softening or nanofiltration (NF) for this proposed WTP. This project included long-term pilot testing of nanofiltration at the proposed site to confirm the viability of this treatment technology, using source water that is anticipated to be of similar quality to the raw water supply that will be available at the future WTP.

1.2 Scope of Work

Nanofiltration design criteria necessary to achieve treatment goals can be approximated using process calculations and computer models of membrane performance. As such, pilot testing is not typically considered critical for determining the anticipated finished water quality. Conversely, the fouling rate of a membrane system is highly dependent upon site-specific source water characteristics, among other factors, and this fouling cannot be accurately estimated via computer models. It is extremely important to note that the rate of fouling can significantly impact the operation and useful life of the membranes, and has a direct effect on operations and annual operating costs. As such, it is important to perform pilot testing on the site-specific water supply to gather data to assist with preliminary design for the proposed membrane facilities and to identify any unforeseen site-specific issues that could impact the overall process design for the facility.

The specific goals of the project included:

- Obtain site-specific raw-water quality data.
- Pilot Study using raw water supply from new Upper Floridan well
- Documentation of findings and results of Pilot Study
- Recommend design criteria for the development of the proposed Erie Road WTP.

2.0 PILOT STUDY APPROACH

The desktop evaluation (2005) included recommended actions for testing a 2-1 array nanofiltration pilot system for a duration of 2,000 hours (approximately three months). As part of the test process, acid and antiscalant (scale inhibitor) were added upstream of the cartridge filter to reduce salt precipitation potential through the membrane equipment (Figure 1). A testing protocol was developed, and pilot equipment was mobilized based on the desktop evaluation's recommended piloting approach.

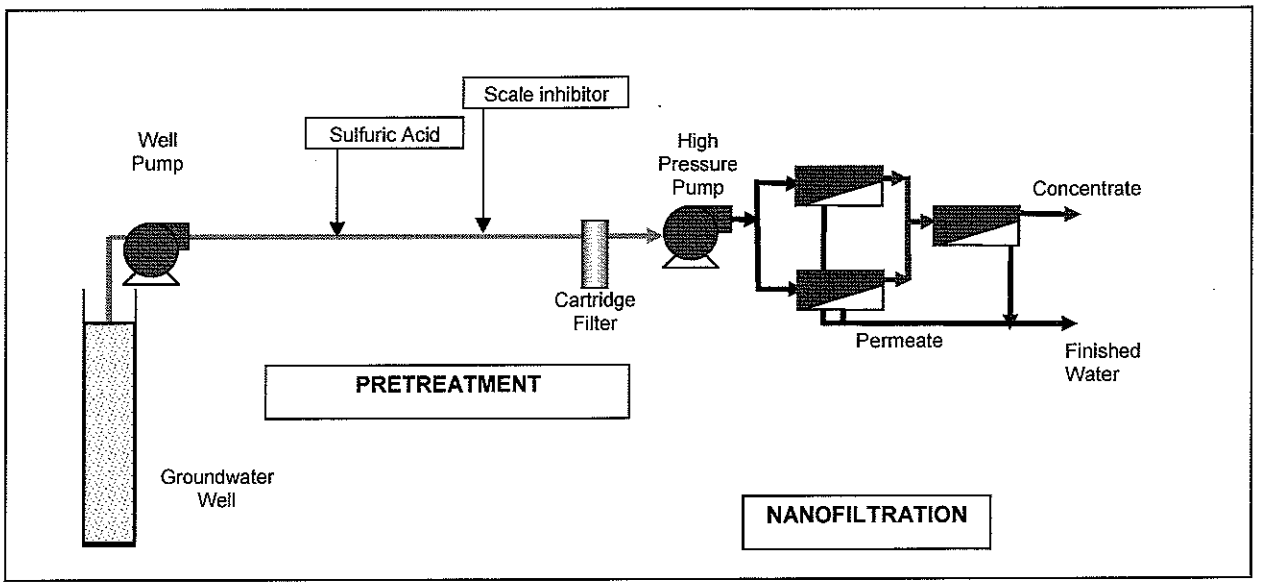

Figure 1. Process Schematic of the Pilot Plant.

The plan for the study consisted of locating the pilot unit at Site 10 adjacent to the recently constructed Upper Floridan production well. Water for the pilot unit was supplied from this well to simulate projected raw water characteristics for the proposed WTP. Appendix A includes the detailed protocol utilized for this pilot study.

2.1 Nanofiltration Pilot Equipment

The Pilot Plant (Figure 1) consisted of the Upper Floridan Well, a 40 gpm well pump, a sulfuric acid feed system, an antiscalant feed system, 5 micron pore size cartridge filters, a high pressure pump, and the equivalent of three 4-inch diameter pressure vessels, each capable of containing seven membrane elements. The nanofiltration pilot is referred to as a 2-1 array pilot (typically called a "brackish" membrane system), since the configuration consists of two pressure vessels in the first stage and one pressure vessel in the second stage. The membranes in the second stage pressure vessels are to treat the concentrate of the first stage to increase overall recovery of water from the system. This system was designed to provide representative flux and recovery settings consistent with full-scale designs.

The Pilot Plant was used to treat approximately 27,800 gallon per day (gpd) of raw water from the new source well producing approximately 23,600 gpd of finished water. TFCS4920 membrane elements as manufactured by Koch were utilized in the pressure vessels to treat the groundwater. As pretreatment to the NF system, sulfuric acid and antiscalant were added to the raw water using two metering pumps, and the water (post-chemical addition) was transferred through a 5 micron cartridge filter before being pumped to the NF membranes. Permeate and concentrate flows were monitored via rotometers and the raw, permeate and concentrate pressures were monitored via pressure gauges.

2.2 Operational Conditions

The experimental program for pilot testing was developed as presented in the Pilot Protocol, provided in Appendix A. To support final design conditions, the Pilot Plant was operated for approximately 2,000 hours at the approximate operating conditions as shown in Table 1.

Table 1. Pilot Testing – Approximate Operational Conditions

Setting	Units	Pilot Operating Values
System Flux	gfd	15.0
First Stage Flux	gfd	17.5
Second Stage Flux	gfd	10.0
Recovery	%	85
Acid dose	mg/L	pH of ~6.5
Antiscalant dose	mg/L	2.25

Design conditions for a 15-gfd flux system (stage 1 flux of 17.5-gfd, stage 2 flux of 10-gfd), included permeate backpressure of approximately 5 psi on first stage and 15 psi on the second stage, and a feed pressure of approximately 75 psi, applicable for tests with an 85% recovery. Data was collected twice per day for flow, pressure and temperature. Additional samples for more detailed laboratory analytical evaluations were also taken several times during the pilot test period. Also, water quality analyses were performed once per day for TDS, pH and turbidity.

3.0 PRETREATMENT PILOT STUDY RESULTS

Pilot results from early testing, as well as during the 2,000 consecutive-hour test, indicated the potential for significant solids generation from the raw water. This phenomenon was observed primarily in the pretreatment system; specifically, the 5 um cartridge filtration system. The unusual combination of data, field measurements, and visual observations associated with the deposition of solids on the cartridge filters was the primary focus of operational analyses during the pilot program. Significant solids deposition (as suggested by visual inspection of the cartridge filters) usually translates into high cartridge differential pressure and high turbidity measurements, which were not readily observed during this study. This phenomenon is rarely observed when treating groundwater in Florida.

Because the operation of the pretreatment system is significantly different from that of the nanofiltration (membrane) unit, the discussion of pilot results has been separated into two sections: this section, dealing with pretreatment, and the following section which addresses the nanofiltration operation.

3.1 Initial Sequence of Events

After pumping the new well to waste for several days to flush accumulated solids, on May 18, 2007 raw groundwater was pumped to a break feed tank upstream of the NF unit. It was noticed that a black color developed in the water while in the break tank; the color disappeared after a few hours and did not occur over the following several days. It was concluded, at that time, that the black solids observed were due to the well's inoperation, and that the flushing and continuous pumping during testing would alleviate future issues.

Concurrent with the well flushing, SDI and turbidity from the groundwater source were measured and the results were deemed favorable for starting the NF system. On May 22, the pilot system was started, and the unit began producing water. After three days of operation, the NF system was shut down due to high pressure (caused by fouling) in the NF vessels, and it was observed that the cartridge filters and the NF membranes were coated with a grey/black layer of solids (Picture 1).

From that day, investigations were conducted to determine the origin of the solids and to determine what adjustments were needed for the Pilot Plant to continue with operation. Various tests were performed to determine whether the break tank and/or the chemical feeds contributed to the grey and black color fouling. In addition, the well pump was lowered (by the end of June), since it was also determined that the pump may be drawing water that was not typical of average raw water quality. Several initial steps were taken to minimize or eliminate the observed solids, as described below. The system was checked to ensure that air was not being introduced into the system prior to the NF membranes. It should be noted that measurements of raw water quality for turbidity and SDI continued to be within the range of accepted industry standards, which indicated that NF treatment should be a viable treatment alternative, even during solids excursions.

The following is a summary of modifications and their associated results that occurred shortly after the membrane fouling:

1. The chemical additions were eliminated (5/29/07) and the same phenomenon was observed, even though the coating was more black, which suggested that pH may have an impact on the rate of fouling on the cartridge filter (Picture 2).
2. The elimination of the break tank (5/30/07) resulted in lower SDI values at the NF unit. However, the grey color was still present on the new cartridge filters (Picture 3) although the consistency (texture) of the solids had changed. This suggested that although aeration was a contributing factor to solids deposition, it was not the sole cause of the observed cartridge filter fouling.
3. The submerged pump in the well was lowered, (6/19/07) and again the same phenomenon was observed on July 3, 2007. The break tank was off-line at this time, and the chemicals were also added to the raw groundwater (Picture 4). This observation suggested that the solids deposition tendency was inherent to the raw water source as a whole, and not a function of well pump location in the water column.

It was noted that the color of cartridge filters changed to a reddish/brown color once they were exposed to the atmosphere for a few days, suggesting that iron had some role in the material present on the cartridge filers. Furthermore, staff observed a noticeable odor from the dried cartridge filters, similar to a "burnt match" or "spent firework."

3.2 Cartridge Filter Fouling Discussion

One SDI filter pad (coated with the solids) and a NF membrane were sent for autopsy in July, 2007 to determine the constituents in the grey/black layer on the membrane. The laboratory report is provided in Appendix B. The report concluded that most materials found on the SDI pad consisted primarily of sulfur, iron and oxygen.

Picture 1. 5/25/07 - Tank & Chemicals	Picture 2. 5/29/07 - Tank & No Chemicals
Picture 3. 6/6/07 - No tank & Chemicals	Picture 4. 7/3/07 - Pump lowered, No tank & Chemicals
Picture 5. 6 Hours after being exposed to atmosphere	Picture 6. CF after 2 weeks exposed to atmosphere next to CF just removed

After the additional data were collected and analyzed, modifications were made to the operation of the Pilot Plant, and the operations were re-started.

Operation at a feed water pH of 6.2 (via acid addition) demonstrated that, although solids deposition was still occurring, pressures on the cartridge filter did not increase over approximately 6 weeks of operation. When the solids reached a critical point, pressures rose quickly and a filter change was required. Visual observations showed that a significant solids

layer had deposited over that time, black in color and of similar consistency to that seen previously.

Independent of the solids issue, it was considered appropriate to lower the acid dose and increase pH in the feed water, based on the success of the NF test though the first six weeks. The main goal of lowering the acid dose was to determine whether the membrane system would still be able to sustain productivity at a higher pH and minimize the use of acid to lower the operation costs at full-scale. After this operational change to pH 6.5, a marked increase in cartridge filter solids deposition occurred. Filter runs that had been lasting several weeks were now lasting 4-6 days. Increases in cartridge filter solids deposition occurred, and increases in cartridge filter pressure drops were observed within 1-2 days of new filter insertion. The obvious changes strongly suggested a pH dependence for the solids precipitation observed.

With the change in deposition came an increase in the mass of solids available for sampling. M&C staff collected a sample of the deposited solids, and delivered the sample to the contract laboratory for further analysis. The results of this testing is included in Appendix B. As shown, the deposited solids consisted almost completely of iron and sulfur.

In addition, a particle size distribution analysis was performed on the raw water to determine the size of the precipitated solids, as a potential indication of filterability. The results are shown in Appendix C, and indicate that a majority of the particles were less than 2 um in size.

Subsequent investigations indicated that the deposited solids are likely ferrous sulfide (FeS), a black solid which oxidizes once exposed to atmosphere to form ferric oxide (Fe_2O_3) solid, which has a reddish brown color (as shown in Picture 6), and the gas sulfur dioxide (SO_2) according to the chemical reaction:

$$4\ FeS(s) + 7\ O_2(g) \leftrightarrow 2\ Fe_2O_3(s) + 4\ SO_2(g)$$

(FeS is the primary component in the mineral pyrrhotite)

Of additional note is that sulfur dioxide has a distinct odor of "burnt matches" as observed from the cartridge filters when exposed to air. Therefore, it is believed that deposition of ferrous sulfide and oxidation to ferric oxide is what was observed during this pilot program. Ferrous sulfide is either present in the groundwater, or it is formed (from iron and sulfide) from the time ground water is pumped to the time the groundwater is filtered or a combination of these.

Additional membrane and cartridge filter autopsies performed after testing (reports included in Appendix B) was completed confirmed the presence of ferrous sulfide solids in the system, though no appreciable buildup was identified on the NF membranes themselves.

3.3 Pretreatment Summary

It is not known if FeS was a pre-formed precipitate or if iron and sulfide ions were in solution then precipitated to form FeS. If the iron and sulfide were in ionic form initially, the antiscalant used during the pilot study should have been adequate to keep these ions in solution and avoid

precipitation of FeS. However, given that FeS is a primary mineral component and there were no known chemistry effects during withdrawal of water from the well, it is possible that FeS was present in colloidal form in the raw water. If this is the case, filtration for removal of solid FeS might be required to ensure cartridge filter and NF fouling do not occur. Alternately, a significant lowering of pH could possibly resolubilize FeS.

Regardless of the form of the iron and sulfide present in the water in the aquifer, the pilot study clearly showed that, at the time water enters the treatment system, FeS precipitate is present. Therefore the use of antiscalant was inadequate and particle plugging of the cartridge filters and NF elements occurred. For the future, some form of resolubilization of FeS or filtering of FeS appears necessary.

Based on these results, appropriate pretreatment of the groundwater is recommended to ensure that ferrous sulfide does not foul the NF membranes downstream of the cartridge filters or precipitate in finished water and cause deteriorated water quality. The use of cartridge filters to remove ferrous sulfide is not recommended, since the cartridge filters serve as emergency protection of the NF membranes against unforeseen particle spikes.

4.0 NANOFILTRATION PILOT STUDY RESULTS

As described previously, one of the Pilot Study's primary objectives was to focus on the productivity performance of the membranes, and demonstrate that typical design criteria would lead to reasonable cleaning frequency of the membranes. Pilot testing was conducted from May 2007 to October 2007 at the proposed Site 10 according to the Protocol (Appendix A). The field data collected during the study is presented in Appendix D. This section presents a summary of the results for the NF pilot study.

4.1 Prefiltration Results

Performance of prefiltration using 5 micron cartridge filters was evaluated in order to determine the anticipated replacement frequency of the cartridge filters for the proposed WTP. Cartridge filters are used to protect the NF membranes from fouling and from physical damage caused by particulate matter. Typical differential pressures across the cartridge filter range from 3 psi (clean filters) to 15 psi (fouled filters). Cartridge filter replacement time depends on source water quality and the degree of pretreatment. Cartridge filter replacement is typically conducted once every two to four months. It is important to note that cartridge filtration is not typically used to remove particles on a regular (continuous) basis, but is used as a last membrane protection against pretreatment upset or feed water contamination.

The cartridge filters were operated at a loading rate of 4 gpm/Ten Inch Equivalent (TIE) and within the standard range of cartridge filtration loading rate (2-5 gpm/TIE) during the Pilot Study. Cartridge filtration performance is monitored through the differential pressure across the cartridge filters as presented in Figure 2. As seen in Figure 2, the maximum runtime on a set of cartridge filters was approximately 1,000 hours (40 days) when the feed pH was 6.1 – 6.2. When the feed pH was increased to 6.6 – 6.7, the run time did not exceed 265 hours (11 days). This run time on the cartridge filters was therefore not within the replacement frequency goal of two to four months. It is important to note that extended cartridge filters run times are anticipated with a reduced pH in the NF feedwater stream.

The rapid increase in differential pressure was due to the accumulation of black ferrous sulfide on the filters as observed and discussed in Section 3.0.

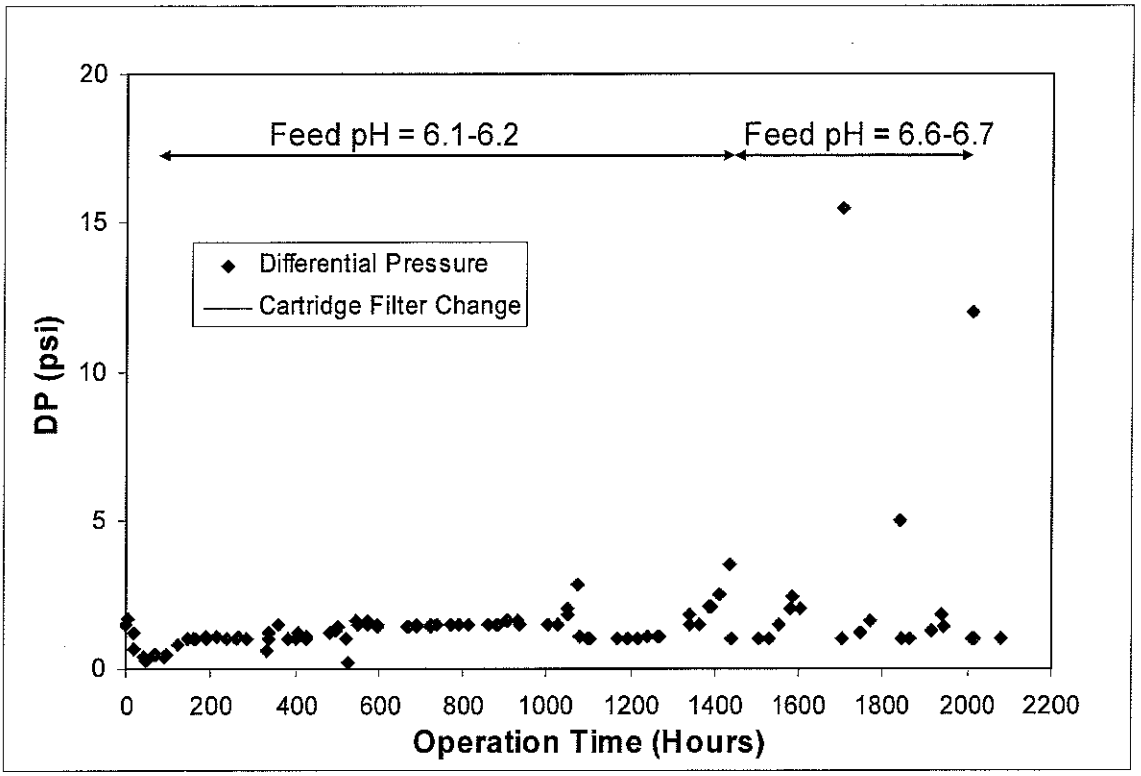

Figure 2. Cartridge Filter Differential Pressure

4.2 Nanofiltration Results

Performance of the NF system was studied using TFCS4920 Koch membranes for treatment. The system was operated for a total of 2,090 hours during the 3 month pilot study. Productivity and water quality data were recorded during this study, and the interpretation of these data is provided in the following subsections.

4.2.1 *Productivity*

A NF system may experience a decline in productivity over time due to deposition of foulants such as particles, precipitates, or biological material. Productivity is defined by the amount of treated water produced for a given pressure, and can be presented as normalized permeate flow or water mass transfer coefficient (MTC). Fouling is evidenced by a decline in the MTC or an increase in pressure differential across the feed side of the membrane. A significant decline in productivity requires a chemical cleaning of the NF system to restore membrane performance. A chemical cleaning is typically performed following a 10 to 20 percent decline in the MTC or a 50 percent increase in feed-side pressure differential. Chemical cleaning frequencies for a groundwater source are typically on the order of once every 4 to 18 months. A common cleaning frequency goal is once every 6 months.

During the course of pilot testing, operational variables were kept constant to determine their impact on the rate of NF membrane fouling. At the beginning of this pilot testing program, the design flux rate was set at 15-gfd and the recovery at 85%, with adjustments as necessary to maintain these conditions. In addition, antiscalant was added at a dose of 2.25 mg/L (per recommendations from the manufacturer of the antiscalant).

A summary of recovery, flux, feed-side pressure differential and MTC results are presented in Figures 3 through 5. As shown in Figure 3, the flux rate of the overall system remained constant at 15-gfd, with flux rates for stage 1 and stage 2 maintained at 17.5-gfd and 10-gfd, respectively, during the entire pilot study. In addition, recovery was maintained at 85% for the duration of the study. The feed-side pressure differential did not show any marked increase during the pilot study, as shown in Figure 4, indicating that significant particle plugging did not appear to occur.

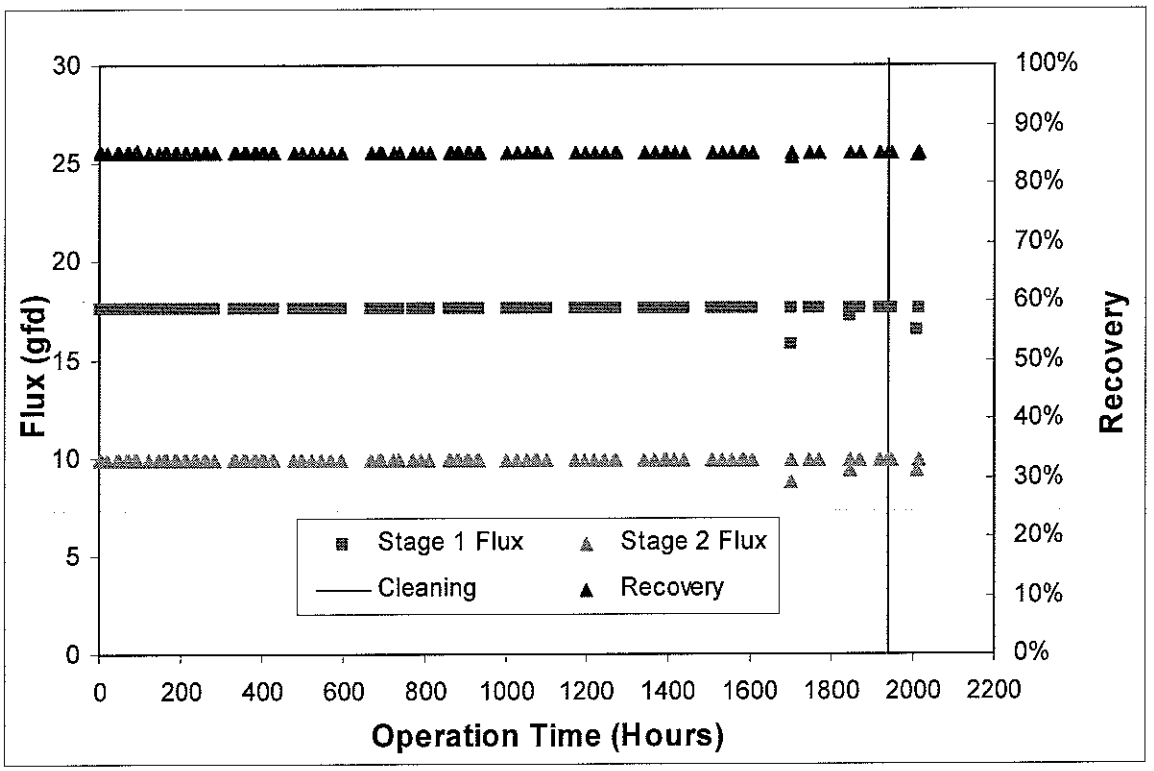

Figure 3. Flux and Recovery.

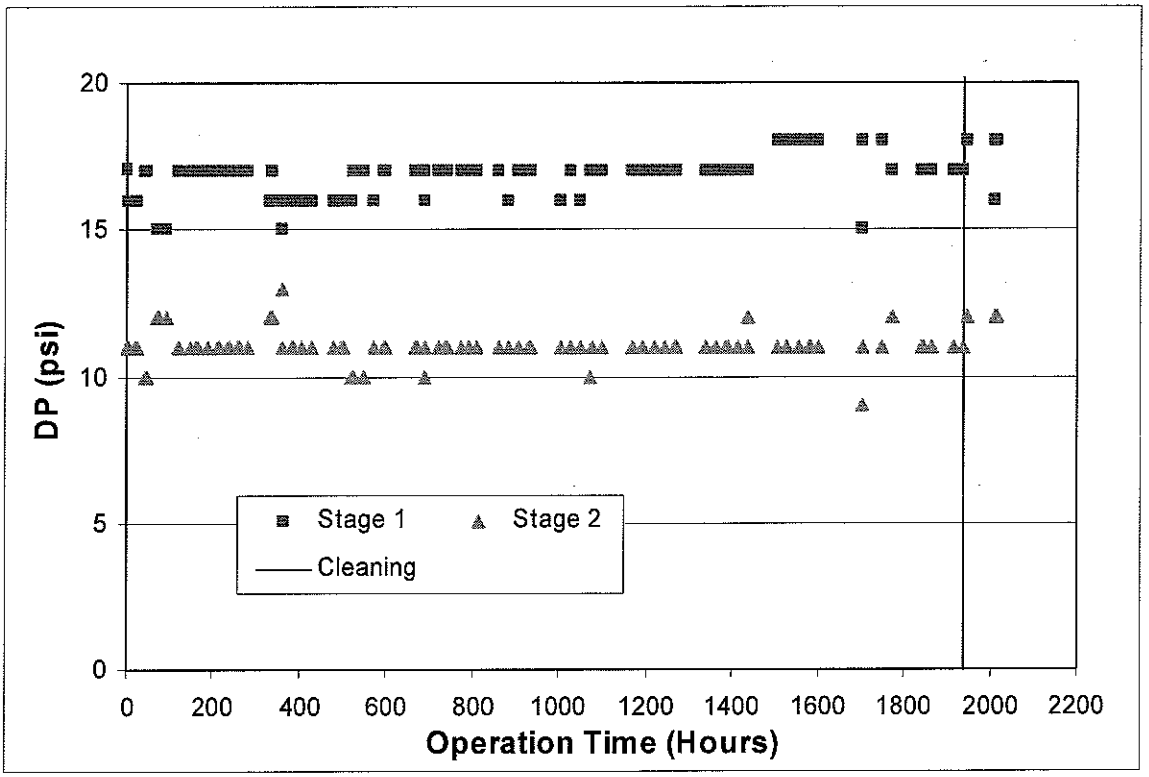

Figure 4. Differential Feed Side Pressure.

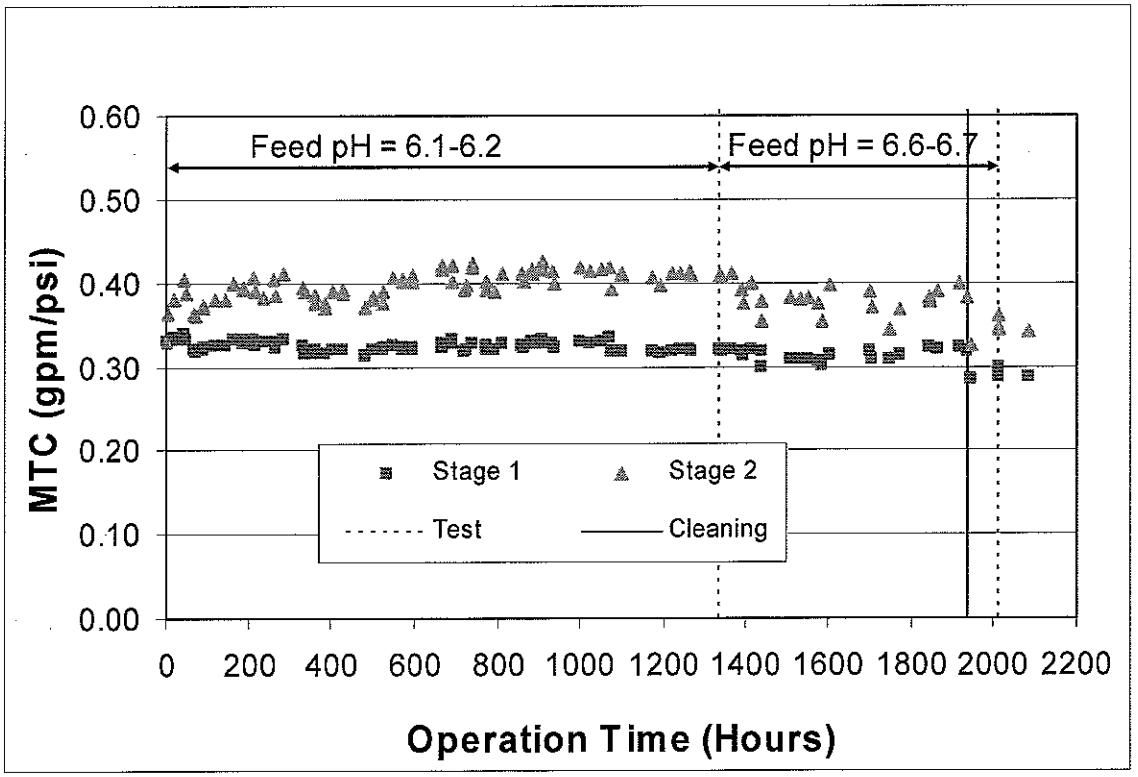

Figure 5. Normalized Mass Transfer Coefficient.

The water mass transfer coefficient (MTC or Kw) is a measure of the resistance to permeation of water; added resistance to the passage of water through the membrane (a reduction in MTC) is an indicator that the membrane surface is becoming fouled in some way. It is an inherent characteristic of each membrane and varies based on the polymer chemistry and fabrication of the specific membrane element. Higher MTC values are desired as they correspond to lower feed pressure requirements and thus lower operating costs. While manufacturers report MTC values, pilot testing confirms site-specific membrane characteristics and determines the rate of membrane fouling by the decline of MTC. As shown in Figure 5, the calculated normalized MTC showed that the MTC did not decrease when the feed pH was maintained at 6.1, whereas, a decrease in membrane MTC was observed when the feed pH was increased to 6.6-6.7.

In summary, the NF system was operated successfully treating groundwater from the newly installed well at the proposed Site 10 using Koch membranes, including 2,090 hours of operation with minimal fouling at a feed pH of 6.1. At full scale, the NF system could be conservatively designed to operate at a flux of 15-gfd and 85% recovery with a 2.25 mg/L dose of Antiscalant (Vitec 4000) and by adding sulfuric acid to reach a pH of 6.1. Chemical cleaning frequency goals would be on the order of every 6 months (or longer) based on these observations.

Note that a chemical cleaning was performed towards the end of the study (10/19/07). The chemical cleaning was performed using sulfuric acid and no significant change in membrane performances was observed, suggesting that the membranes were not scaled (no salt precipitation) and were not fouled by ferrous sulfide (at that point in time) to the point that operations were affected.

4.2.2 *Water Quality*

The raw and finished water quality results are presented in the following subsections. All detailed results are presented in Appendix E.

4.2.2.1 Turbidity

Turbidity of the feed water is one of the key water quality parameters in the membrane performance. The turbidity data collected during this pilot study are presented in Figure 6. The turbidity of the NF feed water (post-filtration) was consistently below the recommended value by the membrane manufacturer of 0.5 NTU, and more specifically was less than 0.1 NTU on an average for the duration of the 2,090 hour pilot study program. The turbidity of the membrane permeate was less than 0.1 NTU

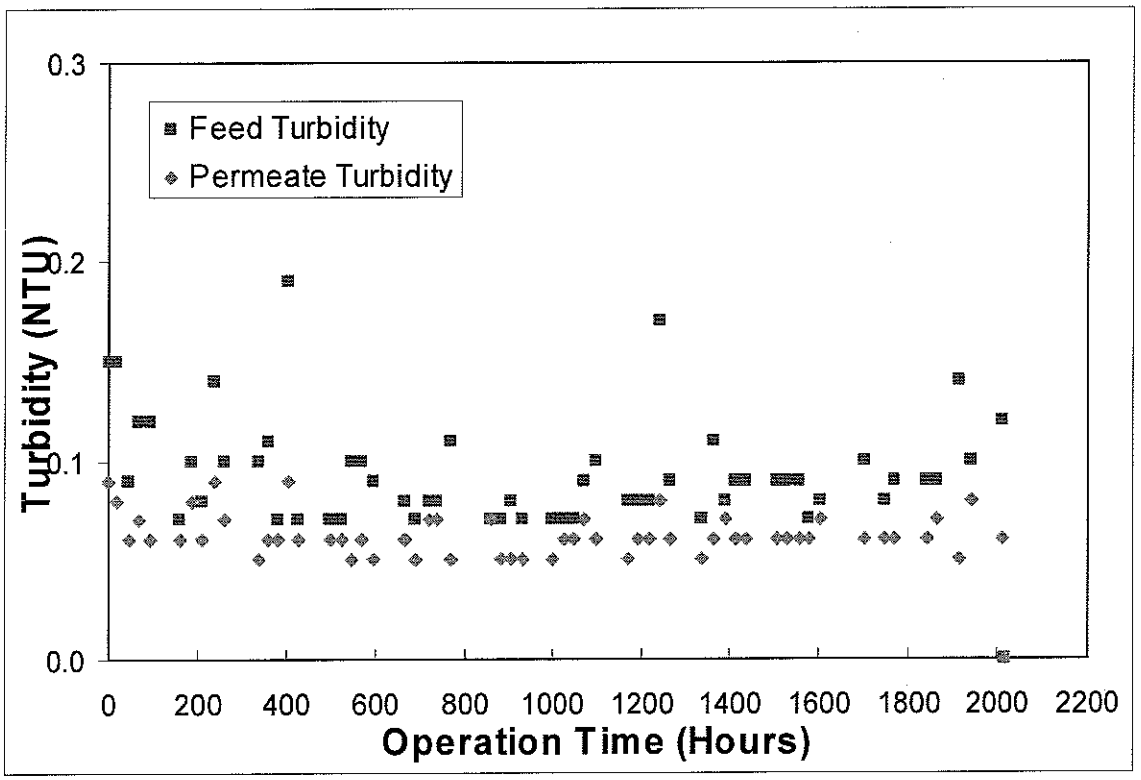

Figure 6. Turbidity

4.2.2.2 TDS

Typically TDS is measured to assess the performance of the nanofiltration system in terms of finished water quality. The observed TDS of the feed water was consistently measured at a level of 620 mg/L and the permeate TDS was approximately 120 mg/L (Figure 7). The nanofiltration system removal capacity in terms of TDS was approximately 80%, and was within the expected range for the specific NF element tested. Note that where TDS was calculated by converting conductivity (measured on-site), a conversion factor of 0.6 was used for the estimation.

4.2.2.3 Other Water Quality Considerations

The permeate water quality goals are summarized in Table 2 along with the feed water quality data from the NF pilot system for several parameters. As shown, the proposed treatment system provided exceptional water quality with low levels of inorganic compounds and heavy metals (all water quality data are presented in Appendix E). Water quality produced during pilot testing was found to be better than the existing County's water quality in terms of inorganic compounds and heavy metals goals, other than for chloride. The finished water chloride level is discussed in more detail as part of the basis of design report, where blending issues are addressed for the overall proposed facility.

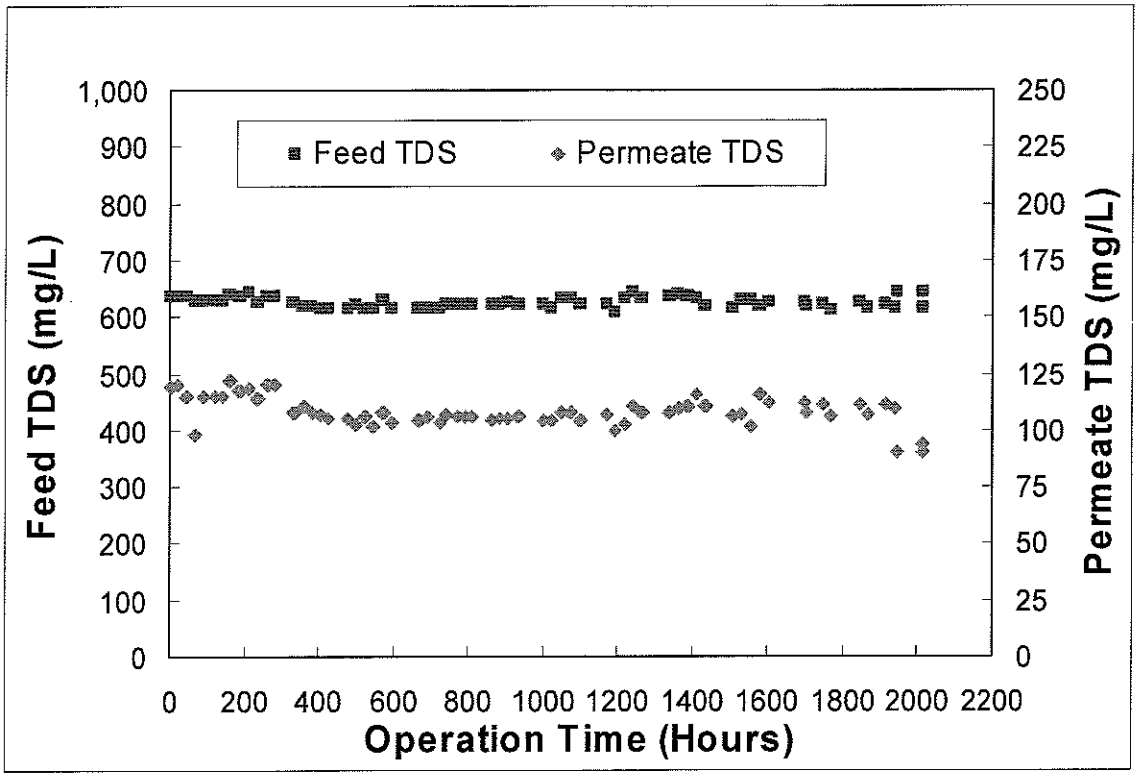

Figure 7. TDS

Table 1. Water Quality Summary

Parameter	Unit	Feed Water (9/26/07)	Permeate (9/26/07)	Existing*
TDS**	mg/L	720	110	230
Chloride	mg/L	63	33	20
Sulfate	mg/L	350	16	110
Calcium	mg/L as $CaCO_3$	300	27	NA
Total hardness	mg/L as $CaCO_3$	525	50	172
Color	CU	5	< 5	< 5
Foaming Agents	mg/L	< 0.05	< 0.05	< 0.05
Aluminum	mg/L	< 0.1	< 0.1	< 0.1
Zinc	mg/L	< 0.006	< 0.003	0.05
Manganese	mg/L	< 0.01	< 0.010	0.014
Iron	mg/L	0.7	< 0.060	< 0.06

*From 2006 Drinking Water Quality Summary
** TDS analyzed with gravimetric method

5.0 CONCLUSIONS/RECOMMENDATIONS

A nanofiltration pilot unit was operated for 2,090 hours at the proposed 3 MGD Erie Road WTP site. The purpose of this pilot study was to focus on the potential application of membrane technology for production of potable water at this site. The results of the pilot study indicated that NF technology can successfully treat the new groundwater supply to meet the water quality goals and objectives of the County, but will require some form of pretreatment to address the presence and formation of ferrous sulfide solids.

With regards to membrane performance, the pilot study results indicated that operation of the NF membranes fell within standard engineering practice for operation and maintenance of a membrane facility. Specific conclusions are as follows:

- The nanofiltration system was operated successfully treating groundwater at Site 10 using KFCS 4920 Koch membranes (including 2,090 hours of operation). No significant membrane fouling was observed when the feed pH was maintained at 6.1-6.2.

- The projected cleaning interval is estimated to be approximately 6 months, which is typical for a NF membrane water treatment plant.

- A full scale NF system would be operated at a maximum flux of 15-gfd and 85% recovery with a 2.25 mg/L dose of Antiscalant Vitec 4000 from Avista Technologies. It would be recommended to design the system with a slightly lower flux (especially in the first stage) to fall within the membrane manufacturer warranty. Table 2 presents the design criteria for the full-scale plant.

Table 2. Full-Scale WTP Design Criteria

Criteria	Units	Design Values
Configuration		2-1 Array
System Flux	gfd	14.0
First Stage Flux	gfd	16.5
Second Stage Flux	gfd	9
Recovery	%	85
Acid dose	mg/L	TBD (See Process Recommendations)
Antiscalant dose	mg/L	2.25
Filtration		TBD (See Process Recommendations)

- The pilot program confirmed the need for the addition of sulfuric acid to the feed water stream and/or additional pretreatment prior to the membranes, as demonstrated by the fouling observed when the pH was raised to 6.6-6.7.

Process Recommendations

Based on the Pilot Study results, and discussion with project team members from Manatee County, M&C and REI, several recommendations were developed associated with the facility basis of design:

1. The production well used for pilot test source water is one of 13 planned raw-water wells associated with the new WTP facility. Considering the unusual characteristics (ferrous sulfide) of the first well, and the potential for variability in water quality from the future wells (positioned in various locations nearby), it is recommended that the County consider installation of the 12 remaining wells and the performance of further water quality testing once the actual future raw water quality can be simulated.

2. Given the existing information, it is recommended that the facility plan include the use of pretreatment prior to the NF system (including the cartridge filters) for the removal of solids.

3. Based on several critical facility limitations associated with concentrate disposal, it has been initially suggested that the County consider operation of the NF system at recoveries lower than the 85% tested. The test results support the feasibility of such an approach, and no scaling or process issues (beyond the solids issues described above) with the design and operation of a lower-recovery system are anticipated.

4. The facility design basis should continue to include chemical feed systems for antiscalant and acid for NF treatment, as well as sodium bisulfite for dechlorination prior to the NF system (it is anticipated that chlorine will be used as part of the pretreatment system, and residual chlorine must be removed prior to the NF membranes).

5. The remaining issue of the observed permeate chloride concentrations should be addressed in the facility basis of design report, where blending scenarios with pre-treated raw water will be evaluated using several control criteria, including meeting finished water chloride targets.

APPENDIX A

PILOTING STUDY PROTOCOL

MANATEE COUNTY, FLORIDA

GROUNDWATER MEMBRANE TREATMENT SYSTEM PILOT-TEST PROTOCOL

PREPARED FOR:
MANATEE COUNTY

PREPARED BY

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APRIL 2006

REISS ENVIRONMENTAL
CONSULTING ENGINEERS

TABLE OF CONTENTS

1.0 INTRODUCTION

Manatee County is currently exploring the potential development of groundwater resources to meet projected future potable water demands, and to ensure continued quality of service to existing and future customers. The first phase of this study included a *Preliminary Site Selection Study for Reverse Osmosis Facilities* (submitted in June 2005) which consisted of groundwater source identification, a water treatability evaluation, a concentrate management evaluation and an assessment of infrastructure requirements. The results of this study suggested that one specific location, the North Site (also designated as Site 10), provided the highest quality raw water for treatment using membrane technology, and resulted in the lowest capital and operating costs.

This report includes proposed plans for implementation of a formal pilot study to verify the water quality and treatment assumptions from Phase I, and establish the potential long-term success of membrane technology for this application. The specific goals of the project include:

- Confirmation of actual site-specific raw-water quality.
- Re-evaluation of initial assumptions for membrane treatment application.
- Assessment of membrane design and operations based on long-term pilot testing.
- Establish membrane fouling potential over time.
- Identification of pre- and post-treatment requirements.

McKim and Creed (M&C) and Reiss Environmental, Inc. (REI) will provide technical leadership of the pilot-test program, including planning, startup, and coordination of operations and data collection. The following plan outlines the overall approach to completing test requirements for the purposes of finalizing design criteria and assessing the overall applicability of membrane technology.

2.0 ROLES AND RESPONSIBILITIES

The pilot study responsibilities for M&C, REI, and Manatee County are as follows:

<u>McKim & Creed</u>

1. Monitor overall study progress and schedule.
2. Provide oversight of pilot test program.
3. Assist in mobilization at test site.
4. Assist in conducting pilot study kick-off meeting.
5. Assist in coordination between all parties.
6. Operate and monitor the unit on a continuous basis.
    a. Monitor, maintain and document operation of the pilot.
    b. Collect unit operating data twice per day (weekdays) for three months.
    c. Change-out or refill pretreatment chemicals as needed.

d. Perform sampling events.

7. Coordinate outside contracted analytical laboratory services.
8. Prepare chain-of-custody sheets and deliver samples to Certified laboratory.

Reiss Environmental

1. Provide, set-up and start-up RO pilot trailer for study.
2. Field verify RO trailer functionality and performance.
3. Conduct kick-off meeting to familiarize Manatee County staff with pilot operation and monitoring.
4. Train Manatee County and M&C staff.
5. Manage and assess data collected on-site on a weekly basis.
6. Coordinate with trailer operators regarding potential setting changes, troubleshoot issues, etc.
7. Communicate with M&C and Manatee County regarding the preliminary results of the study.
8. Provide chemicals.

Manatee County

1. Provide mechanical and electrical assistance during pilot trailer setup (via contractor).
2. Provide mechanical assistance and support for routine and minor equipment repair.
3. Provide electrical assistance.

3.0 PILOT STUDY

This study will consist of testing a membrane pilot system for a duration of 120 days (total operation time) to confirm and optimize key design parameters such as flux, recovery, system array configuration and pretreatment (i.e., acid and antiscalant feed) requirements. This document outlines the operating protocol to implement the pilot testing.

3.1 Source Water

The membrane pilot will be tested at the North Site (Site 10) where construction of wells and infrastructure for the future facility is currently being completed. Raw water from the new test well will be used for pilot treatment. The pilot system will require at least 30 gallons per minute (gpm) at positive pressure to feed the treatment unit.

3.2 Membrane Pilot Equipment

The membrane pilot equipment consists of a trailer mounted 2-1 brackish-water two-stage array system. Chemical storage and feed equipment for acid and antiscalant additions will be contained in the trailer. The system will simulate the proposed facility design with a two-stage, 2:1 array configuration. The first stage consists of two pressure vessels while the second stage consists of one. Each pressure vessel houses 7 membrane elements for a total of 21 elements in the array. These elements are 4-inch diameter by 40-inch in length. First stage permeate water back pressure is used for control to ensure proper flux through each stage. The Koch membrane model number 4920S will be tested in the membrane system.

3.3 Pretreatment

Pretreatment of the raw water may consist of sulfuric acid and antiscalant addition followed by cartridge filtration. Final pretreatment chemicals will be determined based on water quality data from the new on-site well.

3.3.1 Acid

Sulfuric acid will be used to lower the pH of the raw water for control of calcium carbonate scaling within the membrane elements. The pH will be adjusted such as the LSI in the concentrate is approximately 0. If utilized, available size carboys (i.e., 30 gallon) at ~40% sulfuric acid will be used for containment. These carboys shall be stored on-site in a secure location on top of a pallet contaminant pad. A metering pump located in the pilot trailer will be used to inject sulfuric acid into the system feed water. Reiss Environmental will procure the sulfuric acid for this project.

3.3.2 Antiscalant

One antiscalant will be tested at a concentration of TBD mg/L. The antiscalant will be acquired from the Vendor by REI. Antiscalant will be diluted and stored in the trailer for use during piloting. A metering pump located in the pilot trailer will be used to inject the antiscalant into the raw water during testing.

3.3.3 Pre-filter

A 5 μm cartridge filter will be utilized as a pre-filter for the membrane system. The pilot system is equipped with a cartridge filter housing. The cartridge filter shall be changed when the head loss increases 10 psi above the startup pressure drop.

3.4 Electrical

The trailer, including pumps, air-conditioning unit, lighting and electrical outlets will require a 3-phase, 460 V, 60 amp power supply. Power will be supplied via electrical connection (same power source as well pumps) provided by the on-site contractor.

3.5 Discharge Management

Permeate and concentrate waters will be blended together to achieve water quality similar to the raw water prior to discharge.

3.6 Calibration

Flow meters and instruments shall be calibrated prior to use. Flow meters will be calibrated by manual measurement of observed volumes and times. The turbidimeter and pH meter will be calibrated per manufacturer specifications and requirements.

4.0 TESTING APPROACH

4.1 Pilot Tests

The Koch membranes will be tested under the following conditions:

- 85% recovery, dependent upon projection results (raw water quality data)
- system flux of 15 gfd
- stage 1 flux of 17.5 gfd
- stage 2 flux of 10.0 gfd
- antiscalant addition (per projections using raw water quality data)
- acid addition (per projections using raw water quality data)

The flow meters and the chemical pumps shall be set as described in Table 1. The flow settings shall be checked and maintained at the target values during the experiment.

Table 1. Array Pilot Settings

Parameter	Unit	
Stage 1 permeate	gpm	12.8
Stage 2 permeate	gpm	3.6
Stage 2 concentrate	gpm	2.9
Antiscalant metering pump*	mL/min (gpd)	TBD
Acid metering pump	mL/min (gpd)	TBD

* Antiscalant solution is made up of 2 liters of 100% Antiscalant solution in 30 gallons of water

Note that the operating settings may be adjusted as needed during the pilot study to optimize the operation of the reverse osmosis membrane system.

Fouling will be assessed based on declines in mass transfer coefficients (MTC) and increases in headloss along the membranes feed side. REI will calculate all required operational parameters based on field data collected. REI will provide data-collection sheets and spreadsheets for guidance in required informatory and for ease in transmitting data (sheets attached).

5.0 DATA COLLECTION

A basic flow diagram of the two-stage system that will be used is shown in Figure 1. Monitoring and/or sampling points have been identified by the numbers shown, and are described in Table 2. Data collection will consist of on-site readings, on-site analysis and laboratory analysis as follows.

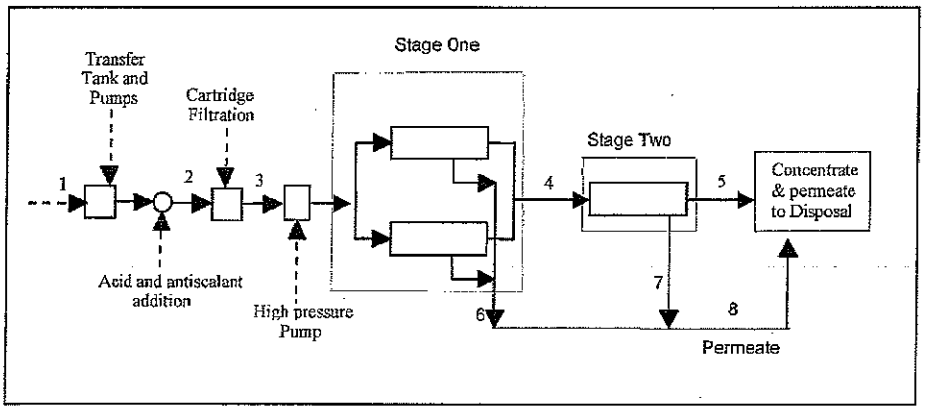


Figure 1. Pilot Plant Sampling and Monitoring Locations

Table 2. Pilot Plant Sampling and Monitoring Locations

Number	Description
1	Raw water
2	Pre-filter
3	Post-filter/RO Feed
4	Stage 1 concentrate
5	Stage 2 concentrate
6	Stage 1 permeate
7	Stage 2 permeate
8	Combined permeate

5.1 On-site Data Collection

On-site data will be collected to monitor pilot settings and performance as shown in Table 3. Data Sheets 1 and 2 (attached) will be used to record and track on-site data for the pilot, including flow and pressure readings and daily analyses, respectively. The data will be entered into a spreadsheet and transmitted to REI for archiving and interpretation at least two times per week.

Table 3. Sampling Matrix

Parameter	Sampling Frequency
Readings	
Flows	2D
Pressures	2D
Temperature	2D
Analysis	
TDS (Conductivity)	1D
pH	1D
Turbidity	1D
Silt density index	1W

1D – Once Daily, 2D – Twice Daily, once in the morning & once in the afternoon, 1W – Once Weekly

Chemical feed storage tank levels and refilling activities will be monitored and reported on Data Sheet 3 as follows:

- read and record level of tanks daily,
- read and record level of tank before adding new chemicals,
- record volume of chemical added, strength and dilution volumes,
- read and record level of tank after adding chemical

5.2 Off-site data

In addition to on-site readings and analysis, samples will be collected on a monthly basis for analysis of specific parameters as shown on Data Sheet 4. The Manatee County laboratory or an off-site contract laboratory for the County will conduct the analyses.

5.3 Logbook

A Pilot Study Logbook will be maintained on-site to record all operational changes, conditions, and observations, including, but not limited to, the following:

- The date and time of membrane cleaning and a detailed description of the cleaning procedure (i.e. cleaning agent, volume of cleaning solution, duration of cleaning, etc.),
- Process upsets that could affect performance (e.g. pretreatment failure, a major change in water quality, operator error, etc.),
- Replacement and specification of cartridge filters and membrane elements or any other system components,
- Any change in the system's operating parameters, and
- Any time that the system is shut down.

Operations personnel will enter all activities in this logbook that might be considered of importance in interpretation of pilot results. Logbook entries will be transcribed into the pilot spreadsheet (MS Excel) and transmitted to REI at least twice per week.

6.0 MANPOWER

A coordinated effort is required to effectively monitor pilot performance. Personnel from M&C will be on-site one 5 days per week. M&C shall provide daily support as follows:

- On-site time of at least 2 hours per day, 5 days per week is required.
- This person will take manual readings and make basic measurements while on-site.
- This person will be in charge of collecting samples, adjusting valves and flow rates to meet operational objectives, preparing pretreatment chemicals, entering readings and measurements into a spreadsheet, and serve as the primary contact regarding pilot operations.
- Should any problem arise which cannot be readily rectified, REI should be notified immediately.

Data Sheet 1. Flow & Pressure Template for Membrane Pilot

PROJECT: MANTEE COUNTY - GROUNDWATER PILOT STUDY - NORTH SITE
FIELD DATA COLLECTION

Time		Temp (F)	Reverse Osmosis Flow (gpm)				Cartridge Filter Pressure (psi)		Reverse Osmosis Pressure (psi)					
Date	Time	Feed	Recycle	Conc	Stage 1 Permeate	Stage 2 Permeate	Pre-Filter	Post Filter	System Feed	System Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Combined Perm.

Data Sheet 2. Daily and Weekly Analyses Template for Array Pilot

PROJECT: MANTEE COUNTY - GROUNDWATER PILOT STUDY - NORTH SITE
FIELD DATA COLLECTION

Time		Turbidity (NTU)					pH (SU)						Conductivity (uS/cm)					
Date	Time	Feed	Conc.	Stage 1 Permeate	Stage 2 Permeate	Combined Perm.	Raw feed	feed	Conc	Stage 1 Permeate	Stage 2 Permeate	Combined Perm	Feed	Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Combined Perm.

Data Sheet 3. Chemical Tank Monitoring Template

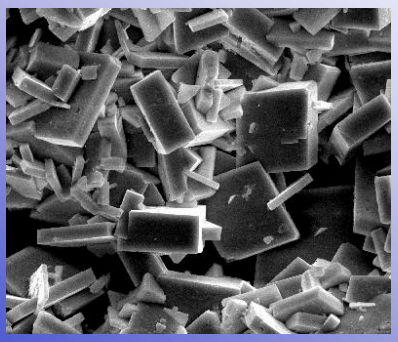
PROJECT: MANTEE COUNTY - GROUNDWATER PILOT STUDY - NORTH SITE
FIELD DATA COLLECTION

Time		Chemical Tank Levels		Comments
Date	Time	Sulfuric Acid Tank Level (gal)	Antiscalent Tank Level (gal)	Specify quantities of chemicals added and quantities of water

Data Sheet 4. Water Quality Laboratory Analysis

Parameter	Raw	Pretreated NF Feed Water	Stage 1 Permeate	Stage 2 Feed	Stage 2 Permeate	Stage 2 Concentrate	System Permeate
Location	1	4	7	5	8	6	9
Total Alkalinity	W	W	W		W	W	W
Total Hardness	W	W	W		W	W	W
TDS–gravimetric	3	3				3	3
Conductivity	W	W					W
Arsenic	3	3				3	3
Nitrate	3	3				3	3
Calcium Hardness	W	W				3	W
Magnesium Hardness	W	W				3	W
Iron	W	3				3	3
Manganese	3	3				3	3
Sodium	3	3				3	3
Chloride	3	3				3	3
Sulfate	3	3				3	3
Fluoride	3	3				3	3
Aluminum	3	3				3	3
Barium	3	3				3	3
Strontium	3	3				3	3
Silica	3	3				3	3
Potassium	3	3				3	3
Total Coliform	3	3				3	3
Total Organic Carbon	W	3				W	W
True Color	W	3				W	W

W – weekly, D – daily, 3 - Three sampling events during study



Foulant Analysis

Completed for:

Reiss Environmental

November 2007

102407-2reiss

avista technologies

INTRODUCTION & RESULTS

A fouled cartridge filter was received at the laboratory for analysis. The filter was coated with orange and black colored deposits (See photo in Appendix A, Figure 1) It was requested that the chemistry of the solids be determined. Solids were analyzed by SEM/Energy Dispersive X-ray Analysis to determine the chemical constituents. The following report summarizes the analytical results.

Materials and Method:
The sample labeled as follows was analyzed by SEM/EDS.

Scanning Electron Microscopy /Energy Dispersive X-ray Analysis (SEM/EDS)

In this technique, an electron microscope with an energy dispersive X-ray spectrometer is used for analysis. The electron beam in the microscope causes specimens to emit x-rays including those from the k, l and m atomic shells. Spectrometer counts of these x-rays, which are said to be "characteristic" of the elements present in the specimen, can be used to calculate composition for a full qualitative analysis. The analysis is non-destructive and is accurate to ~ 1 %.

*This technique determines the elements (**like Si, O, Ca, Fe, etc**) present in the powder sample*

Results and Discussion:
Elemental composition is shown in the following Table.

Elements (wt. %)	Fouled Cartridge Filter
Carbon	9.7
Oxygen	18.4
Sodium	0.5
Magnesium	<0.2
Aluminum	<0.1
Silicon	<0.1
Sulfur	23.1
Phosphorous	0.5
Calcium	1.6
Potassium	<0.2
Titanium	<0.2
Iron	45.6

The foulant is iron sulfide. An SEM image of foulant is included in Appendix A, Figure 2.

APPENDIX A

Figure 1: Digital photo of fouled cartridge filter.

APPENDIX A

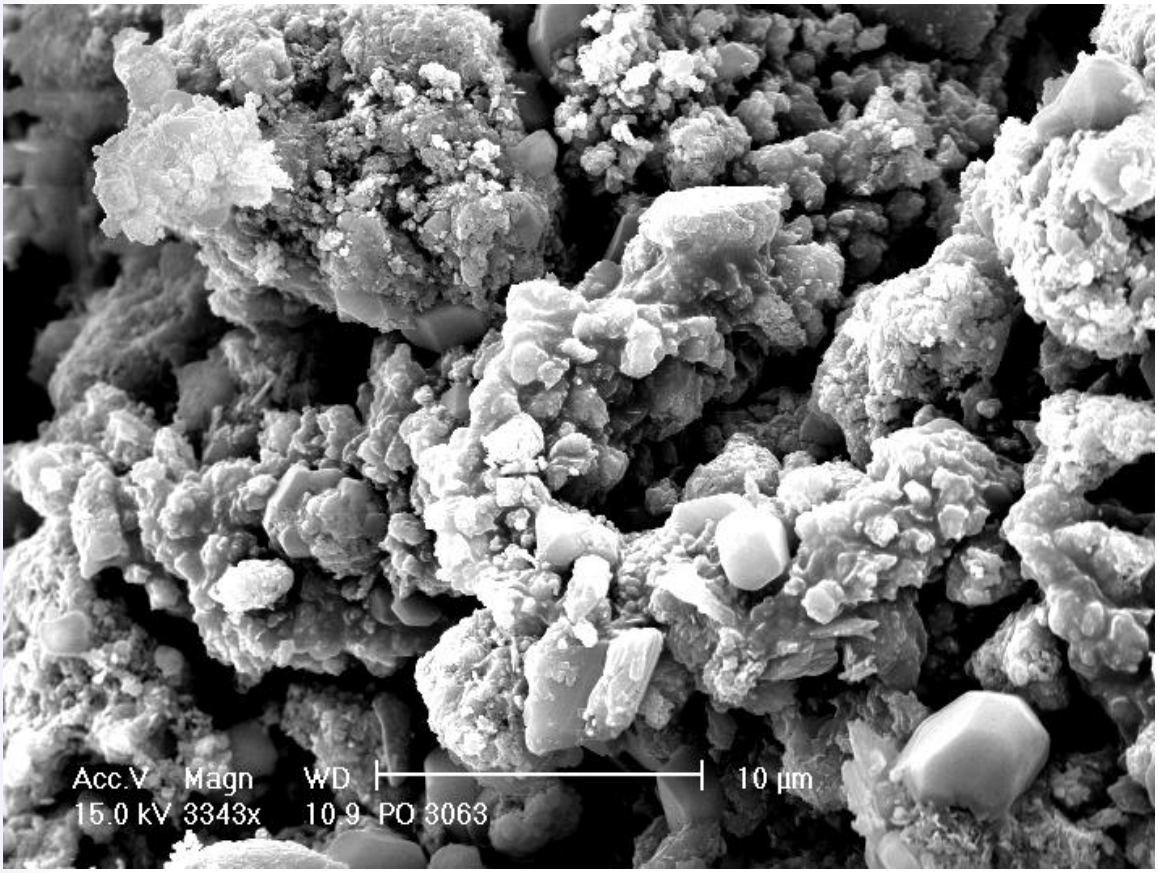


Figure 2: SEM image of foulant @ 3343x.

APPENDIX B

SDI PAD AUTOPSY

AEROTECH P&K
An Affiliate of Severn Trent Laboratories, Inc.

McKim & Creed
1365 Hamlet Avenue
Clearwater, FL 33756

Attention: Ann Rocke
STL Job #: 760-707-0004
Billing Ref: Membrane Analysis

July 18, 2007

Dear Ann,

Please find enclosed nine (9) SEM photomicrographs, nine (9) EDX spectra, and two (2) FTIR spectral printouts collected from the sample membrane submitted for SEM/EDX and FTIR analysis.

METHODS:

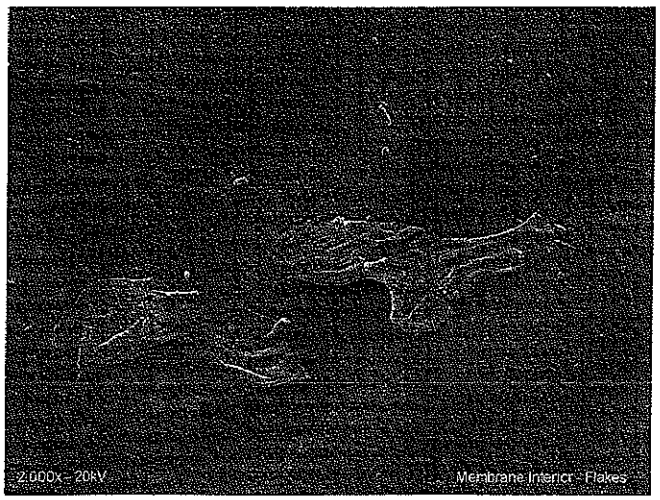
The tube containing the sample membrane was sectioned and opened. A portion of the enclosed membrane was then removed, cut into strips, and dried in a low temperature drying oven in order to remove ambient moisture from the sample. A portion of the enclosed SDI filter was similarly dried, resulting in the material visible on the surface of the filter turning a reddish brown. A portion of the dried membrane was then freeze fractured after exposure to liquid nitrogen in order to preserve the underlying pore structure and morphology. A portion of the SDI filter and fractured membrane were then placed on an aluminum analysis stub using adhesive carbon impregnated conductive tape. These sample mounts were then coated with evaporated graphite, which improves imaging quality and resolution. The material was then examined for surface features and incident particles under the SEM. Photomicrographs were taken in order to document morphology of areas of interest. In addition, EDX spectroscopy was used in order to determine the elemental composition of the documented areas.

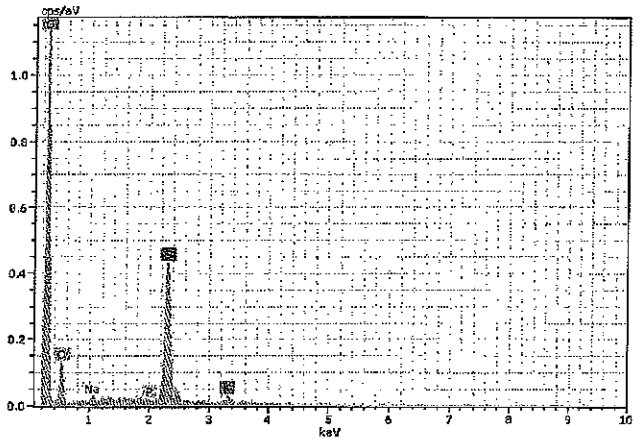
For the FTIR examination, a portion of the dried membrane material was sectioned and placed against a ZnSe prism with a clamping mount. The IR sampling beam was then directed through the prism in the instrument chamber, allowing for a surface scanning ATR spectrum to be collected from any organic material within a few microns of the interior membrane surface. This reflection spectrum was then collected, corrected for spectral path length variance, and compared against samples in our reference library. Potential matches and peak-by-peak analysis was used in order to highlight areas of spectral activity in the sample spectrum.

FINDINGS:

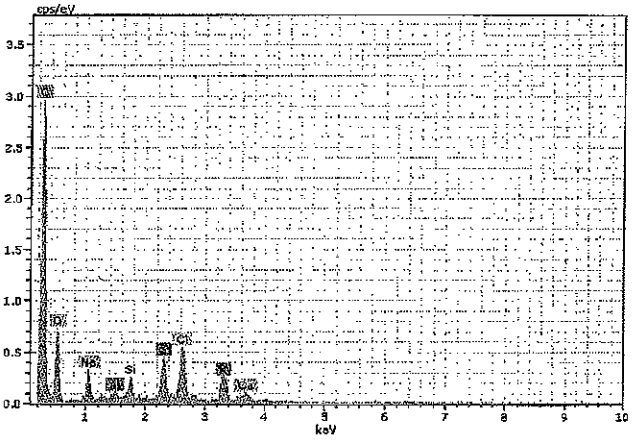
Please refer to the individual photomicrographs and spectra. The bulk of the interior of the membrane surface appears to be largely free of consistent defect, impacted particles, or discrete fouling layers. The material appears to show a

smooth, finely porous surface similar to reference membranes examined of a similar manufacture in the past. There were a number of areas where there appeared to be organic flakes, small folds or materials that resembled the membrane



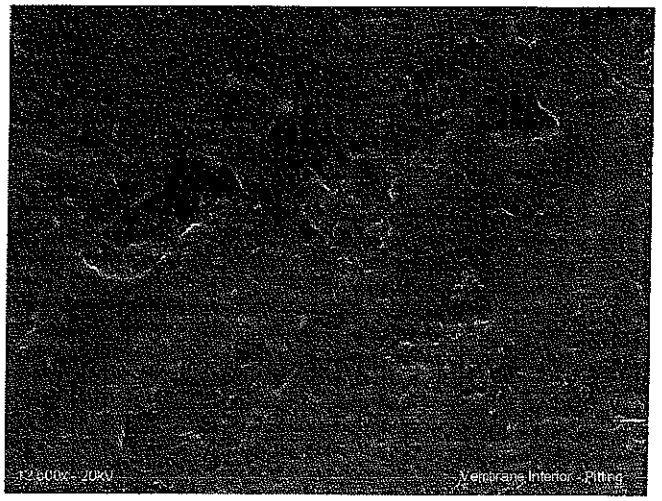


polymer surface, and areas where the surface of the membrane had been altered. Many of these particles appeared to be organic in nature, often with evidence of pressure related denaturation or deformation. These flat, organic appearing particles could also be commonly attributed to pressure alteration or manufacturing alteration of the membrane itself. In most cases, these particles were under a hundred microns, and were likely not significant in occluding the membrane from proper water flow. Sulfur, carbon and



oxygen were detected throughout these samples. Some samples showed signs of trace amounts of potassium, sodium, chlorine, phosphorous or calcium. These sorts of elements are common in organic particles previously exposed to water, and represent a mixture of cellular residue and electrolytes from the water source. Other than deformation and flattening due to pressure, these particles did not appear to be especially strongly adhered to the membrane surface.

The membrane surface itself showed some signs of wear, though the overall pore structure of the surface appeared to be largely intact. Some rare areas appear to show some granularization and porosity in excess of the norm, though these areas, once again were sporadic and only showed a small amount of penetration into the surface. The overall chemistry of the sample membrane surface was as expected a mixture of carbon, sulfur and oxygen. This chemistry reflects the base polymer membrane material, and appears to be present without alteration, other than trace amounts of sodium, chlorine, calcium and potassium. These traces,



similar to the organic particles noted above, appeared to be independent of any individual particulate materials, and reflect a certain amount of salt material that has been isolated and in the membrane.

The FTIR examination of the membrane showed that the surface of the membrane returned a strong, easily resolvable spectrum, indicating that the surface was overall smooth, and free of dispersive features. The spectrum from the membrane was an excellent match with reference poly-sulfone membrane materials examined in the past. There were only a few extraneous peaks present on the membrane sample that did not correlate with the base membrane material. These peaks, around 1660, 1530 and 700 wave numbers, likely represent a light loading of unsaturated aliphatic hydrocarbon. The peak near 1660 might also be due to a conjugated ketone or aldehyde, but the other peaks present in the material do not support additional aromatic or heterocyclic groups other than those present in the poly-sulfone material itself. These additional peaks likely represent either a slight oxidation of the membrane material itself, or perhaps a skim coating of aliphatic hydrocarbon, potentially either as an oil residue, or perhaps from some of the discrete organic materials present. In either case, any organic material present is likely only in small quantities, as the bulk of the returned spectral data appeared to be from the membrane itself.

The SDI filter showed a wide variety of densely packed crystalline and inorganic mineral forms. Prevalent in the filter material were aluminum silicate and quartz family mineral grains, metallic iron fragments and iron rich salts, as well as calcium carbonate and oxide formations. The majority of the material examined appeared to be contributed by salts and precipitates, based

on the size and arrangement of particles. These precipitates appeared to be concentrated from material that precipitated and was later collected on the filter surface, rather than forming as water evaporated from the filter. There were additional metallic iron fragments noted in the material, as well as mineral grains. These materials however, appeared to be the minority constituent in the mixture. Also noted were a number of calcium and sulfur crystals with needle-like fragments, similar to gypsum crystals. Several individual crystals and phases are included in the appendix to indicate the breadth of particulate material present in the SDI filter. Elemental mapping has also been included in order to document the relative distribution of particles in some areas. Due to the inorganic material that appeared to comprise the bulk of the sample, FTIR examination was not performed on the SDI filtrate material.

DISCUSSION:

The membrane surface itself appears to be largely free of any consistent fault, defect, or sign of fouling. The membrane shows intermittent signs of stress and deformation of the membrane pores. However, due to increased water pressure, mechanical disturbances during handling, preparation, and manufacturing, and the addition of sulfuric acid, none of the areas which showed some variation from normal pore structure and surface texture appeared out of the ordinary. Smooth, clear membrane surface reflected the bulk of the examined areas. The particles that were detected on the surface that could not be attributed to fragmentation of the membrane housing during preparation appeared to be discrete mineral, salt, or denatured organic particulate materials that did not appear to be strongly adhered to the membrane, nor did they appear to be forming a significant obstacle to water flow. Organic chemical examination of the membrane showed only slight, largely insignificant variations from poly-sulfone membrane standards. These variations might represent a small amount of organic material being present on the membrane, but could also be variation in manufacturing lots, due to exposure to acidic and high pressure environments, or due to alterations in formula since the time of the reference standards acquisition. Other than small, localized disturbances, the membrane appears to be free of fouling and chemical contamination, showing only trace amounts of salts commonly expected to be present in a filtration application.

The material present on the SDI filter appears to represent a host of different calcium and iron based salts, along with some fragments of metallic iron and mineral material. These particles represent a large amount of crystallized material, and very few solid mineral grains or clay amalgams that might form particulate that might bind on the surface of the purification membrane. The variety and preponderance of salts involving both iron and calcium indicate that there is likely a high concentration of both either in the source water, or in the water as influent to the membrane. Weather this is due to treatment of the water with anti-scaling chemicals, due to rich mineral content in the source, or a combination of both is unknown. While there is very little discrete mineral material present, the filtrate does appear to have a very granular, silt like consistency as observed on the filter. While this material does not appear to have fouled the membrane to any appreciable degree, it is likely a factor in increasing load on the membrane, and thereby decreasing efficiency.

Based on narrative communication with the submitting client, it appears that, while the membrane does not appear to be fouling or losing functionality, there does appear to be a persistent formation of a silt like material. This formation is occurring after the membrane stage of purification, and is likely interfering with ongoing water purification efforts. After discussion that revealed that the material forming into a silt layer after membrane filtration was complete showed that the material was changing from a gray black to reddish brown on drying, and based on the number and variety of iron bearing particles seen on the SDI filter, it was determined that the root cause of this problem was likely iron oxide present in the FeO state forming in solution and precipitating into a solid. This material is then changing into a high oxidation state on exposure to air and drying. Unfortunately, there was no sample of this precipitate submitted, so this is merely informed conjecture. Examination of the precipitated silt, as well as the nature of the anti-scaling additive should be undertaken. Documentation as to weather the anti-scaling material was added to the source water filtered through the SDI filters submitted should also be made in order to assess any potential impact on the examined particles. Additionally, process diagrams of the additional chemical purification or separation steps should be submitted where possible in order to assess the likelihood that additional steps might be able to ease the burden on the poly-sulfone membrane. Submission and analysis of the raw inlet water to the system, before any treatment or additives would also be helpful, in order to document minerals, dissolved

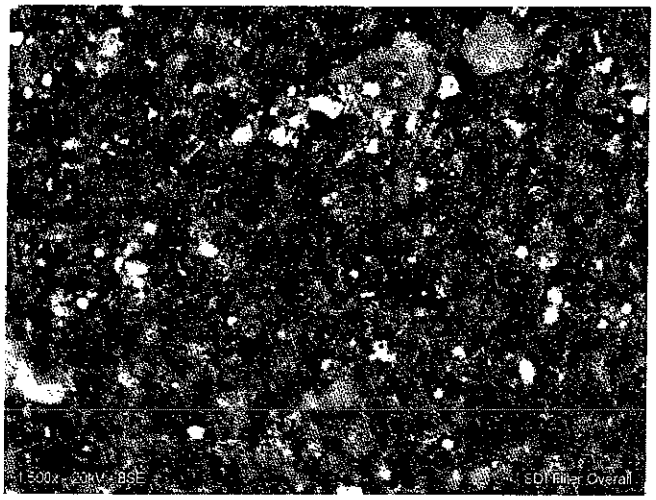
inorganics, metals, and particulate loading. Currently, the description of the scenario being described seems to indicate that the membrane is not removing all of the iron from the influent water, leaving a sufficient concentration in the effluent to cause spontaneous precipitation of iron oxide rich salts and solids in the water. This appears to be due to a higher than normal concentration of iron in the inlet water, rather than any fault or flaw in the membrane as examined. Ongoing analysis would likely assist in evaluating further steps at remediation. Ultimately, the current findings, analysis of raw water, anti-scaling materials, as well as the sediment should be conducted, consolidated and ultimately submitted for consideration to a process engineer at the originating membrane company. Examination of the suitability of this membrane for the used application and the examination of per-ion surface chemistry in purification applications is beyond the scope of this analysis.

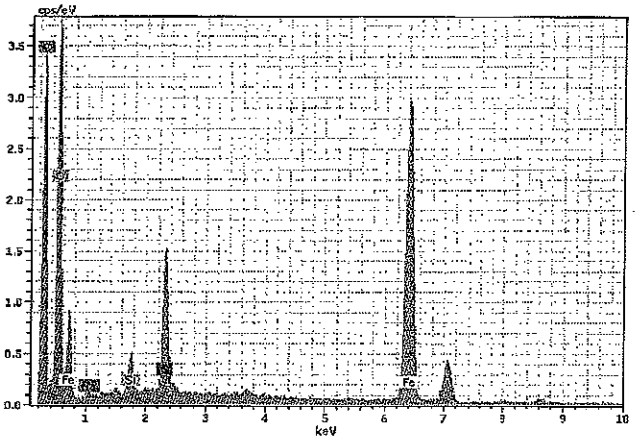
If you have any questions or need additional assistance, please contact me through client services at any time.

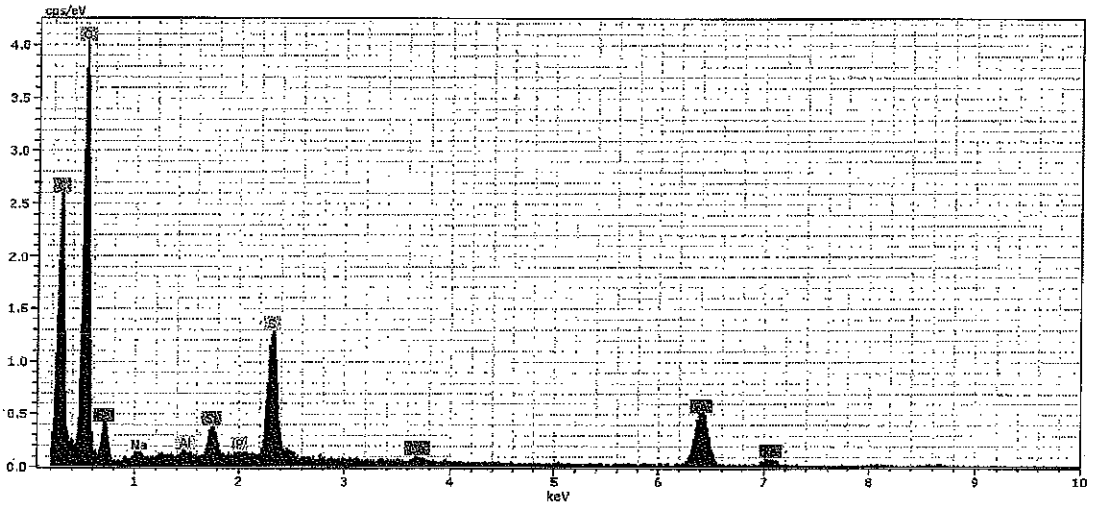
Sincerely,

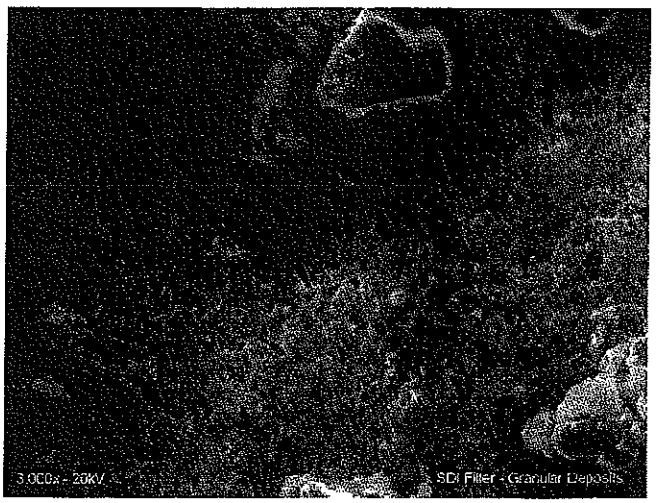
Jared Kelly
Analyst

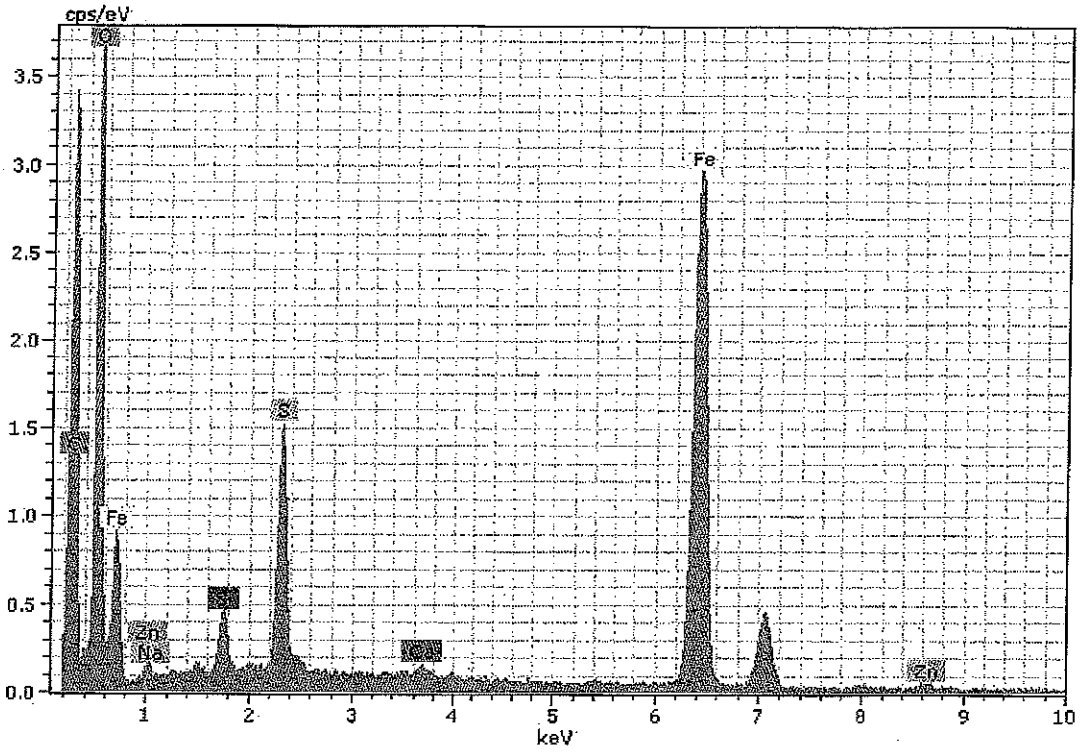
APPENDIX I: Collected SDI Filter Materials

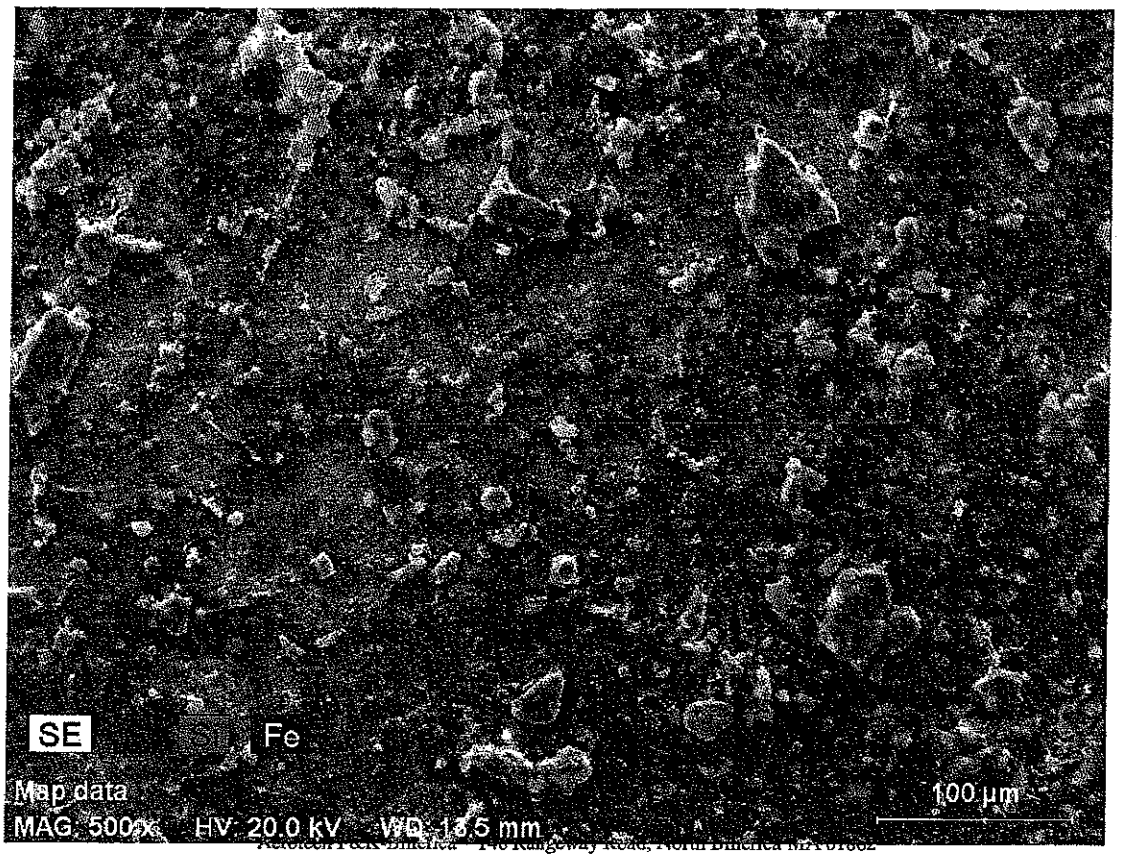


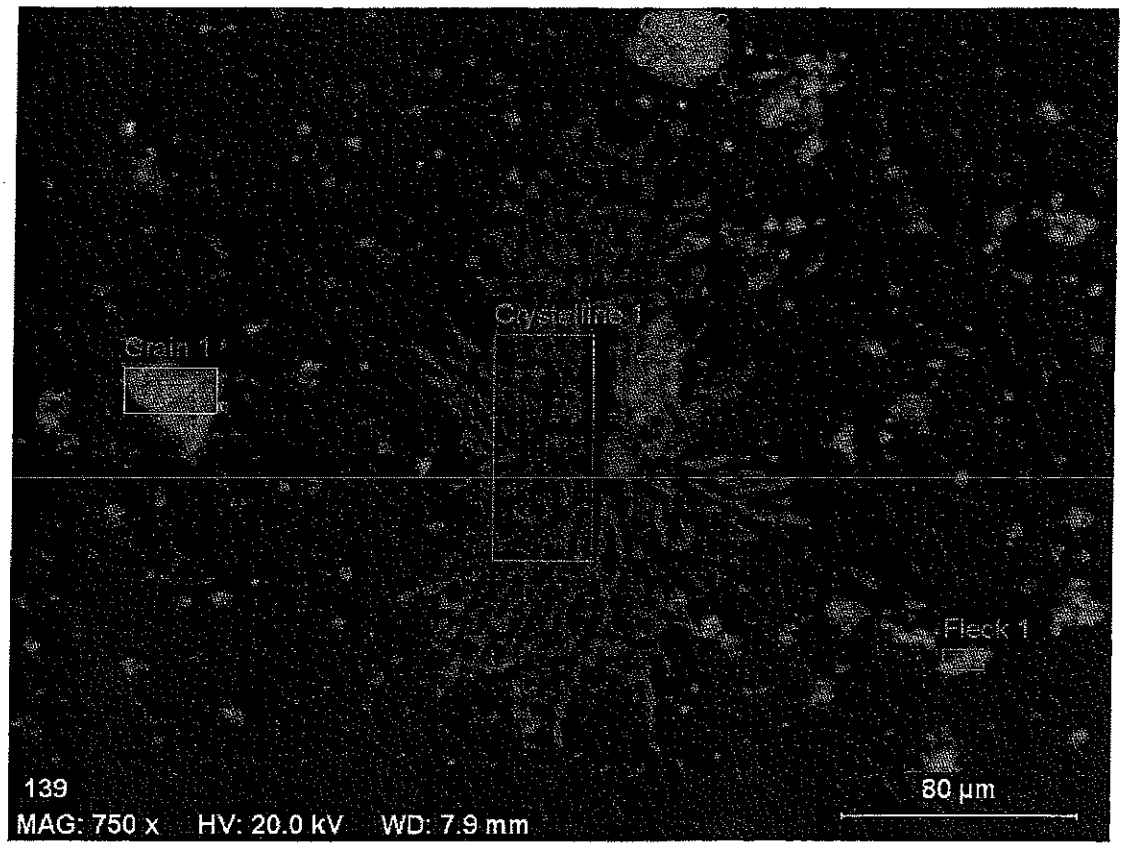


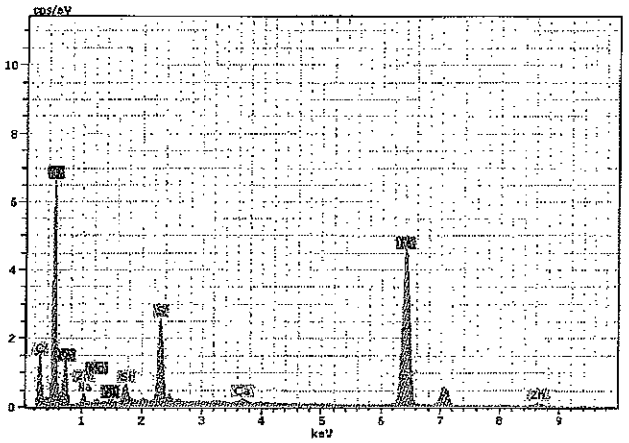


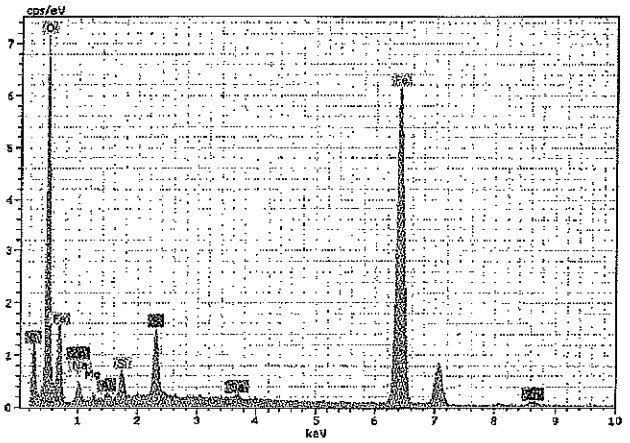


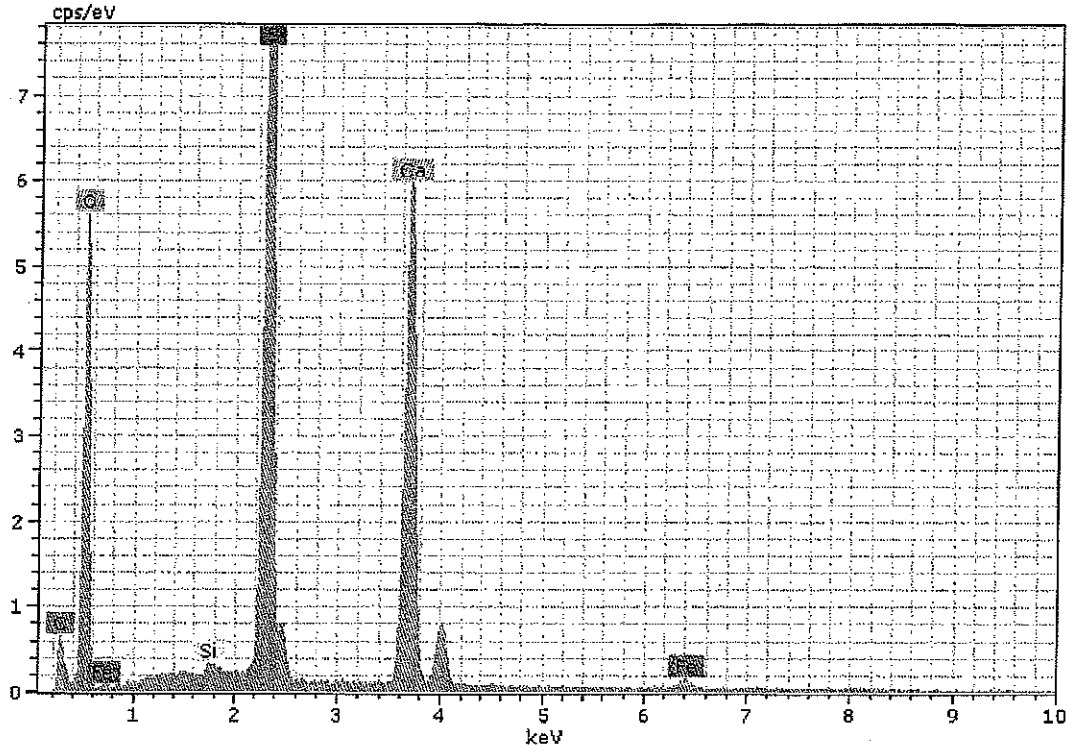

cps/eV
O
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Fe
S
Fe
Zn
Na
Zn
1
2
3
4
5
6
7
8
9
10
keV

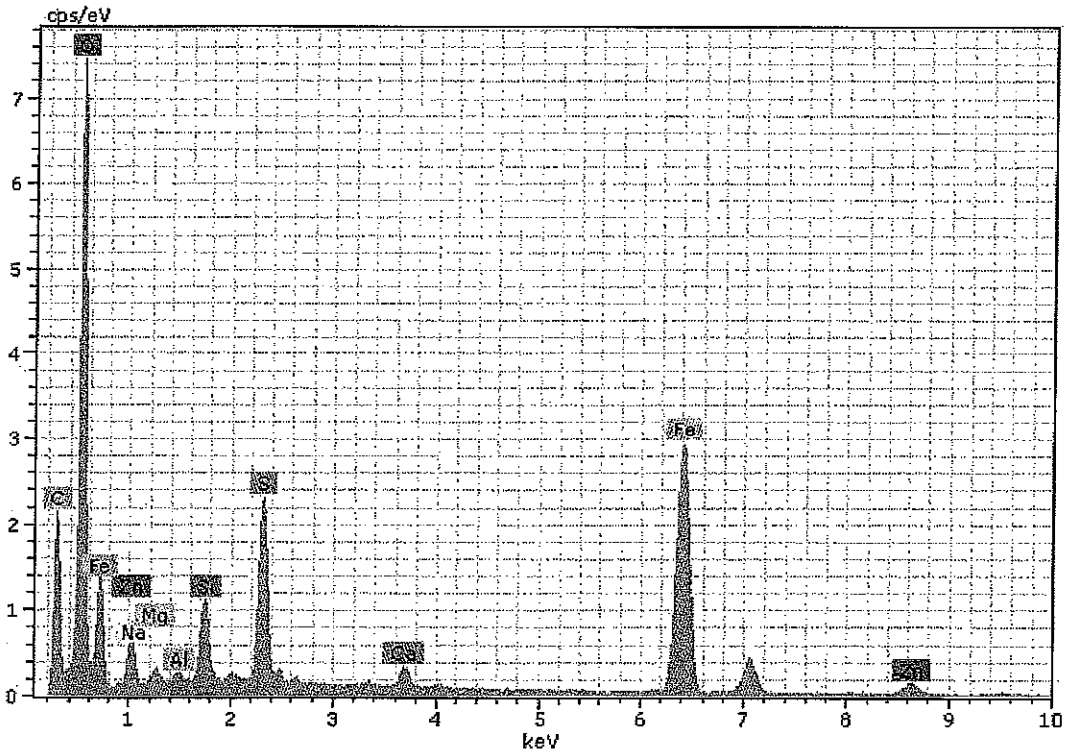

SE
Fe
Map data
MAG: 500x HV: 20.0 kV WD: 13.5 mm
100 µm

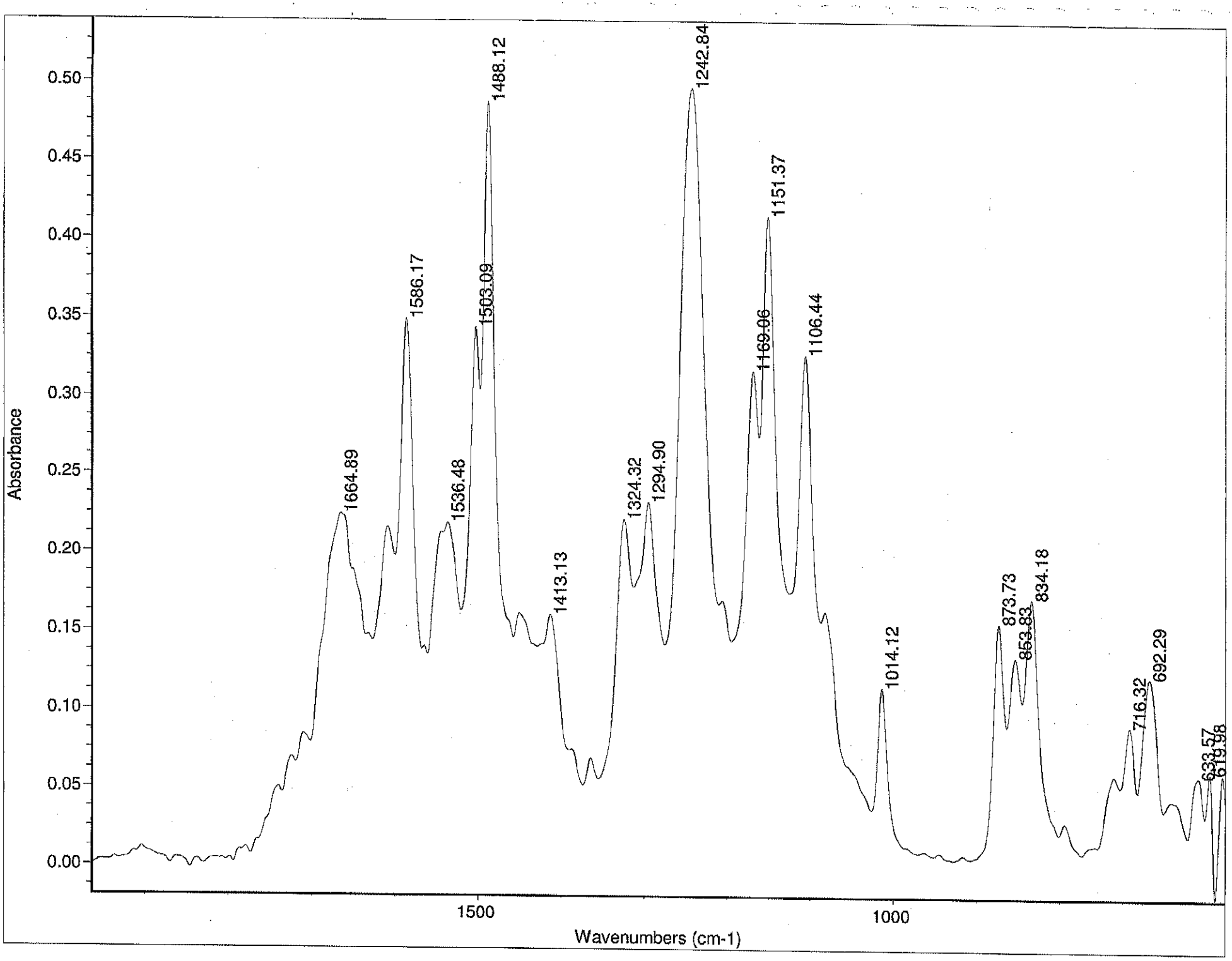

Crystalline 1
Grain 1
Fleck 1
139
MAG: 750 x HV: 20.0 kV WD: 7.9 mm
80 µm

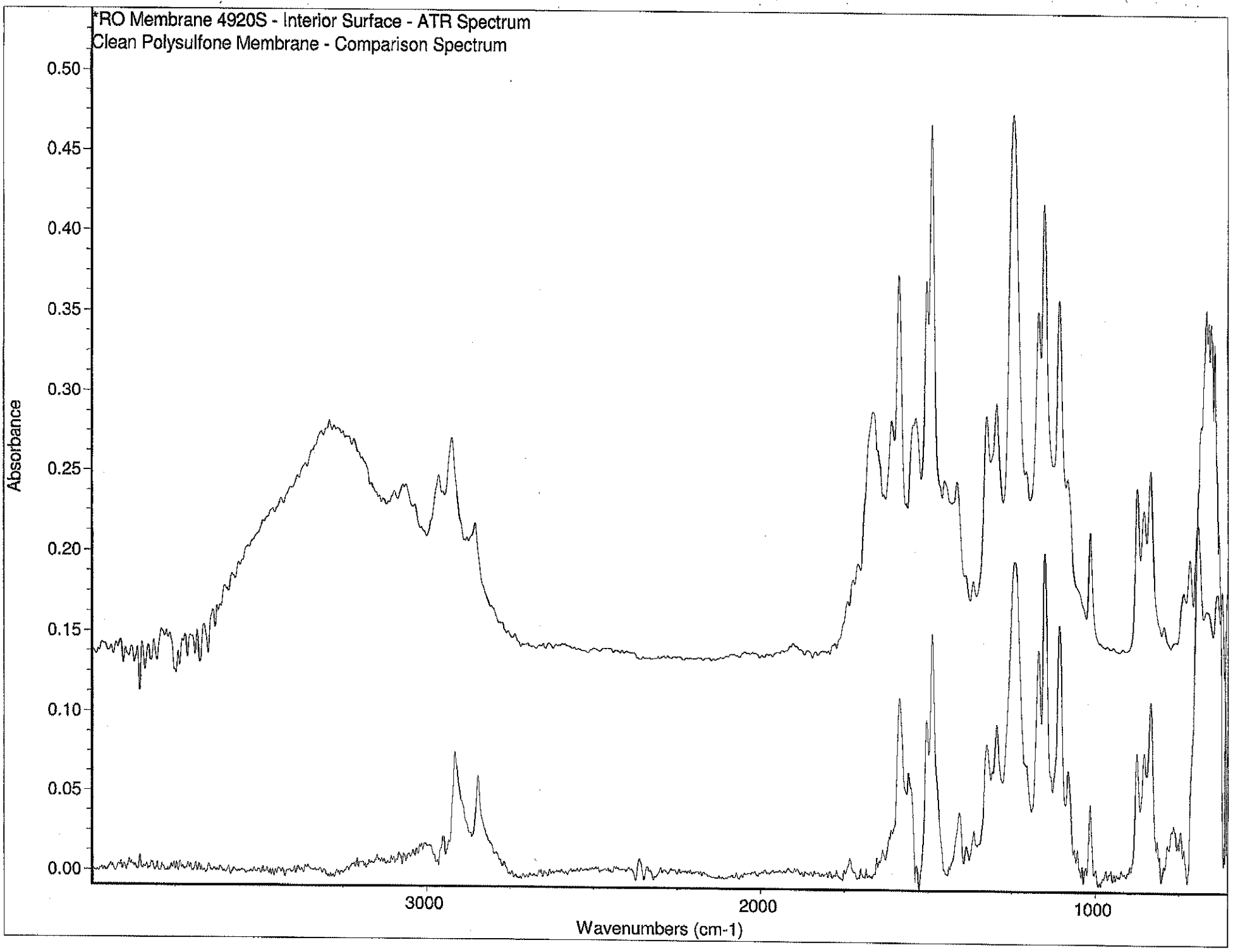

cps/eV
keV


cps/eV
keV


cps/eV
O
Ca
Si
Fe
keV


cps/eV
O
Ca
Fe
Cl
Fe
Si
Mg
Na
Al
Si
Ca
Fe
keV


Absorbance
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1664.89
1586.17
1536.48
1503.09
1488.12
1413.13
1324.32
1294.90
1242.84
1169.06
1151.37
1106.44
1014.12
873.73
853.83
834.18
716.32
692.29
633.57
619.98
1500
1000
Wavenumbers (cm-1)


*RO Membrane 4920S - Interior Surface - ATR Spectrum
Clean Polysulfone Membrane - Comparison Spectrum
Absorbance
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3000
2000
1000
Wavenumbers (cm-1)

APPENDIX C

PARTICLE SIZE DISTRIBUTION

	Particle Sizes												Totals
Sample ID	2 - 3um	3 - 4um	4 - 5um	5 - 6um	6 - 7um	7 - 8um	8 - 9um	9 - 10um	10 - 20um	20 - 30um	30 - 40um	40 - 50um	
Raw Feed	5110.1	419.7	153.8	7.3	3.9	1.5	0.4	1.0	1.5	0.4	0.1	0.0	5699.6
Post Chem	28.3	2.5	3.4	1.6	1.5	0.7	0.3	0.2	1.7	0.0	0.0	0.0	40.3

APPENDIX D

FIELD DATA

PROJECT: MANATEE COUNTY- GROUNDWATER PILOT STUDY
FIELD DATA COLLECTION

Time		Temp (F)	Reverse Osmosis Flow (gpm)			Cartridge Filter Pressure (psi)		Reverse Osmosis Pressure (psi)					Turbidity (NTU)			pH (SU)				Conductivity (uS/cm)					
Date	Time	Feed	Conc	Stage 1 Permeate	Stage 2 Permeate	Pre-Filter	Post Filter	System Feed	System Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Feed	Post CF	Combined Perm.	Raw feed	feed	Conc	Combined Perm	Feed	Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Combined Perm.
5/22/2007	11:30	84	2.9	12.8	3.6	45.6	45.2	68.0	45.0	54.0	7.0	9.8	0.17	0.13	0.06		6.0	6.6	5.8	1,126	4,330	2,690	164	517	250
5/22/2007	14:00	84	2.9	12.6	3.6	45.3	45.0	68.0	45.0	54.0	6.5	9.2	0.11	0.08	0.04	7.5	6.1	6.6	5.8	1,118	4,620	2,680	164	517	252
5/22/2007	15:53	84	2.9	12.5	3.6	45.4	45.2	69.0	45.0	54.0	6.5	9.1	0.15	0.15	0.05	7.5	6.1	6.6	5.8	1,123	4,370	2,680	163	517	250
5/23/2007	9:22	83	2.8	12.8	3.6	46.0	45.1	77.0	43.0	54.0	7.9	7.5	0.08	0.07	0.1	7.5	6.1	6.8	5.8	1,127	4,840	2,700	163	525	250
5/23/2007	11:19	83	2.8	12.8	3.5	45.9	45.0	77.0	42.0	54.0	7.3	6.9													
7/30/2007	13:05	83	2.9	12.8	3.6	42.5	41.0	74.0	46.0	57.0	6.8	6.5	0.15	0.13	0.09	7.3	6.3	6.8	5.9	1,060	4,420	2,540	134	553	199
7/30/2007	16:28	83	2.9	12.8	3.6	42.9	41.2	73.0	46.0	57.0	6.0	9.0								1,060	4,420	2,540	134	553	199
7/31/2007	8:00	83	2.9	12.8	3.6	43.0	41.8	73.0	46.0	57.0	6.8	10.0	0.15	0.13	0.08	7.3	6.4	7.0	6.0	1,058	4,480	2,480	127	542	200
7/31/2007	10:20	83	2.9	12.8	3.6	47.0	46.3	73.0	46.0	57.0	7.0	10.0								1,058	4,480	2,480	127	542	200
8/1/2007	8:00	83	2.9	12.8	3.6	47.4	47.0	74.0	47.0	57.0	7.9	11.0	0.09	0.08	0.06	7.3	5.9	6.8	5.6	1,060	4,490	2,510	122	396	191
8/1/2007	12:00	83	2.9	12.8	3.6	46.0	45.7	74.0	47.0	57.0	6.9	10.0								1,060	4,490	2,510	122	396	191
8/2/2007	9:30	83	2.9	12.8	3.6	45.5	45.0	75.0	48.0	60.0	7.2	11.0	0.12	0.09	0.07	7.4	6.0	6.7	6.3	1,050	4,280	2,440	103	343	163
8/2/2007	12:30	83	2.9	12.8	3.6	45.0	44.5	75.0	48.0	60.0	7.0	10.8								1,050	4,280	2,440	103	343	163
8/3/2007	7:30	83	2.9	12.8	3.6	45.0	44.6	75.0	48.0	60.0	7.4	11.0								1,046	4,490	2,540	124	400	192
8/3/2007	9:45	83	2.8	12.8	3.6	44.5	44.0	75.0	48.0	60.0	7.3	10.9	0.12	0.11	0.06	7.3	6.1	6.5	5.8	1,046	4,490	2,540	124	400	192
8/4/2007	14:30	83	2.9	12.8	3.6	43.0	42.2	75.0	47.0	58.0	6.9	10.0								1,046	4,490	2,540	124	400	192
8/5/2007	14:45	83	2.9	12.8	3.6	43.3	42.3	75.0	47.0	58.0	6.9	10.0								1,046	4,490	2,540	124	400	192
8/6/2007	7:15	83	2.9	12.8	3.6	45.0	44.0	75.0	47.0	58.0	8.0	11.1	0.07	0.06	0.06	7.4	6.1	6.7	6.0	1,066	4,510	2,540	128	414	203
8/6/2007	9:30	83	2.9	12.8	3.6	44.6	43.6	75.0	47.0	58.0	7.9	11.1								1,066	4,510	2,540	128	414	203
8/7/2007	8:45	83	2.9	12.8	3.6	44.8	43.7	75.0	47.0	58.0	7.9	11.1	0.10	0.08	0.08	7.4	6.1	6.8	6.0	1,063	4,440	2,510	127	407	198
8/7/2007	10:45	83	2.9	12.8	3.6	44.0	43.0	75.0	47.0	58.0	7.4	11.0								1,063	4,440	2,510	127	407	198
8/8/2007	8:15	83	2.9	12.9	3.6	44.8	43.7	75.0	47.0	58.0	7.8	11.0	0.08	0.07	0.06	7.5	6.1	6.9	6.0	1,070	4,670	2,540	127	413	198
8/8/2007	11:34	83	2.9	12.8	3.6	44.7	43.6	75.0	47.0	58.0	7.0	10.1								1,070	4,670	2,540	127	413	198
8/9/2007	8:15	83	2.9	12.8	3.6	45.0	44.0	75.0	47.0	58.0	7.8	11.0								1,045	4,220	2,530	121	399	190
8/9/2007	10:30	83	2.9	12.8	3.6	44.0	43.0	75.0	47.0	58.0	7.5	11.0	0.14	0.12	0.09	7.6	6.4	7.0	6.1	1,045	4,220	2,530	121	399	190
8/10/2007	8:00	83	2.9	12.8	3.6	45.0	44.0	75.0	47.0	58.0	7.8	11.1	0.10	0.07	0.07	7.5	6.1	6.8	5.9	1,058	4,650	2,500	127	410	200
8/10/2007	13:00	83	2.9	12.8	3.6	43.5	42.4	75.0	47.0	58.0	6.6	10.0								1,058	4,650	2,500	127	410	200
8/11/2007	8:00	83	2.9	12.8	3.6	45.0	44.0	75.0	47.0	58.0	8.0	11.5								1,058	4,650	2,500	127	410	200
8/13/2007	8:00	83	2.9	12.8	3.6	45.0	44.4	75.0	47.0	59.0	7.9	11.3								1,045	4,600	2,400	109	388	179
8/13/2007	11:00	83	2.9	12.8	3.6	44.5	43.3	76.0	47.0	59.0	7.0	11.0	0.10	0.08	0.05	7.4	6.1	6.8	6.0	1,045	4,600	2,400	109	388	179
8/13/2007	13:00	83	2.9	12.8	3.6	44.0	43.0	76.0	47.0	59.0	6.9	11.1								1,045	4,600	2,400	109	388	179
8/14/2007	11:00	83	2.9	12.8	3.6	44.5	43.0	75.0	47.0	60.0	7.0	11.5	0.11	0.09	0.06	7.6	6.2	6.9	6.1	1,028	4,410	2,550	112	395	184
8/14/2007	13:00	83	2.9	12.8	3.6	44.5	43.0	76.0	49.0	60.0	7.0	11.8								1,028	4,410	2,550	112	395	184
8/15/2007	11:30	83	2.9	12.8	3.6	44.0	43.0	76.0	49.0	60.0	7.0	11.9	0.07	0.06	0.06	7.5	6.2	6.9	6.0	1,030	4,440	2,500	112	392	179
8/15/2007	13:30	83	2.9	12.8	3.6	44.0	43.0	76.0	49.0	60.0	7.0	11.5								1,030	4,440	2,500	112	392	179
8/16/2007	8:00	83	2.9	12.8	3.6	45.8	44.8	76.0	49.0	60.0	8.0	13.0	0.18	0.15	0.09	7.5	6.1	6.8	6.0	1,022	4,420	2,440	113	384	178
8/16/2007	10:00	83	2.9	12.8	3.6	45.2	44.0	76.0	49.0	60.0	7.9	12.9								1,022	4,420	2,440	113	384	178
8/17/2007	7:00	83	2.9	12.8	3.6	46.0	45.0	76.0	49.0	60.0	8.0	13.0	0.07	0.07	0.06	7.5	6.1	6.7	6.0	1,023	4,410	2,390	108	381	175
8/17/2007	9:00	83	2.9	12.8	3.6	45.5	44.4	76.0	49.0	60.0	8.1	13.2								1,023	4,410	2,390	108	381	175
8/19/2007	13:45	83	2.9	12.8	3.6	44.2	43.0	76.0	49.0	60.0	7.0	11.9								1,023	4,410	2,390	108	381	175

PROJECT: MANATEE COUNTY- GROUNDWATER PILOT STUDY
FIELD DATA COLLECTION

Time		Temp (F)	Reverse Osmosis Flow (gpm)			Cartridge Filter Pressure (psi)		Reverse Osmosis Pressure (psi)					Turbidity (NTU)			pH (SU)				Conductivity (uS/cm)					
Date	Time	Feed	Conc	Stage 1 Permeate	Stage 2 Permeate	Pre-Filter	Post Filter	System Feed	System Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Feed	Post CF	Combined Perm.	Raw feed	feed	Conc	Combined Perm	Feed	Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Combined Perm.
8/20/2007	7:30	83	2.9	12.8	3.6	45.8	44.5	76.0	49.0	60.0	8.0	13.0	0.07	0.06	0.06	7.3	6.1	6.8	5.9	1,039	4,210	2,460	106	372	171
8/20/2007	9:30	83	2.9	12.8	3.6	45.4	44.0	76.0	49.0	60.0	7.9	12.9								1,039	4,210	2,460	106	372	171
8/21/2007	7:15	83	2.9	12.8	3.6	46.0	45.0	76.0	50.0	60.0	7.9	12.9	0.07	0.06	0.06	7.5	6.1	6.8	5.9	1,026	4,270	2,450	110	380	176
8/21/2007	10:00	83	2.9	12.8	3.6	45.0	44.8	76.0	49.0	59.0	7.9	12.9								1,026	4,270	2,450	110	380	176
8/22/2007	7:00	83	2.9	12.8	3.6	45.8	44.2	76.0	49.0	59.0	8.0	13.0	0.10	0.06	0.05	7.5	6.1	6.8	6.0	1,022	4,460	2,480	107	387	170
8/22/2007	9:00	83	2.9	12.8	3.6	45.5	44.0	76.0	49.0	59.0	8.0	13.0								1,022	4,460	2,480	107	387	170
8/23/2007	7:45	83	2.9	12.8	3.6	45.9	44.2	76.0	49.0	60.0	8.0	13.0	0.10	0.06	0.06	7.5	6.1	6.8	6.0	1,046	4,610	2,530	112	391	180
8/23/2007	10:00	83	2.9	12.8	3.6	46.0	43.5	76.0	49.0	60.0	7.7	12.8								1,046	4,610	2,530	112	391	180
8/24/2007	8:05	83	2.9	12.8	3.6	45.8	44.4	76.0	48.0	59.0	7.6	12.9	0.09	0.07	0.05	7.5	6.1	6.8	6.0	1,024	4,470	2,460	107	384	172
8/24/2007	10:30	83	2.9	12.8	3.6	46.0	43.5	76.0	48.0	59.0	7.3	12.5								1,024	4,470	2,460	107	384	172
8/27/2007	9:00	83	2.9	12.8	3.6	45.4	44.0	76.0	48.0	59.0	7.9	13.0	0.08	0.07	0.06	7.5	6.2	6.8	6.0	1,023	4,550	2,460	107	382	174
8/27/2007	11:00	83	2.9	12.8	3.6	43.0	41.6	75.0	47.0	56.0	7.5	12.3								1,023	4,550	2,460	107	382	174
8/28/2007	7:30	83	2.9	12.8	3.6	44.0	42.5	74.0	47.0	58.0	7.9	12.8	0.07	0.08	0.05	7.5	6.2	6.7	6.0	1,025	4,410	2,410	110	381	176
8/28/2007	9:30	83	2.9	12.8	3.6	44.5	43.1	75.0	48.0	58.0	7.5	12.2								1,025	4,410	2,410	110	381	176
8/29/2007	16:00	83	2.9	12.8	3.6	42.0	40.6	75.0	47.0	58.0	6.2	11.0	0.08	0.09	0.07	7.5	6.2	6.7	6.0	1,022	4,420	2,430	104	373	172
8/29/2007	17:00	83	2.9	12.8	3.6	42.5	41.0	75.0	47.0	58.0	6.6	11.3								1,022	4,420	2,430	104	373	172
8/30/2007	7:30	83	2.9	12.8	3.6	43.9	42.4	75.0	47.0	58.0	7.5	12.5	0.08	0.07	0.07	7.5	6.1	6.8	6.0	1,037	4,480	2,490	110	389	178
8/30/2007	9:30	83	2.9	12.8	3.6	43.5	42.0	75.0	47.0	58.0	7.4	12.2								1,037	4,480	2,490	110	389	178
8/31/2007	16:15	83	2.9	12.8	3.6	42.5	41.0	75.0	47.0	58.0	6.5	11.2	0.11	0.07	0.05	7.5	6.1	6.8	6.0	1,034	4,340	2,470	106	373	177
8/31/2007	18:15	83	2.9	12.8	3.6	43.1	41.6	75.0	47.0	58.0	7.0	11.8								1,034	4,340	2,470	106	373	177
9/1/2007	13:00	83	2.9	12.8	3.6	42.1	40.6	75.0	47.0	58.0	6.4	11.1								1,034	4,340	2,470	106	373	177
9/2/2007	8:30	83	2.9	12.8	3.6	43.5	42.0	75.0	47.0	58.0	7.5	12.3								1,034	4,340	2,470	106	373	177
9/4/2007	10:00	83	2.9	12.8	3.6	43.0	41.5	75.0	47.0	58.0	7.0	12.0	0.07	0.07	0.07	7.5	6.1	6.7	6.0	1,037	4,430	2,440	109	370	173
9/4/2007	12:00	83	2.9	12.8	3.6	42.4	40.9	75.0	47.0	58.0	6.8	11.6								1,037	4,430	2,440	109	370	173
9/5/2007	7:00	83	2.9	12.8	3.6	43.9	42.4	74.0	47.0	58.0	7.4	12.4	0.07	0.06	0.05	7.6	6.2	6.8	6.0	1,038	4,450	2,440	106	384	176
9/5/2007	9:00	83	2.9	12.8	3.6	43.4	41.9	74.0	47.0	58.0	7.1	12.1								1,038	4,450	2,440	106	384	176
9/6/2007	7:00	83	2.9	12.8	3.6	44.0	42.4	75.0	47.0	58.0	7.9	12.6	0.08	0.07	0.05	7.5	6.1	6.8	6.0	1,044	4,470	2,480	108	374	175
9/6/2007	9:00	83	2.9	12.8	3.6	43.5	41.9	75.0	47.0	58.0	7.4	12.1								1,044	4,470	2,480	108	374	175
9/7/2007	8:00	83	2.9	12.8	3.6	43.4	41.8	75.0	47.0	58.0	7.4	12.1	0.07	0.06	0.05	7.5	6.1	6.8	6.0	1,038	4,480	2,440	107	387	176
9/7/2007	12:00	83	2.9	12.8	3.6	42.1	40.6	75.0	47.0	58.0	6.8	11.3								1,038	4,480	2,440	107	387	176
9/10/2007	6:30	83	2.9	12.8	3.6	43.4	41.9	74.0	47.0	58.0	7.4	12.3	0.07	0.06	0.05	7.5	6.1	6.8	6.0	1,038	4,480	2,430	109	371	173
9/11/2007	6:30	83	2.9	12.8	3.6	43.5	42.0	75.0	47.0	58.0	7.4	12.2	0.07	0.06	0.06	7.6	6.2	6.7	6.0	1,027	4,430	2,450	108	379	173
9/12/2007	7:30	83	2.9	12.8	3.6	43.7	41.9	74.0	47.0	58.0	7.3	12.1	0.07	0.07	0.06	7.6	6.2	6.8	6.0	1,056	4,500	2,490	108	386	179
9/12/2007	8:30	83	2.9	12.8	3.6	43.5	41.5	74.0	47.0	58.0	7.2	12.0								1,056	4,500	2,490	108	386	179
9/13/2007	6:00	83	2.9	12.8	3.6	43.9	41.1	74.0	47.0	57.0	7.3	12.1	0.09	0.07	0.07	7.5	6.2	6.8	6.0	1,052	4,360	2,500	110	392	180
9/13/2007	10:30	83	2.9	12.8	3.6	46.6	45.5	77.0	49.0	60.0	7.8	13.1								1,052	4,360	2,500	110	392	180
9/14/2007	7:30	83	2.9	12.8	3.6	47.0	46.0	77.0	49.0	60.0	8.0	13.5	0.10	0.07	0.06	7.5	6.0	6.7	5.9	1,036	4,610	2,480	106	382	173
9/14/2007	10:00	83	2.9	12.8	3.6	46.7	45.7	77.0	49.0	60.0	7.9	13.4								1,036	4,610	2,480	106	382	173
9/17/2007	7:00	83	2.9	12.8	3.6	46.8	45.8	77.0	49.0	60.0	7.9	13.3	0.08	0.09	0.05	7.6	6.1	6.7	6.0	1,038	4,580	2,520	108	392	178
9/18/2007	6:30	83	2.9	12.8	3.6	46.9	45.9	77.0	49.0	60.0	8.0	13.4	0.08	0.07	0.06	7.6	6.1	6.7	5.9	1,012	4,470	2,390	106	385	167
9/19/2007	7:00	83	2.9	12.8	3.6	47.0	46.0	77.0	49.0	60.0	7.9	13.3	0.08	0.07	0.06	7.5	6.1	6.7	6.0	1,057	4,650	2,520	108	394	171

PROJECT: MANATEE COUNTY- GROUNDWATER PILOT STUDY
FIELD DATA COLLECTION

Time		Temp (F)	Reverse Osmosis Flow (gpm)			Cartridge Filter Pressure (psi)		Reverse Osmosis Pressure (psi)					Turbidity (NTU)			pH (SU)				Conductivity (uS/cm)					
Date	Time	Feed	Conc	Stage 1 Permeate	Stage 2 Permeate	Pre-Filter	Post Filter	System Feed	System Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Feed	Post CF	Combined Perm.	Raw feed	feed	Conc	Combined Perm	Feed	Conc.	Stage 1 concentrate	Stage 1 Permeate	Stage 2 Permeate	Combined Perm.
9/20/2007	6:00	83	2.9	12.8	3.6	47.1	46.0	77.0	49.0	60.0	8.0	13.3	0.17	0.12	0.08	7.6	6.1	6.7	5.9	1,069	4,630	2,580	111	404	184
9/21/2007	6:00	83	2.9	12.8	3.6	47.1	46.0	77.0	49.0	60.0	7.9	13.2	0.09	0.07	0.06	7.6	6.1	6.7	5.9	1,055	4,670	2,560	110	387	180
9/21/2007	10:00	83	2.9	12.8	3.6	46.6	45.5	77.0	49.0	60.0	7.8	13.0								1,055	4,670	2,560	110	387	180
9/24/2007	6:30	83	2.9	12.8	3.6	47.4	45.9	77.0	49.0	60.0	8.0	13.1	0.07	0.09	0.05	7.6	6.1	6.7	6.0	1,062	4,640	2,510	112	380	180
9/24/2007	9:00	83	2.9	12.8	3.6	47.0	45.2	77.0	49.0	60.0	7.9	13.0								1,062	4,640	2,510	112	380	180
9/25/2007	7:00	83	2.9	12.8	3.6	47.2	45.7	77.0	49.0	60.0	7.9	13.1	0.11	0.10	0.06	7.6	6.2	6.7	6.0	1,068	4,650	2,570	112	390	182
9/26/2007	6:00	83	2.9	12.8	3.6	47.1	45.0	77.0	49.0	60.0	7.9	13.0	0.08	0.07	0.07	7.5	6.1	6.6	5.9	1,056	4,380	2,520	113	382	184
9/26/2007	12:00	83	2.9	12.8	3.6	45.8	43.7	77.0	49.0	60.0	7.0	12.0								1,056	4,380	2,520	113	382	184
9/27/2007	6:00	83	2.9	12.8	3.6	47.5	45.0	77.0	49.0	60.0	7.9	12.9	0.09	0.10	0.06	7.6	6.6	7.1	6.1	1,053	4,610	2,560	119	428	193
9/28/2007	6:00	83	2.9	12.8	3.6	47.5	44.0	77.0	49.0	60.0	7.8	12.8	0.09	0.06	0.08	7.6	6.5	7.1	6.1	1,030	4,140	2,500	110	382	184
9/28/2007	11:00	83	2.9	12.8	3.6	47.2	46.2	79.0	50.0	62.0	6.8	12.8								1,030	4,140	2,500	110	382	184
10/1/2007	7:00	83	2.9	12.8	3.6	48.0	47.0	79.0	50.0	61.0	7.9	13.1	0.09	0.07	0.08	7.6	6.4	7.1	6.2	1,023	4,580	2,460	104	394	176
10/2/2007	7:00	83	2.9	12.8	3.6	48.0	47.0	79.0	50.0	61.0	7.8	13.1	0.09	0.06	0.06	7.6	6.5	7.1	6.2	1,049	4,520	2,480	108	398	178
10/3/2007	7:00	83	2.9	12.8	3.6	48.0	46.5	79.0	50.0	61.0	7.6	13.0	0.09	0.08	0.06	7.6	6.7	7.3	6.3	1,047	4,600	2,510	112	420	169
10/4/2007	7:00	83	2.9	12.8	3.6	48.0	46.0	79.0	50.0	61.0	7.4	13.0	0.07	0.07	0.06	7.6	6.7	7.3	6.3	1,031	4,550	2,460	111	436	193
10/4/2007	13:30	83	2.9	12.8	3.6	46.7	44.3	79.0	50.0	61.0	6.5	11.4								1,031	4,550	2,460	111	436	193
10/5/2007	7:30	83	2.9	12.8	3.6	46.1	46.1	78.0	49.0	60.0	7.5	12.8	0.08	0.07	0.07	7.6	6.5	7.1	6.2	1,044	4,590	2,510	114	413	187
10/9/2007	11:00	83	2.7	11.5	3.2	49.0	33.5	69.0	45.0	54.0	5.9	10.0								1,044	4,590	2,510	114	413	187
10/9/2007	12:00	83	2.9	12.8	3.6	45.3	44.3	78.0	49.0	60.0	6.9	11.9	0.10	0.07	0.06	7.6	6.6	7.1	6.2	1,029	4,460	2,410	105	402	180
10/11/2007	8:00	83	2.9	12.8	3.6	46.6	45.4	78.0	49.0	60.0	7.5	12.8	0.08	0.07	0.06	7.6	6.6	7.1	6.2	1,036	3,660	2,260	113	391	185
10/12/2007	7:30	83	2.9	12.8	3.6	46.6	45.0	77.0	48.0	60.0	7.6	12.8	0.08	0.07	0.06	7.6	6.5	7.1	6.2	1,021	4,010	2,310	111	389	177
10/15/2007	7:30	82	2.8	12.5	3.4	47.0	42.0	75.0	47.0	58.0	7.2	12.0	0.09	0.07	0.06	7.6	6.4	7.0	6.3	1,041	4,170	2,440	116	394	188
10/15/2007	10:30	82	2.9	12.8	3.6	45.0	44.0	76.0	48.0	59.0	7.0	12.0								1,041	4,170	2,440	116	394	186
10/16/2007	7:00	82	2.9	12.8	3.6	45.5	44.5	76.0	48.0	59.0	7.0	12.1	0.09	0.07	0.07	7.5	6.4	7.1	6.2	1,024	4,290	2,410	109	372	176
10/18/2007	7:45	82	2.9	12.8	3.6	45.5	44.2	76.0	48.0	59.0	7.1	12.1	0.14	0.08	0.05	7.6	6.4	7.0	6.2	1,036	4,490	2,440	114	406	185
10/19/2007	7:00	82	2.9	12.8	3.6	45.6	43.8	76.0	48.0	59.0	7.1	12.0	0.10	0.08	0.06	7.6	6.4	7.1	6.2	1,026	4,430	2,150	112	368	182
10/19/2007	14:00	83	2.9	12.8	3.6	44.2	42.8	82.0	52.0	64.0	7.1	10.8				7.5	6.5	7.0	6.0	1,070	4,840	2,290	107	349	150
10/22/2007	8:00	83	2.6	12.0	3.4	46.5	34.5	75.0	47.0	59.0	6.6	10.0								1,070	4,840	2,290	107	340	150
10/22/2007	10:00	83	2.9	12.8	3.6	46.2	45.2	82.0	52.0	64.0	7.2	12.9	0.12	0.10	0.08	7.6	6.4	7.1	6.2	1,026	4,580	2,400	95	346	156
10/22/2007	11:30	83	2.9	12.8	3.6	45.2	44.2	82.0	52.0	64.0	7.1	12.8					6.1			1,026	4,580	2,400	95	346	156
10/25/2007	6:00	83	2.9	12.8	3.6	45.9	44.9	82.0	52.0	64.0	7.8	13.1	0.11	0.08	0.09	7.5	6.1	6.6	6.0	1,017	4,590	2,190	94	340	156
10/25/2007	9:45	SHUT DOWN																							

APPENDIX E

WATER QUALITY RESULTS

Results from Samples taken of Raw Feed at the Well
Needed to Acquire the Discharge Permit
Collected on March 12, 2007

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

AC Schultes of Florida
11865 US Highway 41 S
Gibsonton, FL 33534-5505

March 23, 2007
Project No: 68823

Laboratory Report

Project Name: Groundwater Discharge to Surface

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		TP-1					
Matrix		Groundwater					
SAL Sample Number		68823.01					
Date/Time Collected		03/12/07 13:20					
Date/Time Received		03/12/07 14:40					
Semivolatile Analyses							
Naphthalene	ug/l	1 U	EPA 625	1	03/14/07 23:48	03/14/07 10:00	BTJ
Purgeable Aromatics							
Benzene	ug/l	0.5 U	EPA 602	0.5	03/15/07 22:39		JRW
Inorganics							
Total Organic Carbon	mg/l	1.2 I	EPA 415.1	0.5	03/13/07 07:00		ARM
Metals							
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	03/22/07 17:31	03/22/07 13:30	LCB
Chromium	mg/l	0.01 U	EPA 200.7	0.01	03/22/07 17:31	03/22/07 13:30	LCB
Copper	mg/l	0.028	EPA 220.2	0.0005	03/23/07 13:36	03/20/07 13:30	BMD
Hexavalent Chromium	mg/l	0.01 U	SM 3500 Cr D	0.01	03/13/07 09:00	03/12/07 16:00	MEJ
Mercury, low level	ng/l	2.2	EPA 1631	0.2	03/20/07 09:00	03/16/07 16:00	DP
Lead	mg/l	0.001 U	EPA 239.2	0.001	03/21/07 17:36	03/20/07 13:30	BMD
Zinc	mg/l	0.016	EPA 200.7	0.003	03/22/07 17:31	03/22/07 13:30	LCB
Sample Description		Field Blank					
Matrix		Reagent Water					
SAL Sample Number		68823.02					
Date/Time Collected		03/12/07 13:15					
Date/Time Received		03/12/07 14:40					
Metals							
Mercury, low level	ng/l	1.6	EPA 1631	0.2	03/20/07 09:00	03/16/07 16:00	DP

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

Results from Samples taken of Raw Feed at the Well
During a 10-day Aquifer Performance Test
Collected on April 20, 2007

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
200 MacKennan Court
Suite 200
Cary, NC 27511-

May 2, 2007
Project No: 70197

Laboratory Report

Project Name	**Manatee County Groundwater Analyses**
Sample Description	**TP-1 (Erie Road)**
Matrix	**Raw Source Water**
SAL Sample Number	**70197.01**
Date/Time Collected	**04/20/07 11:00**
Date/Time Received	**04/20/07 14:30**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Field Parameter							
Specific Conductance	umhos/cm	980	DEP FT1200		04/20/07 11:00		TDD
Water Temperature	C	27.6	DEP FT1400		04/20/07 11:00		TDD
pH	Units	7.1	DEP FT1100		04/20/07 11:00		TDD
Turbidity	NTU	0.70	DEP FT1600		04/20/07 11:00		TDD
Inorganics							
Total Alkalinity as CaCO3	mg/l	140	SM 2320B	2	05/01/07 13:48		MEJ
Ammonia Nitrogen	mg/l N	0.22	EPA 350.1	0.01	04/24/07 18:13		BMD
Bromide	mg/l	0.03 U	EPA 300.0	0.03	04/24/07 10:32		DP
Chloride	mg/l	38	EPA 300.0	0.1	04/24/07 10:32		DP
Color	CU	5 U	SM 2120 B	5	04/21/07 13:20		MEJ
Fluoride	mg/l	0.81	EPA 300.0	0.003	04/24/07 10:32		DP
Hydrogen Sulfide (Unionized)	mg/l	0.01 U	EPA 376.1	0.01	04/25/07 10:43		MEJ
Nitrate (as N)	mg/l	0.002 U,Q	EPA 300.0	0.002	04/24/07 10:32		DP
Sulfate	mg/l	320	EPA 300.0	0.1	04/24/07 10:49		DP
Total Dissolved Solids	mg/l	670	SM 2540 C	10	04/21/07 17:00	04/21/07 13:18	MEJ
Total Organic Carbon	mg/l	0.94 I	EPA 415.1	0.5	04/26/07 06:45		ARM
UV254 Absorbance	cm-1	0.034	SM 5910 B	0.005	04/21/07 10:51	04/21/07 10:00	DP
Metals							
Aluminum	mg/l	0.1 U	EPA 200.7	0.1	04/23/07 16:06	04/23/07 09:20	PSS
Barium	mg/l	0.028 I	EPA 200.7	0.01	04/23/07 16:06	04/23/07 09:20	PSS
Calcium	mg/l	110	EPA 200.7	0.1	04/25/07 13:52		PSS
Iron, Dissolved	mg/l	0.044 I	EPA 200.7	0.02	04/20/07 18:27	04/20/07 11:34	PSS
Iron	mg/l	0.041 I	EPA 200.7	0.02	04/23/07 16:06	04/23/07 09:20	PSS
Potassium	mg/l	2.4	EPA 200.7	0.1	04/25/07 13:52		PSS
Magnesium	mg/l	48	EPA 200.7	0.1	04/25/07 13:52		PSS
Sodium	mg/l	16	EPA 200.7	0.1	04/25/07 13:52		PSS
Dissolved Silica as SiO2	mg/l	21	EPA 200.7	0.02	04/23/07 11:41		PSS
Strontium	mg/l	11	EPA 6010	0.01	04/23/07 16:06	04/23/07 09:20	PSS
Microbiology							
Heterotrophic Plate Count	CFU/ml	164	SM9215B	1	04/22/07 14:30	04/20/07 17:30	MEJ

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2219

McKim & Creed, PA
200 MacKennan Court
Suite 200
Cary, NC 27511-

May 2, 2007
Project No: 70197

Laboratory Report

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
U	Analyte was undetected. Indicated concentration is method detection limit.
U,Q	Analyte was not detected; indicated concentration is method detection limit. Sample held beyond the accepted holding time.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 70197

Client Name	Contact / Phone:
McKim & Creed	Ash Vakharkar 941-379-3404
Project Name / Location: Manatee County Groundwater Analyses	
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 1LP, Cool T. Alk, Br, Cl, Color, F, NO_3, Sulfate, TDS	250 ml P, HNO_3 Al, Ba, Ca, Fe, Mg, K, Na, Sr, silica dioxide	250 ml P, H_2SO_4 NH3	100 ml P, sterile, cool HPC	1LP, NaOH/Zn Acetate hydrogen sulfide	250 ml P, ~~HNO_3~~ Cool, 4°C dissolved Fe (field filtered)	40 ml aV, HCl TOC	1LaG, Cool 4C UV254	No. of Containers (Total per each location)
01	TP-1 (Erie Road)	4/20/07	1100	GW		X	1	1	1	2	1	1	2	1	

Containers Prepared/ Relinquished:	Date/Time: 1520 4/13/07	Received:	Date/Time: 1520 4/19/07
Relinquished:	Date/Time: 1430 4/20/07	Received:	Date/Time: 1430 04/20/07
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N (N/A)
Samples intact upon arrival? (Y) N N/A
Received on ice? Temp_____ (Y) N N/A
Proper preservatives indicated? (Y) N N/A
Rec'd within holding time? (Y) N N/A
Volatiles rec'd w/out headspace? Y N (N/A)
Proper containers used? (Y) N N/A

Instructions / Remarks: raw water going into a membrane pilot unit for DW

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

GROUNDWATER SAMPLING LOG

Client Name:	McKim & Creed	Location:	Manatee County	Contact:	Ash Vakharker
				Phone:	941-379-3404
Date Sampled	4/20/17	SAL Project #	70197	Project Name	
Well Number	TP-1 (Exit Ramp)	Sample ID	-01	GPS LAT	
				GPS LONG	

PURGING DATA

WELL DIAMETER (Inches)	—	WELL CAPACITY (gal/ft)	—	Screen Interval (Feet)	UNK	To	UNK	Static Depth to Water (Feet)	—	PURGE PUMP CODE	PP GP IBP
TOTAL WELL DEPTH (Feet)	—	REFERENCE ELEVATION (NGVD)	—	GROUND WATER ELEVATION (REFERENCE-STATIC)	—			TUBING DIAMETER (Inches)	—	TUBING CAPACITY (gal/ft)	—

Purge Technique: q Submerged Screen (1,1/4,1/4 Well) q Submerged Screen (1EQ Volume, 3, 3 Minutes) q Partially Submerged Screen (1 Well, 3,3 minutes)

WELL VOLUME = (TOTAL DEPTH - STATIC DEPTH) x WELL CAPICITY = (0.00 -) *

ONE WELL VOLUME	—	1/4 WELL VOLUME	—	3 WELL VOLUMES	—	5 WELL VOLUMES	—

EQUIPMENT VOLUME = PUMP VOLUME + (TUBING CAPACITY X TUBING LEGNTH) + FLOW CELL VOLUME

PUMP VOLUME	—	TUBING LEGNTH	—	FLOW CELL VOLUME	—	EQUIPMENT VOLUME	—

INITIAL TUBING LEGNTH IN WELL (FEET)	—		FINAL TUBING LEGNTH IN WELL (FEET)	—	PURGE TIME START	—	PURGE TIME END	—	TOTAL PURGED	—	

TIME	VOLUME PURGED (Gallons)	TOTAL VOLUME PURGED (Gallons)	PURGE RATE (gpm)	Depth to Water (Feet)	pH (SU) (Δ <0.2)	TEMP (oC) (Δ <0.2)	SP COND (uS/cm) (Δ <5%)	DO (mg/L) (% SAT <20)	TURBIDITY (NTUs) (<20 NTU)	COLOR (Describe)	ODOR (Describe)
1100	—	—	1,000	—	7.1	27.6	980	4.1	0.69	Clear	Sulfur

Well Capacity (gallons/foot): 0.75"=0.02, 1.25"=0.06, 2"=0.16, 3"=0.37, 4"=0.65, 5"=1.02, 6"=1.47, 12"5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY / COMPANY (PRINT)	[signature]			SAMPLER(S) SIGNATURES:	SAC		
TUBING MATERIAL CODE (CIRCLE ONE)	PP PE NP TL TT	SAMPLE TUBING LEGNTH IN WELL (FEET)	—	SAMPLE PUMP FLOW RATE (mL/min)	—		
SAMPLING INITIATED	1100	SAMPLING ENDED	1110	FIELD CLEANED	Y N	CLEANING STEPS	—
FIELD FILTERED?	Y (N)	FILTER SIZE (µm)	—	DUPLICATE	Y (N)	VOC COLLECTED BY REVERSE FLOW?	Y N (N/A)
PRESERVATION CHECKED IN FIELD?	(Y) N N/A	LIST PRESERVATIVES ADDED				SEMI-VOLS COLLECTED THROUGH TRAP?	Y N (N/A)
WEATHER CONDITIONS							
COMMENTS							

PUMP CODES: PP=Peristaltic Pump, GP= Submersible Grundfos Pump, IBP= In-place Bladder Pump

TUBING MATERIAL CODES: PP= Polypropylene, PE= Polyethylene, NP= Non-inert Plastic, TL= Teflon Lined, TT= Teflon

Reviewed By: TAM Date: 4/23/17

Results from Samples taken of Raw Feed
Sample was taken between Break Tank and Day Tank
Collected on May 18, 2007
Well Pump is at 40 feet Below Grade

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
200 MacKennan Court
Suite 200
Cary, NC 27511-

May 21, 2007
Project No: 71083

Laboratory Report

Project Name: TP-1 Erie Rd.

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description	#1						
Matrix	Groundwater						
SAL Sample Number	71083.01						
Date/Time Collected	05/18/07 09:40						
Date/Time Received	05/18/07 15:30						
Inorganics							
pH	Units	7.5 Q5	EPA 150.1		05/18/07 16:10		RKB
Sulfate	mg/l	310	EPA 300.0	0.1	05/19/07 00:02		DB
Turbidity	NTU	70	EPA 180.1	0.05	05/18/07 16:39		RSM
Metals							
Iron	mg/l	4.9	EPA 200.7	0.02	05/19/07 18:01	05/19/07 10:35	PSS
Manganese	mg/l	0.53	EPA 200.7	0.01	05/19/07 18:01	05/19/07 10:35	PSS
Sample Description	#2						
Matrix	Groundwater						
SAL Sample Number	71083.02						
Date/Time Collected	05/18/07 10:52						
Date/Time Received	05/18/07 15:30						
Inorganics							
pH	Units	7.5 Q5	EPA 150.1		05/18/07 16:10		RKB
Sulfate	mg/l	320	EPA 300.0	0.1	05/19/07 00:19		DB
Turbidity	NTU	28	EPA 180.1	0.05	05/18/07 16:39		RSM
Metals							
Iron	mg/l	2.7	EPA 200.7	0.02	05/19/07 18:01	05/19/07 10:35	PSS
Manganese	mg/l	0.059	EPA 200.7	0.01	05/19/07 18:01	05/19/07 10:35	PSS
Sample Description	#3						
Matrix	Groundwater						
SAL Sample Number	71083.03						
Date/Time Collected	05/18/07 11:37						
Date/Time Received	05/18/07 15:30						

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McKim & Creed, PA
200 MacKennan Court
Suite 200
Cary, NC 27511-

May 21, 2007
Project No: 71083

Laboratory Report

Project Name: TP-1 Erie Rd.

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		#3					
Matrix		Groundwater					
SAL Sample Number		71083.03					
Date/Time Collected		05/18/07 11:37					
Date/Time Received		05/18/07 15:30					
Inorganics							
pH	Units	7.4 Q5	EPA 150.1		05/18/07 16:10		RKB
Sulfate	mg/l	320	EPA 300.0	0.1	05/19/07 00:36		DB
Turbidity	NTU	31	EPA 180.1	0.05	05/18/07 16:39		RSM
Metals							
Iron	mg/l	2.5	EPA 200.7	0.02	05/19/07 18:01	05/19/07 10:35	PSS
Manganese	mg/l	0.054	EPA 200.7	0.01	05/19/07 18:01	05/19/07 10:35	PSS
Sample Description		#4					
Matrix		Groundwater					
SAL Sample Number		71083.04					
Date/Time Collected		05/18/07 11:55					
Date/Time Received		05/18/07 15:30					
Inorganics							
pH	Units	7.5 Q5	EPA 150.1		05/18/07 16:10		RKB
Sulfate	mg/l	320	EPA 300.0	0.1	05/19/07 00:53		DB
Turbidity	NTU	28	EPA 180.1	0.05	05/18/07 16:39		RSM
Metals							
Iron	mg/l	0.98	EPA 200.7	0.02	05/19/07 18:01	05/19/07 10:35	PSS
Manganese	mg/l	0.023 I	EPA 200.7	0.01	05/19/07 18:01	05/19/07 10:35	PSS

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL. 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
200 MacKennan Court
Suite 200
Cary, NC 27511-

May 21, 2007
Project No: 71083

Laboratory Report

Project Name TP-1 Erie Rd.

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. _____

COPY

Client Name	Contact / Phone:
McKim and Creed	Ann Rock 727-366-4845
Project Name / Location: TP-1 Erie Rd	
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: mLP, Cool SO4, Turb. pH	250 mL P Fe, Mn							No. of Containers (Total per each location)
01		5/18/07	0940	GW			1	1							
02		↓	1052	GW			1	1							
03			1137	GW			1	1							
04			1155	GW			1	1							

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
[signature]	15:30	[signature]	5/18/07 1530
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal Intact?	Y	N	N/A
Samples intact upon arrival?	Y	N	N/A
Received on Ice? Temp_____	Y	N	N/A
Proper preservatives indicated?	Y	N	N/A
Rec'd w ithin holding time?	Y	N	N/A
Volatiles rec'd w /out headspace?	Y	N	N/A
Proper containers used?	Y	N	N/A

Instructions / Remarks

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. _____

Client Name	Contact / Phone:
McKim and Creed	Ann Rock 727-366-4845
Project Name / Location	
TP-1 Erie Rd	
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 1LP, Cool SO4, Turb, pH	250 mL P, HNO3 Fe, Mn							No. of Containers (Total per each location)
01				GW			1	1							2

Containers Prepared/ Relinquished:	Date/Time: 1500 05-18-07	Received:	Date/Time: 15:30
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y	N	N/A
Samples intact upon arrival?	Y	N	N/A
Received on ice? Temp_____	Y	N	N/A
Proper preservatives indicated?	Y	N	N/A
Rec'd within holding time?	Y	N	N/A
Volatiles rec'd w/out headspace?	Y	N	N/A
Proper containers used?	Y	N	N/A

Instructions / Remarks

Chain of Custody Rev.Date 11/19.

Chain of Custody

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 71083

Client Name	Contact / Phone:
McKim and Creed	Ann Rock 727-366-4845
Project Name / Location: TP-1 Erie Rd	
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 500 mLP, Cool SO4, Turb, pH	250 mL P Fe, Mn							No. of Containers (Total per each location)
01	#1	5/18/07	0940	GW			1	1							
02	#2	↓	1052	GW			1	1							
03	#3	↓	1137	GW			1	1							
04	#4	↓	1155	GW			1	1							

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
JF James	15:30	JMcA	5/18/07 1530
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N N/A

Samples intact upon arrival? Y N N/A

Received on Ice? Temp_____ Y N N/A

Proper preservatives indicated? Y N N/A

Rec'd within holding time? Y N N/A

Volatiles rec'd w/out headspace? Y N N/A

Proper containers used? Y N N/A

Instructions / Remarks

Page 4 of 4

Chain of Cust. Rev.Date 11/19/01

Results from Samples taken of Raw Feed at the Well
Collected on May 21, 2007

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
200 MacKennan Court
Suite 200
Cary, NC 27511-

June 4, 2007
Project No: 71126

Laboratory Report

Project Name: **Manatee County Groundwater Analyses**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**TP-1 (Erle Road)**					
Matrix		**Raw Source Water**					
SAL Sample Number		**71126.01**					
Date/Time Collected		**05/21/07 13:20**					
Date/Time Received		**05/21/07 14:35**					
Field Parameter							
Specific Conductance	umhos/cm	1119 D1	DEP FT1200		05/21/07 13:20		
Water Temperature	C	28.5 D1	DEP FT1400		05/21/07 13:20		
pH	Units	7.4 D1	DEP FT1100		05/21/07 13:20		
Inorganics							
Total Alkalinity as CaCO3	mg/l	140	SM 2320B	2	05/24/07 14:41		RSM
Ammonia Nitrogen	mg/l N	0.19	EPA 350.1	0.01	05/22/07 11:26		MEJ
Bromide	mg/l	0.37	EPA 300.0	0.03	05/22/07 11:24		DP
Chloride	mg/l	80	EPA 300.0	0.1	05/22/07 11:42		DP
Color	CU	5 U	SM 2120 B	5	05/22/07 15:15	05/22/07 15:06	AMP
Fluoride	mg/l	1.1	EPA 300.0	0.003	05/22/07 11:24		DP
Hydrogen Sulfide (Unionized)	mg/l	0.084	EPA 376.1	0.01	05/24/07 14:25		DP
Nitrate (as N)	mg/l	0.002 U	EPA 300.0	0.002	05/22/07 11:24		DP
Sulfate	mg/l	330	EPA 300.0	0.1	05/22/07 11:42		DP
Total Dissolved Solids	mg/l	550	SM 2540 C	10	05/31/07 11:56	05/22/07 15:35	AMP
Total Organic Carbon	mg/l	1.1 I	EPA 415.1	0.5	05/22/07 07:30		ARM
UV254 Absorbance	cm-1	0.042	SM 5910 B	0.005	05/23/07 13:16		RKB
Metals							
Aluminum	mg/l	0.1 U	EPA 200.7	0.1	05/22/07 14:45	05/22/07 14:45	CAC
Barium	mg/l	0.034 I	EPA 200.7	0.01	05/22/07 14:45	05/22/07 14:45	CAC
Calcium	mg/l	120	EPA 200.7	0.1	05/24/07 13:33		PSS
Iron, Dissolved	mg/l	0.069 I	EPA 200.7	0.02	05/22/07 16:30	05/22/07 16:30	CAC
Iron	mg/l	0.077 I	EPA 200.7	0.02	05/22/07 14:45	05/22/07 14:45	CAC
Potassium	mg/l	2.2	EPA 200.7	0.1	05/24/07 13:33	05/24/07 12:00	PSS
Magnesium	mg/l	55	EPA 200.7	0.1	05/24/07 13:33	05/24/07 12:00	PSS
Sodium	mg/l	32	EPA 200.7	0.1	05/24/07 13:33	05/24/07 12:00	PSS
Dissolved Silica as SIO2	mg/l	21	EPA 200.7	0.02	05/26/07 12:52	05/26/07 12:00	PSS
Strontium	mg/l	12	EPA 6010	0.01	05/22/07 14:45	05/22/07 14:45	CAC
Microbiology							
Heterotrophic Plate Count	CFU/ml	1	SM9215B	1	05/23/07 16:10	05/21/07 18:00	RKB

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.
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McKim & Creed, PA
200 MacKennan Court
Suite 200
Cary, NC 27511-

June 4, 2007
Project No: 71126

Laboratory Report

Project Name **Manatee County Groundwater Analyses**

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
D1	Measurement was made in the field. Data supplied by client.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
U	Analyte was undetected. Indicated concentration is method detection limit.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: **Francis I. Daniels, Laboratory Director**
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 71126

Client Name	Contact / Phone:
McKim & Creed	Ash Vakharkar 941-379-3404
Project Name / Location	
Manatee County Groundwater Analyses	
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 1LP, Cool, pH, Cond. T. Alk, Br, Cl, Color, F, NO_3, Sulfate, TDS	250 ml P, HNO_3 Al, Ba, Ca, Fe, Mg, K, Na, Sr, silica dioxide	250 ml P, H_2SO_4 NH3	100 ml P, sterile, cool HPC	1LP, NaOH/Zn Acetate hydrogen sulfide	250 ml P, ~~HNO_3~~ (Lab) dissolved Fe (field filtered)	40 ml aV, HCl TOC	1LaG, Cool 4C UV254	No. of Containers (Total per each location)
01	TP-1	5-21-07	13:20	GW			1	1	1	2	1	1	2	1	

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
ISH / C	5.21.07 1058	Philip J. Fox	5/21/07 11:40am
Relinquished:	Date/Time:	Received:	Date/Time:
Philip Fox	5-21-07 2:55	J Mason	14:35 5-21-07
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N (N/A)
Samples intact upon arrival? (Y) N N/A
Received on ice? Temp____ (Y) N N/A
Proper preservatives indicated? (Y) N N/A
Rec'd within holding time? (Y) N N/A
Volatiles rec'd w/out headspace? Y N (N/A)
Proper containers used? (Y) N N/A

Instructions / Remarks

pH = 7.4
cond = 1119
temp = 28.5

Chain of Custody.xls
Rev.Date 11/18/01

Chain of Custody

Results from Samples taken of Raw Feed at the Well after the Well Pump was Lowered to 400 feet Below Grade.
Collected on June 21, 2007

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
601 Cleveland Street
Suite 205
Clearwater, FL 33755-

July 6, 2007
Project No: 72011

Laboratory Report

Project Name	Manatee County Pilot Study
Sample Description	TP-1 Erie Rd
Matrix	Groundwater
SAL Sample Number	72011.01
Date/Time Collected	06/21/07 14:00
Date/Time Received	06/21/07 15:15

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Inorganics							
Total Alkalinity as CaCO3	mg/l	150	SM 2320B	2	06/28/07 13:24		RSM
Chloride	mg/l	110	EPA 300.0	0.1	06/21/07 19:47		DP
Specific Conductance	umhos/cm	1,126	SM 2510B	0.5	06/25/07 16:50		RKB
Hydrogen Sulfide (Unionized)	mg/l	0.17	EPA 376.1	0.01	06/26/07 11:23		RKB
Silica, Total	mg/l	24	EPA 200.7	0.02	07/03/07 13:50	07/03/07 13:00	PSS
Sulfate	mg/l	570	EPA 300.0	0.1	06/21/07 19:47		DP
Total Dissolved Solids	mg/l	710	EPA 160.1	10	06/26/07 12:36	06/25/07 11:00	AMP
Turbidity	NTU	7.3	EPA 180.1	0.05	06/22/07 13:10		RSM
Metals							
Iron	mg/l	0.061 I	EPA 200.7	0.02	06/27/07 13:27	06/26/07 14:08	PSS
Magnesium	mg/l	53	EPA 200.7	0.1	07/05/07 15:55	07/05/07 15:30	PSS
Sodium	mg/l	29	EPA 200.7	0.1	06/28/07 14:00	06/28/07 14:00	PSS
Strontium	mg/l	12	EPA 6010	0.01	06/27/07 13:27	06/26/07 14:08	PSS

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

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McKim & Creed, PA
601 Cleveland Street
Suite 205
Clearwater, FL 33755-

July 6, 2007
Project No: 72011

Laboratory Report

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

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SAL Project No. 72011

Client Name		Contact / Phone:
	McKim & Creed	Johna Jahn
Project Name / Location	Manatee Co Pilot Study	
Samplers: (Signature)	Jean-Ann James	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 1LP, Cool 4°C SO_4, TDS, Silica, Turbidity, Cl, Conductivity, Alkalinity	250mL P, HNO_3 Mg, Sr, Na, Fe	1LP, NaOH/Zn Acetate Hydrogen Sulfide						No. of Containers (Total per each location)
01	TP-1 Erie Rd	6-21-07	1400	GW		X	1	1	1						3

Containers Prepared	Date/Time:	Received:	Date/Time:
Relinquished: GSA	6-21-07 1024		6-21-07
Relinquished:	6-21-07 1515	Received:	6-21-07 1515
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal Intact?	Y N (N/A)	Instructions / Remarks
Samples intact upon arrival?	(Y) N N/A	
Received on ice? Temp____	(Y) N N/A	
Proper preservatives indicated?	(Y) N N/A	
Rec'd within holding time?	(Y) N N/A	
Volatiles rec'd w/out headspace?	Y N (N/A)	
Proper containers used?	(Y) N N/A	

Chain of Custody.xls
Rev.Date 11/19/01

TDS Results from Sampling of Raw Feed, Total Permeate,
Stage 1 Permeate, Stage 1 Concentrate,
Stage 2 Permeate, and Stage 2 Concentrate
Collected on August 8, 2007
From the RO Pilot Plant Sampling Panel

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McKim & Creed, PA
601 Cleveland Street
Suite 205
Clearwater, FL 33755-

August 23, 2007
Project No: 73609

Laboratory Report

Project Name: **Manatee County RO Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Raw Feed**					
Matrix		**Groundwater**					
SAL Sample Number		**73609.01**					
Date/Time Collected		**08/08/07 11:15**					
Date/Time Received		**08/08/07 12:45**					
Inorganics							
Total Dissolved Solids	mg/l	680	EPA 160.1	10	08/23/07 14:49	08/14/07 12:55	MEJ
Sample Description		**Total Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**73609.02**					
Date/Time Collected		**08/08/07 10:16**					
Date/Time Received		**08/08/07 12:45**					
Inorganics							
Total Dissolved Solids	mg/l	64	EPA 160.1	10	08/23/07 14:49	08/14/07 12:55	MEJ
Sample Description		**Stage 1 Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**73609.03**					
Date/Time Collected		**08/08/07 10:21**					
Date/Time Received		**08/08/07 12:45**					
Inorganics							
Total Dissolved Solids	mg/l	68	EPA 160.1	10	08/23/07 14:49	08/14/07 12:55	MEJ
Sample Description		**Stage 1 Concentrate**					
Matrix		**Groundwater**					
SAL Sample Number		**73609.04**					
Date/Time Collected		**08/08/07 11:19**					
Date/Time Received		**08/08/07 12:45**					
Inorganics							
Total Dissolved Solids	mg/l	1,900	EPA 160.1	10	08/23/07 14:49	08/14/07 12:55	MEJ

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

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McKim & Creed, PA
601 Cleveland Street
Suite 205
Clearwater, FL 33755-

August 23, 2007
Project No: 73609

Laboratory Report

Project Name: **Manatee County RO Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Stage 2 Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**73609.05**					
Date/Time Collected		**08/08/07 11:12**					
Date/Time Received		**08/08/07 12:45**					
Inorganics							
Total Dissolved Solids	mg/l	200	EPA 160.1	10	08/23/07 14:49	08/14/07 12:55	MEJ
Sample Description		**Stage 2 Concentrate**					
Matrix		**Groundwater**					
SAL Sample Number		**73609.06**					
Date/Time Collected		**08/08/07 11:22**					
Date/Time Received		**08/08/07 12:45**					
Inorganics							
Total Dissolved Solids	mg/l	3,900	EPA 160.1	10	08/23/07 14:49	08/14/07 12:55	MEJ

FDOH Laboratory No. E84129
NELAP Accredited

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McKim & Creed, PA
601 Cleveland Street
Suite 205
Clearwater, FL 33755-

August 23, 2007
Project No: 73609

Laboratory Report

Project Name: **Manatee County RO Pilot Study**

Footnotes

* Test results presented in this report meet all the requirements of the NELAC standards.
** A statement of estimated uncertainty of test results is available upon request.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 73609

Client Name	Contact / Phone:
McKim & Creed	Anne Rocke (727) 442-7196
Project Name / Location: Manatee Co RO Pilot	
Samplers: (Signature) Ann H. Rocke	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1 LP Cool TDS								No. of Containers (Total per each location)
01	Raw Feed	8/8/07	1115	GW		X	1								1
02	Total Permeate		1016	GW		X	1								1
03	Stage 1 Permeate		1021	GW		X	1								1
04	Stage 1 Conc.		1119	GW		X	1								1
05	Stage 2 Permeate		1112	GW		X	1								1
06	Stage 2 Conc.		1122	GW		X	1								1

Containers Prepared/ Relinquished: Ann H. Rocke	Date/Time:	Received: J Mason	Date/Time: 1245 8/8/07
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N (N/A)
Samples intact upon arrival? (Y) N N/A
Received on ice? Temp_____ (Y) N N/A
Proper preservatives indicated? Y N (N/A)
Rec'd within holding time? (Y) N N/A
Volatiles rec'd w/out headspace? Y N (N/A)
Proper containers used? Y (N) N/A

Instructions / Remarks

arocke@mckimcreed.com

Page 4 of 4

Results from Field Sampling of Production Well Raw Feed,
Intermediate Well Raw Feed, Stage 1 Permeate, Total Permeate,
Stage 1 Concentrate, and Stage 2 Concentrate
Collected on September 26, 2007
Tests Included Primary and Secondary Standards

SOUTHERN ANALYTICAL LABORATORIES, INC.

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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75524
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Production Well					
Matrix		Groundwater					
SAL Sample Number		75524.01					
Date/Time Collected		09/26/07 11:50					
Date/Time Received		09/26/07 13:00					
Volatile Organic Compounds (Primary DW)							
1,1,1-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 17:21		JRW
1,1,2-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 17:21		JRW
1,1-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
1,2,4 Trichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
1,2-Dichloroethane	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 17:21		JRW
1,2-Dichloropropane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 17:21		JRW
Benzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Carbon tetrachloride	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 17:21		JRW
cis-1,2-Dichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 17:21		JRW
Dichloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Ethylbenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Monochlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
o-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
para-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Styrene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Tetrachloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 17:21		JRW
Toluene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
trans-1,2-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Trichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 17:21		JRW
Vinyl chloride	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Xylenes (Total)	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
m/p-xylenes	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
o-xylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Trihalomethane Analyses							
Bromodichloromethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 17:21		JRW
Bromoform	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Chloroform	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 17:21		JRW
Dibromochloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 17:21		JRW
Total Trihalomethanes	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 17:21		JRW
Chlorinated Pesticides (Primary DW)							
Date Extracted		10/01/07	EPA 508.1			10/01/07 09:00	SMR
Chlordane	ug/l	0.05 U	EPA 508.1	0.05	10/05/07 04:30	10/01/07 09:00	DB
Toxaphene	ug/l	0.5 U	EPA 508.1	0.5	10/05/07 04:30	10/01/07 09:00	DB
Polychlorinated biphenyls (PCBs)	ug/l	0.2 U	EPA 508.1	0.2	10/05/07 04:30	10/01/07 09:00	DB
Chlorinated Herbicides (Primary DW)							
Date Extracted		10/02/07	EPA 515.3			10/02/07 09:00	JLR
Dalapon	ug/l	1 U	EPA 515.3	1	10/09/07 00:45	10/02/07 09:00	BTJ

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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75524
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Production Well**					
Matrix		**Groundwater**					
SAL Sample Number		**75524.01**					
Date/Time Collected		**09/26/07 11:50**					
Date/Time Received		**09/26/07 13:00**					
Chlorinated Herbicides (Primary DW)							
2,4-D	ug/l	1 U	EPA 515.3	1	10/09/07 00:45	10/02/07 09:00	BTJ
Pentachlorophenol	ug/l	0.1 U	EPA 515.3	0.1	10/09/07 00:45	10/02/07 09:00	BTJ
2,4,5-TP (Silvex)	ug/l	0.25 U	EPA 515.3	0.25	10/09/07 00:45	10/02/07 09:00	BTJ
Dinoseb	ug/l	0.5 U	EPA 515.3	0.5	10/09/07 00:45	10/02/07 09:00	BTJ
Picloram	ug/l	0.75 U	EPA 515.3	0.75	10/09/07 00:45	10/02/07 09:00	BTJ
Semivolatile Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 525.2			10/01/07 09:00	SMR
Alachlor	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 19:53	10/01/07 09:00	BTJ
Atrazine	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 19:53	10/01/07 09:00	BTJ
Benzo(a)pyrene	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 19:53	10/01/07 09:00	BTJ
Di(2-ethylhexyl)adipate	ug/l	0.3 U	EPA 525.2	0.3	10/01/07 19:53	10/01/07 09:00	BTJ
Di(2-ethylhexyl)phthalate	ug/l	1.0 U	EPA 525.2	1.0	10/01/07 19:53	10/01/07 09:00	BTJ
Endrin	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 19:53	10/01/07 09:00	BTJ
Heptachlor	ug/l	0.08 U	EPA 525.2	0.08	10/01/07 19:53	10/01/07 09:00	BTJ
Heptachlor Epoxide	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 19:53	10/01/07 09:00	BTJ
Hexachlorobenzene	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 19:53	10/01/07 09:00	BTJ
Hexachlorocyclopentadiene	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 19:53	10/01/07 09:00	BTJ
Lindane	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 19:53	10/01/07 09:00	BTJ
Methoxychlor	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 19:53	10/01/07 09:00	BTJ
Simazine	ug/l	0.07 U	EPA 525.2	0.07	10/01/07 19:53	10/01/07 09:00	BTJ
Pesticide Analyses (Primary DW)							
Date Extracted		09/28/07	EPA 549.2			09/28/07 13:00	JLR
Diquat	ug/l	1 U	EPA 549.2	1	10/02/07 16:03	09/28/07 13:00	JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 504.1			10/01/07 11:30	KAA
Dibromochloropropane	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 01:37	10/01/07 11:30	DB
Ethylene Dibromide (EDB)	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 01:37	10/01/07 11:30	DB
Carbamate Pesticides (Primary DW)							
Carbofuran	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 01:19		JKS
Oxamyl (Vydate)	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 01:19		JKS
Pesticide Analyses (Primary DW)							
Glyphosate	ug/l	10 U	EPA 547	10	10/03/07 22:48		JKS
Pesticide Analyses (Primary DW)							
Date Extracted		09/29/07	EPA 548.1			09/29/07 09:30	JLR
Endothall	ug/l	20 U,J10	EPA 548.1	20	10/04/07 20:23	09/29/07 09:30	DB

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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75524
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Production Well					
Matrix		Groundwater					
SAL Sample Number		75524.01					
Date/Time Collected		09/26/07 11:50					
Date/Time Received		09/26/07 13:00					
Inorganics							
Chloride	mg/l	63	EPA 300.0	0.05	09/27/07 03:11		MLH
Color	CU	5	SM 2120 B	5	09/27/07 11:30		CYF
Cyanide	mg/l	0.005 U	SM 4500 CN	0.005	10/02/07 16:00	10/02/07 11:30	MCD
Fluoride	mg/l	1.9	EPA 300.0	0.01	09/27/07 03:11		MLH
Total Hardness as CaCO3	mg/l	530	SM 2340B	0.5	10/01/07 17:59	10/01/07 13:00	PSS
Nitrate (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 03:11		MLH
Nitrite (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 03:11		MLH
Odor	TON	3	SM 2150 B	1	09/27/07 08:30		MEJ
pH		7.4 Q5	EPA 150.1		09/26/07 17:08		CYF
Sulfate	mg/l	350	EPA 300.0	0.2	09/27/07 03:11		MLH
Foaming Agents	mg/l	0.05 U	SM 5540 C	0.05	09/27/07 13:30		JLS
Total Dissolved Solids	mg/l	720	SM 2540 C	10	10/01/07 17:05	09/26/07 16:59	CYF
Metals							
Silver	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09	09/27/07 17:00	PSS
Aluminum	mg/l	0.1 U	EPA 200.7	0.1	09/27/07 18:09		PSS
Arsenic	mg/l	0.001 U	SM 3113 B	0.001	10/19/07 13:09		AMP
Barium	mg/l	0.030 I	EPA 200.7	0.01	09/27/07 18:09		PSS
Beryllium	mg/l	0.002 U	EPA 200.7	0.002	09/27/07 18:09		PSS
Calcium	mg/l	120	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09	09/27/07 17:00	PSS
Chromium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	09/27/07 18:09		PSS
Iron	mg/l	0.69	EPA 200.7	0.02	09/27/07 18:09		PSS
Mercury	mg/l	0.0001 U	EPA 245.1	0.0001	10/24/07 15:38	10/20/07 09:20	LCB
Magnesium	mg/l	55	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Manganese	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Sodium	mg/l	28	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Nickel	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09		PSS
Lead	mg/l	0.001 U	SM 3113 B	0.001	10/06/07 10:53		AMP
Antimony	mg/l	0.001 U	SM 3113 B	0.001	10/23/07 10:24		AMP
Selenium	mg/l	0.001 U	SM 3113 B	0.001	10/17/07 09:23		AMP
Thallium	mg/l	0.001 U	EPA 200.9	0.001	10/18/07 09:34		AMP
Zinc	mg/l	0.0062 I	EPA 200.7	0.003	09/27/07 18:09		PSS
Microbiology							
Fecal Coliform	Ct/100 ml	1 U	SM 9222 D	1	09/27/07 17:08	09/26/07 13:19	RKB
Total Coliform	Ct/100 ml	1 B	SM 9222 B	1	09/27/07 17:19	09/26/07 13:19	RKB

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75524
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Production Well**					
Matrix		**Groundwater**					
SAL Sample Number		**75524.01**					
Date/Time Collected		**09/26/07 11:50**					
Date/Time Received		**09/26/07 13:00**					
Radiochemistry							
Gross Alpha (Incl. Uranium)	pCi/l	13±3.5	EPA 00-02	3.2	10/18/07 12:47	10/15/07 09:45	MJS
Radium-226	pCi/l	1.5±1.2	EPA 903.1	0.3	10/22/07 14:35	10/12/07 13:30	DF
Radium-228	pCi/l	1.0±0.5 U1	EPA RA-05	1.0	10/27/07 15:50		DF
Combined Uranium	pCi/l	0.5±0.3 U1	EPA 908.0	0.5	10/19/07 12:31	10/17/07 10:05	MJS

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December 17, 2007
Project No: 75524
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Laboratory Report

Project Name **Manatee County Pilot Study**

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
***	For methods marked with ***, all QC criteria have been met for this method which is equivalent to a SAL certified method.
B	Results based upon colony counts outside the method indicated ideal range.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.
SNA	Surrogate not added to this sample for EPA 548.1.
U	Analyte was undetected. Indicated concentration is method detection limit.
U,J10	Analyte was not detected. Indicated concentration is the method detection limit. Value may not be accurate. Surrogate recovery did not meet acceptance criteria.
U1	Analyte was not detected; indicated concentration is method detection limit. Radiochemistry MDL is sample specific and matrix dependent.

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 75524

Client Name: McKim & Creed	Contact / Phone: Johna Jahn (727) 442-7196
Project Name / Location: Manatee County Pilot Study	Turn Around Time Requested (*Surcharges may apply): 24 Hour* ☐ 48 Hour* ☐ 5 Bus. Days ☐ 10 Bus. Days ☑
Samplers: (Signature) Kay Ward	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

PARAMETER / CONTAINER DESCRIPTION

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool 4°C Misc. Inorganics	250ml P, H_2SO_4 Nutrients	250ml P, HNO_3 Metals	250ml P, NaOH Cyanide	1LG, Cool 4°C Odor	40ml V, HCl 502.2, TTHM	1LG, HCl 525.2,508.1	1LaP, H_2SO_4 549.2	40ml V, HCl 504.1	40ml V, MCAA 531.1	40ml Amber V, Cool 515.3	40ml V, Cool 548.1, 547	1LP, HNO_3 Gross Alpha, R226, R228, Uranium	125 mL Sterile P, Cool Total & Fecal Coliforms			Total number of containers
01	Production Well	9/24/07	1150	GW		X	1	1	1	1	1	2	4	1	3	1	3	2	2	4			27
02	Trip Blank	9-25-07	10:35	R								1											

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
Kay Ward	9-25-07 11:00	Kay Ward	9/25/07 1200
Kay Ward	9/26/07 1300		

Seal intact?	Y	N	N/A
Samples intact upon arrival?	Y	N	N/A
Received on ice? Temp	Y	N	N/A
Proper preservatives indicated?	Y	N	N/A
Rec'd within holding time?	Y	N	N/A
Volatiles rec'd w/out headspace?	Y	N	N/A
Proper containers used?	Y	N	N/A

Instructions / Remarks:

Primary and Secondary Inorganics, VOCs, SOCs, Radiochemistry

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

SOUTHERN ANALYTICAL LABORATORIES, INC.

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McKim & Creed, PA
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December 17, 2007
Project No: 75527
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Intermediate Well					
Matrix		Groundwater					
SAL Sample Number		75527.01					
Date/Time Collected		09/26/07 10:43					
Date/Time Received		09/26/07 13:00					
Volatile Organic Compounds (Primary DW)							
1,1,1-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 20:46		JRW
1,1,2-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 20:46		JRW
1,1-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
1,2,4 Trichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
1,2-Dichloroethane	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 20:46		JRW
1,2-Dichloropropane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 20:46		JRW
Benzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Carbon tetrachloride	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 20:46		JRW
cis-1,2-Dichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 20:46		JRW
Dichloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Ethylbenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Monochlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
o-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
para-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Styrene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Tetrachloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 20:46		JRW
Toluene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
trans-1,2-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Trichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 20:46		JRW
Vinyl chloride	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Xylenes (Total)	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
m/p-xylenes	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
o-xylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Trihalomethane Analyses							
Bromodichloromethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 20:46		JRW
Bromoform	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Chloroform	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 20:46		JRW
Dibromochloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 20:46		JRW
Total Trihalomethanes	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 20:46		JRW
Chlorinated Pesticides (Primary DW)							
Date Extracted		10/01/07	EPA 508.1			10/01/07 09:00	SMR
Chlordane	ug/l	0.05 U	EPA 508.1	0.05	10/05/07 04:48	10/01/07 09:00	DB
Toxaphene	ug/l	0.5 U	EPA 508.1	0.5	10/05/07 04:48	10/01/07 09:00	DB
Polychlorinated biphenyls (PCBs)	ug/l	0.2 U	EPA 508.1	0.2	10/05/07 04:48	10/01/07 09:00	DB
Chlorinated Herbicides (Primary DW)							
Date Extracted		10/02/07	EPA 515.3			10/02/07 09:00	JLR
Dalapon	ug/l	1 U	EPA 515.3	1	10/09/07 01:47	10/02/07 09:00	BTJ

FDOH Laboratory No. E84129
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Clearwater, FL 33756-

December 17, 2007
Project No: 75527
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Intermediate Well					
Matrix		Groundwater					
SAL Sample Number		75527.01					
Date/Time Collected		09/26/07 10:43					
Date/Time Received		09/26/07 13:00					
Chlorinated Herbicides (Primary DW)							
2,4-D	ug/l	1 U	EPA 515.3	1	10/09/07 01:47	10/02/07 09:00	BTJ
Pentachlorophenol	ug/l	0.1 U	EPA 515.3	0.1	10/09/07 01:47	10/02/07 09:00	BTJ
2,4,5-TP (Silvex)	ug/l	0.25 U	EPA 515.3	0.25	10/09/07 01:47	10/02/07 09:00	BTJ
Dinoseb	ug/l	0.5 U	EPA 515.3	0.5	10/09/07 01:47	10/02/07 09:00	BTJ
Picloram	ug/l	0.75 U	EPA 515.3	0.75	10/09/07 01:47	10/02/07 09:00	BTJ
Semivolatile Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 525.2			10/01/07 09:00	SMR
Alachlor	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 21:00	10/01/07 09:00	BTJ
Atrazine	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 21:00	10/01/07 09:00	BTJ
Benzo(a)pyrene	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 21:00	10/01/07 09:00	BTJ
Di(2-ethylhexyl)adipate	ug/l	0.3 U	EPA 525.2	0.3	10/01/07 21:00	10/01/07 09:00	BTJ
Di(2-ethylhexyl)phthalate	ug/l	1.0 U	EPA 525.2	1.0	10/01/07 21:00	10/01/07 09:00	BTJ
Endrin	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 21:00	10/01/07 09:00	BTJ
Heptachlor	ug/l	0.08 U	EPA 525.2	0.08	10/01/07 21:00	10/01/07 09:00	BTJ
Heptachlor Epoxide	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 21:00	10/01/07 09:00	BTJ
Hexachlorobenzene	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 21:00	10/01/07 09:00	BTJ
Hexachlorocyclopentadiene	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 21:00	10/01/07 09:00	BTJ
Lindane	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 21:00	10/01/07 09:00	BTJ
Methoxychlor	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 21:00	10/01/07 09:00	BTJ
Simazine	ug/l	0.07 U,J9	EPA 525.2	0.07	10/01/07 21:00	10/01/07 09:00	BTJ
Pesticide Analyses (Primary DW)							
Date Extracted		09/28/07	EPA 549.2			09/28/07 13:00	JLR
Diquat	ug/l	1 U	EPA 549.2	1	10/02/07 16:35	09/28/07 13:00	JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 504.1			10/01/07 11:30	KAA
Dibromochloropropane	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 03:12	10/01/07 11:30	DB
Ethylene Dibromide (EDB)	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 03:12	10/01/07 11:30	DB
Carbamate Pesticides (Primary DW)							
Carbofuran	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 03:08		JKS
Oxamyl (Vydate)	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 03:08		JKS
Pesticide Analyses (Primary DW)							
Glyphosate	ug/l	10 U	EPA 547	10	10/03/07 23:26		JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/02/07	EPA 548.1			10/02/07 10:00	CDD
Endothall	ug/l	20 U	EPA 548.1	20	10/05/07 01:06	10/02/07 10:00	DB

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Clearwater, FL 33756-

December 17, 2007
Project No: 75527
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Intermediate Well					
Matrix		Groundwater					
SAL Sample Number		75527.01					
Date/Time Collected		09/26/07 10:43					
Date/Time Received		09/26/07 13:00					
Field Parameter							
Total Well Depth	ft.	150.00			09/26/07 10:39		LRW
Depth to Water (below Top of Casing)	ft.	25.62	DEP FS2211		09/26/07 10:39		LRW
Specific Conductance	umhos/cm	933	DEP FT1200		09/26/07 10:39		LRW
Water Temperature	C	25.9	DEP FT1400		09/26/07 10:39		LRW
pH	Units	7.3	DEP FT1100		09/26/07 10:39		LRW
Dissolved Oxygen	mg/l	0.0	DEP FT1500		09/26/07 10:39		LRW
Turbidity	NTU	5.0	DEP FT1600		09/26/07 10:39		LRW
Inorganics							
Chloride	mg/l	58	EPA 300.0	0.05	09/27/07 13:44		MLH
Color	CU	5 U	SM 2120 B	5	09/27/07 11:30		CYF
Cyanide	mg/l	0.005 U	SM 4500 CN	0.005	10/02/07 16:00	10/02/07 11:30	MCD
Fluoride	mg/l	1.5	EPA 300.0	0.01	10/02/07 22:24		MLH
Total Hardness as CaCO3	mg/l	380	SM 2340B	0.5	10/02/07 14:20	10/02/07 14:00	PSS
Nitrate (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 13:44		MLH
Nitrite (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 13:44		MLH
Odor	TON	1 U	SM 2150 B	1	09/27/07 08:30		MEJ
pH		7.4 Q5	EPA 150.1		09/26/07 17:08		CYF
Sulfate	mg/l	220	EPA 300.0	0.2	09/27/07 13:44		MLH
Foaming Agents	mg/l	0.05 U	SM 5540 C	0.05	09/27/07 13:30		JLS
Total Dissolved Solids	mg/l	590	SM 2540 C	10	10/02/07 12:00	09/26/07 16:59	CYF
Metals							
Silver	mg/l	0.01 U	EPA 200.7	0.01	10/04/07 00:49		PSS
Aluminum	mg/l	0.1 U	EPA 200.7	0.1	10/04/07 00:49		PSS
Arsenic	mg/l	0.001 U	SM 3113 B	0.001	10/19/07 13:09		AMP
Barium	mg/l	0.022 I	EPA 200.7	0.01	10/04/07 00:49		PSS
Beryllium	mg/l	0.002 U	EPA 200.7	0.002	10/04/07 00:49		PSS
Calcium	mg/l	75	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	10/04/07 00:49		PSS
Chromium	mg/l	0.01 U	EPA 200.7	0.01	10/04/07 00:49		PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	10/04/07 00:49		PSS
Iron	mg/l	0.78	EPA 200.7	0.02	10/04/07 00:49		PSS
Mercury	mg/l	0.0001 U	EPA 245.1	0.0001	10/24/07 15:38	10/20/07 09:20	LCB
Magnesium	mg/l	47	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Manganese	mg/l	0.014 I	EPA 200.7	0.01	10/04/07 00:49	10/03/07 17:30	PSS
Sodium	mg/l	45	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Nickel	mg/l	0.001 U	EPA 200.7	0.001	10/04/07 00:49	10/03/07 17:30	PSS

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Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Intermediate Well					
Matrix		Groundwater					
SAL Sample Number		75527.01					
Date/Time Collected		09/26/07 10:43					
Date/Time Received		09/26/07 13:00					
Metals							
Lead	mg/l	0.001 U	SM 3113 B	0.001	10/06/07 10:53		AMP
Antimony	mg/l	0.001 U	SM 3113 B	0.001	10/23/07 10:24		AMP
Selenium	mg/l	0.001 U	SM 3113 B	0.001	10/17/07 09:23		AMP
Thallium	mg/l	0.001 U	EPA 200.9	0.001	10/18/07 09:34		AMP
Zinc	mg/l	0.27	EPA 200.7	0.003	10/04/07 00:49	10/03/07 17:30	PSS
Microbiology							
Fecal Coliform	Ct/100 ml	1 U	SM 9222 D	1	09/27/07 17:08	09/26/07 13:19	RKB
Total Coliform	Ct/100 ml	1 U	SM 9222 B	1	09/27/07 17:19	09/26/07 13:19	RKB
Radiochemistry							
Gross Alpha (Incl. Uranium)	pCi/l	33±4.1	EPA 00-02	3.4	10/18/07 12:48	10/15/07 09:45	MJS
Radium-226	pCi/l	4.8±0.4	EPA 903.1	0.07	10/22/07 14:35	10/15/07 14:30	DF
Radium-228	pCi/l	1.0±0.5 U1	EPA RA-05	1.0	10/27/07 15:50	10/25/07 14:00	DF
Combined Uranium	pCi/l	0.5±0.4 U1	EPA 908.0	0.5	10/19/07 12:31	10/17/07 10:05	MJS

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December 17, 2007
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Laboratory Report

Project Name **Manatee County Pilot Study**

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
***	For methods marked with ***, all QC criteria have been met for this method which is equivalent to a SAL certified method.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.
U	Analyte was undetected. Indicated concentration is method detection limit.
U,J9	Analyte was not detected; indicated concentration is method detection limit. Matrix spike of this sample was outside typical range. All other QC criteria were acceptable.
U1	Analyte was not detected; indicated concentration is method detection limit. Radiochemistry MDL is sample specific and matrix dependent.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 75527

Client Name: McKim & Creed	Contact / Phone: Johna Jahn (727) 442-7196
Project Name / Location: Manatee County Pilot Study	Turn Around Time Requested (*Surcharges may apply): 24 Hour* ☐ 48 Hour* ☐ 5 Bus. Days ☐ 10 Bus. Days ☑
Samplers: (Signature) Jay Ward	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

PARAMETER / CONTAINER DESCRIPTION

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool 4°C Misc. Inorganics	250ml P, H_2SO_4 Nutrients	250ml P, HNO_3 Metals	250ml P, NaOH Cyanide	1LG, Cool 4°C Odor	40ml V, HCl 502.2, TTHM	1LG, HCl 525.2,508.1	1LaP, H_2SO_4 549.2	40ml V, HCl 504.1	40ml V, MCAA 531.1	40ml Amber V, Cool 515.3	40ml V, Cool 548.1, 547	~~1/2 gal, HNO3~~ Gross Alpha, R226, R228, Uranium	125 mL Sterile P, Cool Total & Fecal Coliforms		Total number of containers
01	Intermediate well	9/25/07	1043	GW		X	1	1	1	1	1	2	4	1	3	1	3	2	~~2~~	4		27
02	Trip Blank	9-25-07	10:55	R								1										

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
	9-25-07 11:00	Jay Ward	9/25/07 1200
Relinquished: Jay Ward	Date/Time: 9/24/07 1300	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y N (N/A)
Samples intact upon arrival?	(Y) N N/A
Received on ice? Temp.	(Y) N N/A
Proper preservatives indicated?	(Y) N N/A
Rec'd within holding time?	(Y) N N/A
Volatiles rec'd w/out headspace?	(Y) N N/A
Proper containers used?	(Y) N N/A

Instructions / Remarks:

Primary and Secondary Inorganics, VOCs, SOCs, Radiochemistry

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 FAX 813-855-2218

GROUNDWATER SAMPLING LOG

Client Name:	Mckim & Creed	Location:	Intermediate Well	Contact:	Anne Rocke
Date Sampled	9/26/07	SAL Project #	75527	Phone:	
Well Number		Sample ID	.01	Project Name	Manatee County Port Sty.
				GPS LAT	
				GPS LONG	

PURGING DATA

WELL DIAMETER (Inches)	6.0 4.0	WELL CAPACITY (gal/ft)	1.47 0.65	Screen Interval (Feet)	UNK To UNK	Static Depth to Water (Feet)	25.87	PURGE PUMP CODE	PP (GP) IBP
TOTAL WELL DEPTH (Feet)	150	REFERENCE ELEVATION (NGVD)		GROUND WATER ELEVATION (REFERENCE-STATIC)		TUBING DIAMETER (Inches)		TUBING CAPACITY (gal/ft)	

Purge Technique: q Submerged Screen (1,1/4,1/4 Well) q Submerged Screen (1EQ Volume, 3, 3 Minutes) q Partially Submerged Screen (1 Well, 3,3 minutes)

WELL VOLUME = (TOTAL DEPTH - STATIC DEPTH) x WELL CAPICITY

ONE WELL VOLUME	180.53 97.70	1/4 WELL VOLUME	45.13 24.42	3 WELL VOLUMES		5 WELL VOLUMES	

EQUIPMENT VOLUME = PUMP VOLUME + (TUBING CAPACITY X TUBING LEGNTH) + FLOW CELL VOLUME

PUMP VOLUME		TUBING LEGNTH		FLOW CELL VOLUME		EQUIPMENT VOLUME	

INITIAL TUBING LEGNTH IN WELL (FEET)		FINAL TUBING LEGNTH IN WELL (FEET)		PURGE TIME START	0905	PURGE TIME END	10:39	TOTAL PURGED	367		
TIME	VOLUME PURGED (Gallons)	TOTAL VOLUME PURGED (Gallons)	PURGE RATE (gpm)	Depth to Water (Feet)	pH (SU) (Δ <0.2)	TEMP (oC) (Δ <0.2)	SP COND (uS/cm) (Δ <5%)	DO (mg/L) (% SAT <20)	TURBIDITY (NTUs) (<20 NTU)	COLOR (Describe)	ODOR (Describe)
0951	~~44.0~~ 183.0	183.0	4.0	26.12	7.4	25.7	560	0.04	5.65	Okeade	none
1003	46.0	229	"	26.12	7.4	25.7	868	0.04	5.27	"	"
10:15	46.0	275	"	26.12	7.3	25.8	893	0.04	5.22	"	"
10:27	46.0	321	"	26.12	7.3	25.9	899	0.03	5.09	"	"
10:39	46.0	367	"	26.12	7.3	25.9	933	0.04	4.99	"	"

Well Capacity (gallons/foot): 0.75"=0.02, 1.25"=0.06, 2"=0.16, 3"=0.37, 4"=0.65, 5"=1.02, 6"=1.47, 12"5.88

TUBING INSIDE DIA. CAPACITY (Gal./Ft.): 1/8" = 0.0006; 3/16" = 0.0014; 1/4" = 0.0026; 5/16" = 0.004; 3/8" = 0.006; 1/2" = 0.010; 5/8" = 0.016

SAMPLING DATA

SAMPLED BY / COMPANY (PRINT)						SAMPLER(S) SIGNATURES:			
TUBING MATERIAL CODE (CIRCLE ONE)	PP PE NP TL (TT)		SAMPLE TUBING LEGNTH IN WELL (FEET)					SAMPLE PUMP FLOW RATE (mL/min)	
SAMPLING INITIATED	10:43	SAMPLING ENDED		FIELD CLEANED	Y (N)	CLEANING STEPS			
FIELD FILTERED?	Y (N)	FILTER SIZE (µm)		DUPLICATE	Y (N)	VOC COLLECTED BY REVERSE FLOW?	Y N (N/A)	SEMI-VOLS COLLECTED THROUGH TRAP?	Y N (N/A)
PRESERVATION CHECKED IN FIELD?	(Y) N N/A	LIST PRESERVATIVES ADDED							
WEATHER CONDITIONS	Clear								
COMMENTS									

PUMP CODES: PP=Peristaltic Pump, GP= Submersible Grundfos Pump, IBP= In-place Bladder Pump

TUBING MATERIAL CODES: PP= Polypropylene, PE= Polyethylene, NP= Non-inert Plastic, TL= Teflon Lined, TT= Teflon

SOUTHERN ANALYTICAL LABORATORIES, INC.

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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75525
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Stage 1 Permeate					
Matrix		Groundwater					
SAL Sample Number		75525.01					
Date/Time Collected		09/26/07 09:55					
Date/Time Received		09/26/07 13:00					
Volatile Organic Compounds (Primary DW)							
1,1,1-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:03		JRW
1,1,2-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:03		JRW
1,1-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
1,2,4 Trichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
1,2-Dichloroethane	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:03		JRW
1,2-Dichloropropane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:03		JRW
Benzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Carbon tetrachloride	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:03		JRW
cis-1,2-Dichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:03		JRW
Dichloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Ethylbenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Monochlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
o-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
para-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Styrene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Tetrachloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:03		JRW
Toluene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
trans-1,2-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Trichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:03		JRW
Vinyl chloride	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Xylenes (Total)	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
m/p-xylenes	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
o-xylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Trihalomethane Analyses							
Bromodichloromethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:03		JRW
Bromoform	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Chloroform	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:03		JRW
Dibromochloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:03		JRW
Total Trihalomethanes	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:03		JRW
Chlorinated Pesticides (Primary DW)							
Date Extracted		10/01/07	EPA 508.1			10/01/07 09:00	SMR
Chlordane	ug/l	0.05 U	EPA 508.1	0.05	10/04/07 21:07	10/01/07 09:00	DB
Toxaphene	ug/l	0.5 U	EPA 508.1	0.5	10/04/07 21:07	10/01/07 09:00	DB
Polychlorinated biphenyls (PCBs)	ug/l	0.2 U	EPA 508.1	0.2	10/04/07 21:07	10/01/07 09:00	DB
Chlorinated Herbicides (Primary DW)							
Date Extracted		10/02/07	EPA 515.3			10/02/07 09:00	JLR
Dalapon	ug/l	1 U	EPA 515.3	1	10/09/07 01:05	10/02/07 09:00	BTJ

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

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December 17, 2007
Project No: 75525
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Stage 1 Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**75525.01**					
Date/Time Collected		**09/26/07 09:55**					
Date/Time Received		**09/26/07 13:00**					
Chlorinated Herbicides (Primary DW)							
2,4-D	ug/l	1 U	EPA 515.3	1	10/09/07 01:05	10/02/07 09:00	BTJ
Pentachlorophenol	ug/l	0.1 U	EPA 515.3	0.1	10/09/07 01:05	10/02/07 09:00	BTJ
2,4,5-TP (Silvex)	ug/l	0.25 U	EPA 515.3	0.25	10/09/07 01:05	10/02/07 09:00	BTJ
Dinoseb	ug/l	0.5 U	EPA 515.3	0.5	10/09/07 01:05	10/02/07 09:00	BTJ
Picloram	ug/l	0.75 U	EPA 515.3	0.75	10/09/07 01:05	10/02/07 09:00	BTJ
Semivolatile Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 525.2			10/01/07 09:00	SMR
Alachlor	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 20:27	10/01/07 09:00	BTJ
Atrazine	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 20:27	10/01/07 09:00	BTJ
Benzo(a)pyrene	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 20:27	10/01/07 09:00	BTJ
Di(2-ethylhexyl)adipate	ug/l	0.3 U	EPA 525.2	0.3	10/01/07 20:27	10/01/07 09:00	BTJ
Di(2-ethylhexyl)phthalate	ug/l	1.0 U	EPA 525.2	1.0	10/01/07 20:27	10/01/07 09:00	BTJ
Endrin	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 20:27	10/01/07 09:00	BTJ
Heptachlor	ug/l	0.08 U	EPA 525.2	0.08	10/01/07 20:27	10/01/07 09:00	BTJ
Heptachlor Epoxide	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 20:27	10/01/07 09:00	BTJ
Hexachlorobenzene	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 20:27	10/01/07 09:00	BTJ
Hexachlorocyclopentadiene	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 20:27	10/01/07 09:00	BTJ
Lindane	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 20:27	10/01/07 09:00	BTJ
Methoxychlor	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 20:27	10/01/07 09:00	BTJ
Simazine	ug/l	0.07 U	EPA 525.2	0.07	10/01/07 20:27	10/01/07 09:00	BTJ
Pesticide Analyses (Primary DW)							
Date Extracted		09/28/07	EPA 549.2			09/28/07 13:00	JLR
Diquat	ug/l	1 U	EPA 549.2	1	10/02/07 16:14	09/28/07 13:00	JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 504.1			10/01/07 11:30	KAA
Dibromochloropropane	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 02:09	10/01/07 11:30	DB
Ethylene Dibromide (EDB)	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 02:09	10/01/07 11:30	DB
Carbamate Pesticides (Primary DW)							
Carbofuran	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 01:55		JKS
Oxamyl (Vydate)	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 01:55		JKS
Pesticide Analyses (Primary DW)							
Glyphosate	ug/l	10 U	EPA 547	10	10/03/07 23:00		JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/02/07	EPA 548.1			10/02/07 10:00	CDD
Endothall	ug/l	20 U	EPA 548.1	20	10/05/07 00:33	10/02/07 10:00	DB

FDOH Laboratory No. E84129
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December 17, 2007
Project No: 75525
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Stage 1 Permeate					
Matrix		Groundwater					
SAL Sample Number		75525.01					
Date/Time Collected		09/26/07 09:55					
Date/Time Received		09/26/07 13:00					
Inorganics							
Chloride	mg/l	20	EPA 300.0	0.05	09/27/07 03:28		MLH
Color	CU	5 U	SM 2120 B	5	09/27/07 11:30		CYF
Cyanide	mg/l	0.005 U	SM 4500 CN	0.005	10/02/07 16:00	10/02/07 11:30	MCD
Fluoride	mg/l	1.5	EPA 300.0	0.01	09/27/07 03:28		MLH
Total Hardness as CaCO3	mg/l	29	SM 2340B	0.5	10/02/07 14:20	10/02/07 14:00	PSS
Nitrate (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 03:28		MLH
Nitrite (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 03:28		MLH
Odor	TON	35	SM 2150 B	1	09/27/07 08:30		MEJ
pH		5.8 Q5	EPA 150.1		09/26/07 17:08		CYF
Sulfate	mg/l	10	EPA 300.0	0.2	09/27/07 03:28		MLH
Foaming Agents	mg/l	0.05 U	SM 5540 C	0.05	09/27/07 13:30		JLS
Total Dissolved Solids	mg/l	74	SM 2540 C	10	10/01/07 17:05	09/26/07 16:59	CYF
Metals							
Silver	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09	09/27/07 17:00	PSS
Aluminum	mg/l	0.1 U	EPA 200.7	0.1	09/27/07 18:09		PSS
Arsenic	mg/l	0.001 U	SM 3113 B	0.001	10/19/07 13:09		AMP
Barium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Beryllium	mg/l	0.002 U	EPA 200.7	0.002	09/27/07 18:09		PSS
Calcium	mg/l	6.3	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09	09/27/07 17:00	PSS
Chromium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	09/27/07 18:09		PSS
Iron	mg/l	0.033 I	EPA 200.7	0.02	09/27/07 18:09		PSS
Mercury	mg/l	0.0001 U	EPA 245.1	0.0001	10/24/07 15:38	10/20/07 09:20	LCB
Magnesium	mg/l	3.2	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Manganese	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Sodium	mg/l	9.2	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Nickel	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09		PSS
Lead	mg/l	0.001 U	SM 3113 B	0.001	10/06/07 10:53		AMP
Antimony	mg/l	0.001 U	SM 3113 B	0.001	10/23/07 10:24		AMP
Selenium	mg/l	0.001 U	SM 3113 B	0.001	10/17/07 09:23		AMP
Thallium	mg/l	0.001 U	EPA 200.9	0.001	10/18/07 09:34		AMP
Zinc	mg/l	0.003 U	EPA 200.7	0.003	09/27/07 18:09		PSS
Microbiology							
Fecal Coliform	Ct/100 ml	1 U	SM 9222 D	1	09/27/07 17:08	09/26/07 13:19	RKB
Total Coliform	Ct/100 ml	1 U	SM 9222 B	1	09/27/07 17:19	09/26/07 13:19	RKB

FDOH Laboratory No. E84129
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December 17, 2007
Project No: 75525
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Stage 1 Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**75525.01**					
Date/Time Collected		**09/26/07 09:55**					
Date/Time Received		**09/26/07 13:00**					
Radiochemistry							
Gross Alpha (Incl. Uranium)	pCi/l	2.5±1.6 U1	EPA 900.0	2.5	10/14/07 09:41	10/10/07 09:30	MJS
Radium-226	pCi/l	0.5±0.8	EPA 903.1	0.2	10/22/07 14:35	10/15/07 14:30	DF
Radium-228	pCi/l	1.0±0.5 U1	EPA RA-05	1.0	10/27/07 15:50	10/25/07 14:00	DF
Combined Uranium	pCi/l	0.4±0.2 U1	EPA 908.0	0.4	10/19/07 12:31	10/17/07 10:05	MJS

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Laboratory Report

Project Name **Manatee County Pilot Study**

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
***	For methods marked with ***, all QC criteria have been met for this method which is equivalent to a SAL certified method.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.
U	Analyte was undetected. Indicated concentration is method detection limit.
U1	Analyte was not detected; indicated concentration is method detection limit. Radiochemistry MDL is sample specific and matrix dependent.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

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SAL Project No. 75525

Client Name	Contact / Phone:
McKim & Creed	Johna Jahn (727) 442-7196
Project Name / Location	**Turn Around Time Requested (*Surcharges may apply)**
Manatee County Pilot Study	24 Hour* ☐ 48 Hour* ☐ 5 Bus. Days ☐ 10 Bus. Days ☑
Samplers: (Signature) Barry Wood	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool 4°C Misc. Inorganics	250ml P, H_2SO_4 Nutrients	250ml P, HNO_3 Metals	250ml P, NaOH Cyanide	1LG, Cool 4°C Odor	40ml V, HCl 502.2, TTHM	1LG, HCl 525.2,508.1	1LaP, H_2SO_4 549.2	40ml V, HCl 504.1	40ml V, MCAA 531.1	40ml Amber V, Cool 515.3	40ml V, Cool 548.1, 547	1/2 gal, Plastic Gross Alpha, R226, R228, Uranium	125 mL Sterile P, Cool Total & Fecal Coliforms		Total number of containers
01	STAGE 1 Permeate	9/24	1600	GW		X	1	1	1	1	1	2	4	1	3	1	3	2	2	4		27
02	Trip Blank	9-25-07	10:55	R								1										

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
	9-25-07 11:00	Barry Wood	9/25/07 12:00
Relinquished: Barry Wood	Date/Time: 9/26/07 1300	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y N (N/A)
Samples intact upon arrival?	(Y) N N/A
Received on ice? Temp.____	(Y) N N/A
Proper preservatives indicated?	(Y) N N/A
Rec'd within holding time?	(Y) N N/A
Volatiles rec'd w/out headspace	(Y) N N/A
Proper containers used?	(Y) N N/A

Instructions / Remarks:

Primary and Secondary Inorganics, VOCs, SOCs, Radiochemistry

Chain of Custody xls
Rev.Date 11/19/01

Chain of Custody

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75523
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Stage 1 Concentrate					
Matrix		Groundwater					
SAL Sample Number		75523.01					
Date/Time Collected		09/26/07 09:40					
Date/Time Received		09/26/07 13:00					
Volatile Organic Compounds (Primary DW)							
1,1,1-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 16:29		JRW
1,1,2-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 16:29		JRW
1,1-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
1,2,4 Trichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
1,2-Dichloroethane	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 16:29		JRW
1,2-Dichloropropane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 16:29		JRW
Benzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Carbon tetrachloride	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 16:29		JRW
cis-1,2-Dichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 16:29		JRW
Dichloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Ethylbenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Monochlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
o-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
para-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Styrene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Tetrachloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 16:29		JRW
Toluene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
trans-1,2-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Trichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 16:29		JRW
Vinyl chloride	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Xylenes (Total)	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
m/p-xylenes	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
o-xylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Trihalomethane Analyses							
Bromodichloromethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 16:29		JRW
Bromoform	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Chloroform	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 16:29		JRW
Dibromochloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 16:29		JRW
Total Trihalomethanes	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 16:29		JRW
Chlorinated Pesticides (Primary DW)							
Date Extracted		10/01/07	EPA 508.1			10/01/07 09:00	SMR
Chlordane	ug/l	0.05 U	EPA 508.1	0.05	10/05/07 04:11	10/01/07 09:00	DB
Toxaphene	ug/l	0.5 U	EPA 508.1	0.5	10/05/07 04:11	10/01/07 09:00	DB
Polychlorinated biphenyls (PCBs)	ug/l	0.2 U	EPA 508.1	0.2	10/05/07 04:11	10/01/07 09:00	DB
Chlorinated Herbicides (Primary DW)							
Date Extracted		10/02/07	EPA 515.3			10/02/07 09:00	JLR
Dalapon	ug/l	1 U	EPA 515.3	1	10/09/07 00:24	10/02/07 09:00	BTJ

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

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December 17, 2007
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Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Stage 1 Concentrate					
Matrix		Groundwater					
SAL Sample Number		75523.01					
Date/Time Collected		09/26/07 09:40					
Date/Time Received		09/26/07 13:00					
Chlorinated Herbicides (Primary DW)							
2,4-D	ug/l	1 U	EPA 515.3	1	10/09/07 00:24	10/02/07 09:00	BTJ
Pentachlorophenol	ug/l	0.1 U	EPA 515.3	0.1	10/09/07 00:24	10/02/07 09:00	BTJ
2,4,5-TP (Silvex)	ug/l	0.25 U	EPA 515.3	0.25	10/09/07 00:24	10/02/07 09:00	BTJ
Dinoseb	ug/l	0.5 U	EPA 515.3	0.5	10/09/07 00:24	10/02/07 09:00	BTJ
Picloram	ug/l	0.75 U	EPA 515.3	0.75	10/09/07 00:24	10/02/07 09:00	BTJ
Semivolatile Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 525.2			10/01/07 09:00	SMR
Alachlor	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 19:20	10/01/07 09:00	BTJ
Atrazine	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 19:20	10/01/07 09:00	BTJ
Benzo(a)pyrene	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 19:20	10/01/07 09:00	BTJ
Di(2-ethylhexyl)adipate	ug/l	0.3 U	EPA 525.2	0.3	10/01/07 19:20	10/01/07 09:00	BTJ
Di(2-ethylhexyl)phthalate	ug/l	1.0 U	EPA 525.2	1.0	10/01/07 19:20	10/01/07 09:00	BTJ
Endrin	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 19:20	10/01/07 09:00	BTJ
Heptachlor	ug/l	0.08 U	EPA 525.2	0.08	10/01/07 19:20	10/01/07 09:00	BTJ
Heptachlor Epoxide	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 19:20	10/01/07 09:00	BTJ
Hexachlorobenzene	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 19:20	10/01/07 09:00	BTJ
Hexachlorocyclopentadiene	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 19:20	10/01/07 09:00	BTJ
Lindane	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 19:20	10/01/07 09:00	BTJ
Methoxychlor	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 19:20	10/01/07 09:00	BTJ
Simazine	ug/l	0.07 U	EPA 525.2	0.07	10/01/07 19:20	10/01/07 09:00	BTJ
Pesticide Analyses (Primary DW)							
Date Extracted		09/28/07	EPA 549.2			09/28/07 13:00	JLR
Diquat	ug/l	1 U	EPA 549.2	1	10/02/07 15:31	09/28/07 13:00	JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 504.1			10/01/07 11:30	KAA
Dibromochloropropane	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 01:05	10/01/07 11:30	DB
Ethylene Dibromide (EDB)	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 01:05	10/01/07 11:30	DB
Carbamate Pesticides (Primary DW)							
Carbofuran	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 00:43		JKS
Oxamyl (Vydate)	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 00:43		JKS
Pesticide Analyses (Primary DW)							
Glyphosate	ug/l	10 U	EPA 547	10	10/03/07 22:35		JKS
Pesticide Analyses (Primary DW)							
Date Extracted		09/29/07	EPA 548.1			09/29/07 09:30	JLR
Endothall	ug/l	20 U	EPA 548.1	20	10/04/07 20:06	09/29/07 09:30	DB

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December 17, 2007
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Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Stage 1 Concentrate**					
Matrix		**Groundwater**					
SAL Sample Number		**75523.01**					
Date/Time Collected		**09/26/07 09:40**					
Date/Time Received		**09/26/07 13:00**					
Inorganics							
Chloride	mg/l	170	EPA 300.0	0.05	09/27/07 02:54		MLH
Color	CU	5	SM 2120 B	5	09/27/07 11:30		CYF
Cyanide	mg/l	0.005 U	SM 4500 CN	0.005	10/02/07 16:00	10/01/07 13:00	MCD
Fluoride	mg/l	2.9	EPA 300.0	0.01	09/27/07 02:54		MLH
Total Hardness as CaCO3	mg/l	1,400	SM 2340B	0.5	10/01/07 17:59	10/01/07 13:00	PSS
Nitrate (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 02:54		MLH
Nitrite (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 02:54		MLH
Odor	TON	6	SM 2150 B	1	09/27/07 08:30		MEJ
pH		6.5 Q5	EPA 150.1		09/26/07 17:08		CYF
Sulfate	mg/l	1,300	EPA 300.0	0.2	09/27/07 12:53		MLH
Foaming Agents	mg/l	0.05 U	SM 5540 C	0.05	09/27/07 13:30		JLS
Total Dissolved Solids	mg/l	2,100	SM 2540 C	10	10/01/07 17:05	09/26/07 16:59	CYF
Metals							
Silver	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09	09/27/07 17:00	PSS
Aluminum	mg/l	0.13 I	EPA 200.7	0.1	09/27/07 18:09		PSS
Arsenic	mg/l	0.0017 I	SM 3113 B	0.001	10/19/07 13:09		AMP
Barium	mg/l	0.083	EPA 200.7	0.01	09/27/07 18:09		PSS
Beryllium	mg/l	0.002 U	EPA 200.7	0.002	09/27/07 18:09		PSS
Calcium	mg/l	330	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09	09/27/07 17:00	PSS
Chromium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	09/27/07 18:09		PSS
Iron	mg/l	1.8	EPA 200.7	0.02	09/27/07 18:09		PSS
Mercury	mg/l	0.0001 U	EPA 245.1	0.0001	10/24/07 15:38	10/20/07 09:20	LCB
Magnesium	mg/l	150	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Manganese	mg/l	0.011 I	EPA 200.7	0.01	09/27/07 18:09		PSS
Sodium	mg/l	65	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Nickel	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09		PSS
Lead	mg/l	0.001 U	SM 3113 B	0.001	10/06/07 10:53		AMP
Antimony	mg/l	0.001 U	SM 3113 B	0.001	10/23/07 10:24		AMP
Selenium	mg/l	0.001 U	SM 3113 B	0.001	10/17/07 09:23		AMP
Thallium	mg/l	0.001 U	EPA 200.9	0.001	10/18/07 09:34		AMP
Zinc	mg/l	0.003 U	EPA 200.7	0.003	09/27/07 18:09		PSS
Microbiology							
Fecal Coliform	Ct/100 ml	1 U	SM 9222 D	1	09/27/07 17:08	09/26/07 13:19	RKB
Total Coliform	Ct/100 ml	1 U	SM 9222 B	1	09/27/07 17:19	09/26/07 13:19	RKB

FDOH Laboratory No. E84129
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Project No: 75522
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Total Permeate					
Matrix		Groundwater					
SAL Sample Number		75522.01					
Date/Time Collected		09/26/07 11:25					
Date/Time Received		09/26/07 13:00					
Volatile Organic Compounds (Primary DW)							
1,1,1-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
1,1,2-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
1,1-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
1,2,4 Trichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
1,2-Dichloroethane	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
1,2-Dichloropropane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
Benzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Carbon tetrachloride	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
cis-1,2-Dichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Dichloromethane	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Ethylbenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Monochlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
o-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
para-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Styrene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Tetrachloroethylene	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Toluene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
trans-1,2-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Trichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Vinyl chloride	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Xylenes (Total)	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
m/p-xylenes	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
o-xylene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Trihalomethane Analyses							
Bromodichloromethane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
Bromoform	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Chloroform	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Dibromochloromethane	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Total Trihalomethanes	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Chlorinated Pesticides (Primary DW)							
Date Extracted		10/01/07	EPA 508.1			10/01/07 09:00	SMR
Chlordane	ug/l	0.05 U	EPA 508.1	0.05	10/05/07 03:53	10/01/07 09:00	DB
Toxaphene	ug/l	0.5 U	EPA 508.1	0.5	10/05/07 03:53	10/01/07 09:00	DB
Polychlorinated biphenyls (PCBs)	ug/l	0.2 U	EPA 508.1	0.2	10/05/07 03:53	10/01/07 09:00	DB
Chlorinated Herbicides (Primary DW)							
Date Extracted		10/02/07	EPA 515.3			10/02/07 09:00	JLR
Dalapon	ug/l	1 U	EPA 515.3	1	10/09/07 15:01	10/02/07 09:00	BTJ

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Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Total Permeate					
Matrix		Groundwater					
SAL Sample Number		75522.01					
Date/Time Collected		09/26/07 11:25					
Date/Time Received		09/26/07 13:00					
Chlorinated Herbicides (Primary DW)							
2,4-D	ug/l	1 U	EPA 515.3	1	10/09/07 15:01	10/02/07 09:00	BTJ
Pentachlorophenol	ug/l	0.1 U	EPA 515.3	0.1	10/09/07 15:01	10/02/07 09:00	BTJ
2,4,5-TP (Silvex)	ug/l	0.25 U	EPA 515.3	0.25	10/09/07 15:01	10/02/07 09:00	BTJ
Dinoseb	ug/l	0.5 U	EPA 515.3	0.5	10/09/07 15:01	10/02/07 09:00	BTJ
Picloram	ug/l	0.75 U	EPA 515.3	0.75	10/09/07 15:01	10/02/07 09:00	BTJ
Semivolatile Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 525.2			10/01/07 09:00	SMR
Alachlor	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 18:47	10/01/07 09:00	BTJ
Atrazine	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 18:47	10/01/07 09:00	BTJ
Benzo(a)pyrene	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 18:47	10/01/07 09:00	BTJ
Di(2-ethylhexyl)adipate	ug/l	0.3 U	EPA 525.2	0.3	10/01/07 18:47	10/01/07 09:00	BTJ
Di(2-ethylhexyl)phthalate	ug/l	1.0 U	EPA 525.2	1.0	10/01/07 18:47	10/01/07 09:00	BTJ
Endrin	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 18:47	10/01/07 09:00	BTJ
Heptachlor	ug/l	0.08 U	EPA 525.2	0.08	10/01/07 18:47	10/01/07 09:00	BTJ
Heptachlor Epoxide	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 18:47	10/01/07 09:00	BTJ
Hexachlorobenzene	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 18:47	10/01/07 09:00	BTJ
Hexachlorocyclopentadiene	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 18:47	10/01/07 09:00	BTJ
Lindane	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 18:47	10/01/07 09:00	BTJ
Methoxychlor	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 18:47	10/01/07 09:00	BTJ
Simazine	ug/l	0.07 U	EPA 525.2	0.07	10/01/07 18:47	10/01/07 09:00	BTJ
Pesticide Analyses (Primary DW)							
Date Extracted		09/28/07	EPA 549.2			09/28/07 13:00	JLR
Diquat	ug/l	1 U	EPA 549.2	1	10/02/07 15:20	09/28/07 13:00	JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 504.1			10/01/07 11:30	KAA
Dibromochloropropane	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 00:34	10/01/07 11:30	DB
Ethylene Dibromide (EDB)	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 00:34	10/01/07 11:30	DB
Carbamate Pesticides (Primary DW)							
Carbofuran	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 00:07		JKS
Oxamyl (Vydate)	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 00:07		JKS
Pesticide Analyses (Primary DW)							
Glyphosate	ug/l	10 U	EPA 547	10	10/03/07 22:22		JKS
Pesticide Analyses (Primary DW)							
Date Extracted		09/29/07	EPA 548.1			09/29/07 09:30	JLR
Endothall	ug/l	20 U	EPA 548.1	20	10/04/07 19:49	09/29/07 09:30	DB

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.
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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75522
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Total Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**75522.01**					
Date/Time Collected		**09/26/07 11:25**					
Date/Time Received		**09/26/07 13:00**					
Inorganics							
Chloride	mg/l	33	EPA 300.0	0.05	09/27/07 02:37		MLH
Color	CU	5 U	SM 2120 B	5	09/27/07 11:30		CYF
Cyanide	mg/l	0.005 U	SM 4500 CN	0.005	10/02/07 16:00	10/01/07 13:00	MCD
Fluoride	mg/l	1.6	EPA 300.0	0.01	09/27/07 02:37		MLH
Total Hardness as CaCO3	mg/l	51	SM 2340B	0.5	10/01/07 17:59	10/01/07 13:00	PSS
Nitrate (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 02:37		MLH
Nitrite (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 02:37		MLH
Odor	TON	120	SM 2150 B	1	09/27/07 08:30		MEJ
pH		5.8 Q5	EPA 150.1		09/26/07 17:08		CYF
Sulfate	mg/l	16	EPA 300.0	0.2	09/27/07 02:37		MLH
Foaming Agents	mg/l	0.05 U	SM 5540 C	0.05	09/27/07 13:30		JLS
Total Dissolved Solids	mg/l	110	SM 2540 C	10	10/01/07 17:05	09/26/07 16:59	CYF
Metals							
Silver	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09	09/27/07 17:00	PSS
Aluminum	mg/l	0.1 U	EPA 200.7	0.1	09/27/07 18:09		PSS
Arsenic	mg/l	0.001 U	SM 3113 B	0.001	10/19/07 13:09		AMP
Barium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Beryllium	mg/l	0.002 U	EPA 200.7	0.002	09/27/07 18:09		PSS
Calcium	mg/l	11	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09	09/27/07 17:00	PSS
Chromium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	09/27/07 18:09		PSS
Iron	mg/l	0.059 I	EPA 200.7	0.02	09/27/07 18:09		PSS
Mercury	mg/l	0.0001 U	EPA 245.1	0.0001	10/24/07 15:38	10/20/07 09:20	LCB
Magnesium	mg/l	5.7	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Manganese	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Sodium	mg/l	13	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Nickel	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09		PSS
Lead	mg/l	0.001 U	SM 3113 B	0.001	10/06/07 10:53		AMP
Antimony	mg/l	0.001 U	SM 3113 B	0.001	10/23/07 10:24		AMP
Selenium	mg/l	0.001 U	SM 3113 B	0.001	10/17/07 09:23		AMP
Thallium	mg/l	0.001 U	EPA 200.9	0.001	10/18/07 09:34		AMP
Zinc	mg/l	0.003 U	EPA 200.7	0.003	09/27/07 18:09		PSS
Microbiology							
Fecal Coliform	Ct/100 ml	1 U	SM 9222 D	1	09/27/07 17:08	09/26/07 13:19	RKB
Total Coliform	Ct/100 ml	23	SM 9222 B	1	09/27/07 17:19	09/26/07 13:19	RKB

FDOH Laboratory No. E84129
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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75522
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Total Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**75522.01**					
Date/Time Collected		**09/26/07 11:25**					
Date/Time Received		**09/26/07 13:00**					
Radiochemistry							
Gross Alpha (Incl. Uranium)	pCi/l	2.5±1.4 U1	EPA 900.0	2.5	10/14/07 09:41	10/10/07 09:30	MJS
Radium-226	pCi/l	0.3±0.6	EPA 903.1	0.1	10/22/07 14:35	10/12/07 13:30	DF
Radium-228	pCi/l	0.9±0.5 U1	EPA RA-05	0.9	10/27/07 15:50	10/25/07 14:00	DF
Combined Uranium	pCi/l	0.5±0.3 U1	EPA 908.0	0.5	10/19/07 12:30	10/17/07 10:05	MJS

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Clearwater, FL 33756-

December 17, 2007
Project No: 75522
Revised

Laboratory Report

Project Name **Manatee County Pilot Study**

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
***	For methods marked with ***, all QC criteria have been met for this method which is equivalent to a SAL certified method.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.
U	Analyte was undetected. Indicated concentration is method detection limit.
U1	Analyte was not detected; indicated concentration is method detection limit. Radiochemistry MDL is sample specific and matrix dependent.

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110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 75522

Client Name	Contact / Phone:
McKim & Creed	Johna Jahn (727) 442-7196
Project Name / Location	**Turn Around Time Requested (*Surcharges may apply)**
Manatee County Pilot Study	24 Hour* ☐ 48 Hour* ☐ 5 Bus. Days ☐ 10 Bus. Day ☑
Samplers: (Signature) Zeng Wood	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool 4°C Misc. Inorganics	250ml P, H_2SO_4 Nutrients	250ml P, HNO_3 Metals	250ml P, NaOH Cyanide	1LG, Cool 4°C Odor	40ml V, HCl 502.2, TTHM	1LG, HCl 525.2,508.1	1LaP, H_2SO_4 549.2	40ml V, HCl 504.1	40ml V, MCAA 531.1	40ml Amber V, Cool 515.3	40ml V, Cool 548.1, 547	~~H2 gel, Nitric~~ Gross Alpha, R226, R228, Uranium	125 mL Sterile P, Cool Total & Fecal Coliforms		Total number of containers
01	Total Permeate	9/26/07	1125	GW		X	1	1	1	1	1	2	4	1	3	1	3	2	3	4		27
02	Trip Blank	9-25-07	10:55	R								1										

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
H/C	9-25-07 11:00	Zeng Wood	9/25/07 1200
Relinquished: Zeng Wood	Date/Time: 9/26/07 1300	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N (N/A)

Samples intact upon arrival? (Y) N N/A

Received on ice? Temp____ (Y) N N/A

Proper preservatives indicated? (Y) N N/A

Rec'd within holding time? (Y) N N/A

Volatiles rec'd w/out headspace (Y) N N/A

Proper containers used? (Y) N N/A

Instructions / Remarks:

Primary and Secondary Inorganics, VOCs, SOCs, Radiochemistry

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

SOUTHERN ANALYTICAL LABORATORIES, INC.
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Clearwater, FL 33756-

December 17, 2007
Project No: 75523
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Stage 1 Concentrate**					
Matrix		**Groundwater**					
SAL Sample Number		**75523.01**					
Date/Time Collected		**09/26/07 09:40**					
Date/Time Received		**09/26/07 13:00**					
Radiochemistry							
Gross Alpha (Incl. Uranium)	pCi/l	33±3.9	EPA 00-02	3.2	10/18/07 12:47	10/15/07 09:45	MJS
Radium-226	pCi/l	6.5±0.6	EPA 903.1	0.1	10/22/07 14:35	10/12/07 13:30	DF
Radium-228	pCi/l	1.0±0.5 U1	EPA RA-05	1.0	10/27/07 15:50		DF
Combined Uranium	pCi/l	0.5±0.3 U1	EPA 908.0	0.5	10/19/07 12:30	10/17/07 10:05	MJS

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December 17, 2007
Project No: 75523
Revised

Laboratory Report

Project Name **Manatee County Pilot Study**

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
***	For methods marked with ***, all QC criteria have been met for this method which is equivalent to a SAL certified method.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.
U	Analyte was undetected. Indicated concentration is method detection limit.
U1	Analyte was not detected; indicated concentration is method detection limit. Radiochemistry MDL is sample specific and matrix dependent.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 77523

Client Name	Contact / Phone:
City of Clearwater Public Utilities	727/224-7690
Project Name / Location	**Turn Around Time Requested (*Surcharges may apply)**
Marshall Street CBOD Study	☐ 24 Hour* ☐ 48 Hour* ☑ 5 Bus. Days* ☐ 10 Bus. Days
Samplers: (Signature) Mike Olsen	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	PARAMETER / CONTAINER DESCRIPTION: 1LP, Cool 4C CBOD	No. of Containers (Total per each location)
01	D001	12-3-07	0500	WW	X		1	1

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
LSH	10/22/07 0900	R. Tavares	10/22/07 1250
Relinquished: R. Tavares	Date/Time: 10/22/07	Received: Mike Olsen	Date/Time: 0500 12-3-07
Relinquished: Mike Olsen	Date/Time: 0700 12-3-07	Received: Luis Acosta	Date/Time:
Relinquished: Luis Acosta	Date/Time: 12-3-07 0900	Received: Roger Hooey	Date/Time: 1030 12/3/07
Relinquished: Roger Hooey	Date/Time: 12/3/07 1040	Received: K Mudrinich	Date/Time: 1040 12/03/07

Seal intact? Y N (N/A)

Samples intact upon arrival? (Y) N N/A

Received on ice? Temp.____ (Y) N N/A

Proper preservatives indicated? Y N (N/A)

Rec'd within holding time? (Y) N N/A

Volatiles rec'd w/out headspace Y N (N/A)

Proper containers used? (Y) N N/A

Instructions / Remarks:

D001:
Start: 12-2-07 0500
Stop: 12-3-07 0500

Chain of Custody.xls
Rev.Date 11/10/01

SOUTHERN ANALYTICAL LABORATORIES, INC.

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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75526
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Stage 2 Concentrate					
Matrix		Groundwater					
SAL Sample Number		75526.01					
Date/Time Collected		09/26/07 10:20					
Date/Time Received		09/26/07 13:00					
Volatile Organic Compounds (Primary DW)							
1,1,1-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:54		JRW
1,1,2-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:54		JRW
1,1-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
1,2,4 Trichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
1,2-Dichloroethane	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:54		JRW
1,2-Dichloropropane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:54		JRW
Benzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Carbon tetrachloride	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:54		JRW
cis-1,2-Dichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:54		JRW
Dichloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Ethylbenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Monochlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
o-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
para-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Styrene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Tetrachloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:54		JRW
Toluene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
trans-1,2-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Trichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:54		JRW
Vinyl chloride	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Xylenes (Total)	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
m/p-xylenes	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
o-xylene	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Trihalomethane Analyses							
Bromodichloromethane	ug/l	0.3 U	EPA 502.2	0.3	10/01/07 19:54		JRW
Bromoform	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Chloroform	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:54		JRW
Dibromochloromethane	ug/l	0.5 U	EPA 502.2	0.5	10/01/07 19:54		JRW
Total Trihalomethanes	ug/l	0.2 U	EPA 502.2	0.2	10/01/07 19:54		JRW
Chlorinated Pesticides (Primary DW)							
Date Extracted		10/03/07	EPA 508.1			10/03/07 09:30	SMR
Chlordane	ug/l	0.05 U	EPA 508.1	0.05	10/05/07 00:30	10/03/07 09:30	DB
Toxaphene	ug/l	0.5 U	EPA 508.1	0.5	10/05/07 00:30	10/03/07 09:30	DB
Polychlorinated biphenyls (PCBs)	ug/l	0.2 U	EPA 508.1	0.2	10/05/07 00:30	10/03/07 09:30	DB
Chlorinated Herbicides (Primary DW)							
Date Extracted		10/02/07	EPA 515.3			10/02/07 09:00	JLR
Dalapon	ug/l	1 U	EPA 515.3	1	10/09/07 01:26	10/02/07 09:00	BTJ

FDOH Laboratory No. E84129
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December 17, 2007
Project No: 75526
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Stage 2 Concentrate**					
Matrix		**Groundwater**					
SAL Sample Number		**75526.01**					
Date/Time Collected		**09/26/07 10:20**					
Date/Time Received		**09/26/07 13:00**					
Chlorinated Herbicides (Primary DW)							
2,4-D	ug/l	1 U	EPA 515.3	1	10/09/07 01:26	10/02/07 09:00	BTJ
Pentachlorophenol	ug/l	0.1 U	EPA 515.3	0.1	10/09/07 01:26	10/02/07 09:00	BTJ
2,4,5-TP (Silvex)	ug/l	0.25 U	EPA 515.3	0.25	10/09/07 01:26	10/02/07 09:00	BTJ
Dinoseb	ug/l	0.5 U	EPA 515.3	0.5	10/09/07 01:26	10/02/07 09:00	BTJ
Picloram	ug/l	0.75 U	EPA 515.3	0.75	10/09/07 01:26	10/02/07 09:00	BTJ
Semivolatile Analyses (Primary DW)							
Date Extracted		10/08/07	EPA 525.2			10/08/07 09:00	SMR
Alachlor	ug/l	0.2 U	EPA 525.2	0.2	10/08/07 22:14	10/08/07 09:00	BTJ
Atrazine	ug/l	0.06 U	EPA 525.2	0.06	10/08/07 22:14	10/08/07 09:00	BTJ
Benzo(a)pyrene	ug/l	0.1 U	EPA 525.2	0.1	10/08/07 22:14	10/08/07 09:00	BTJ
Di(2-ethylhexyl)adipate	ug/l	0.3 U	EPA 525.2	0.3	10/08/07 22:14	10/08/07 09:00	BTJ
Di(2-ethylhexyl)phthalate	ug/l	1.0 U	EPA 525.2	1.0	10/08/07 22:14	10/08/07 09:00	BTJ
Endrin	ug/l	0.1 U	EPA 525.2	0.1	10/08/07 22:14	10/08/07 09:00	BTJ
Heptachlor	ug/l	0.08 U	EPA 525.2	0.08	10/08/07 22:14	10/08/07 09:00	BTJ
Heptachlor Epoxide	ug/l	0.1 U	EPA 525.2	0.1	10/08/07 22:14	10/08/07 09:00	BTJ
Hexachlorobenzene	ug/l	0.05 U	EPA 525.2	0.05	10/08/07 22:14	10/08/07 09:00	BTJ
Hexachlorocyclopentadiene	ug/l	0.2 U	EPA 525.2	0.2	10/08/07 22:14	10/08/07 09:00	BTJ
Lindane	ug/l	0.06 U	EPA 525.2	0.06	10/08/07 22:14	10/08/07 09:00	BTJ
Methoxychlor	ug/l	0.05 U	EPA 525.2	0.05	10/08/07 22:14	10/08/07 09:00	BTJ
Simazine	ug/l	0.07 U	EPA 525.2	0.07	10/08/07 22:14	10/08/07 09:00	BTJ
Pesticide Analyses (Primary DW)							
Date Extracted		09/28/07	EPA 549.2			09/28/07 13:00	JLR
Diquat	ug/l	1 U	EPA 549.2	1	10/02/07 16:24	09/28/07 13:00	JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 504.1			10/01/07 11:30	KAA
Dibromochloropropane	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 02:40	10/01/07 11:30	DB
Ethylene Dibromide (EDB)	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 02:40	10/01/07 11:30	DB
Carbamate Pesticides (Primary DW)							
Carbofuran	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 02:32		JKS
Oxamyl (Vydate)	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 02:32		JKS
Pesticide Analyses (Primary DW)							
Glyphosate	ug/l	10 U	EPA 547	10	10/03/07 23:13		JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/02/07	EPA 548.1			10/02/07 10:00	CDD
Endothall	ug/l	20 U	EPA 548.1	20	10/05/07 00:50	10/02/07 10:00	DB

FDOH Laboratory No. E84129
NELAP Accredited

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December 17, 2007
Project No: 75526
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Stage 2 Concentrate					
Matrix		Groundwater					
SAL Sample Number		75526.01					
Date/Time Collected		09/26/07 10:20					
Date/Time Received		09/26/07 13:00					
Inorganics							
Chloride	mg/l	260	EPA 300.0	0.05	09/27/07 13:27		MLH
Color	CU	25	SM 2120 B	5	09/27/07 11:30		CYF
Cyanide	mg/l	0.005 U	SM 4500 CN	0.005	10/02/07 16:00	10/02/07 11:30	MCD
Fluoride	mg/l	3.4	EPA 300.0	0.01	10/02/07 22:07		MLH
Total Hardness as CaCO3	mg/l	3,000	SM 2340B	0.5	11/20/07 21:03	11/20/07 17:00	PSS
Nitrate (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 13:10		MLH
Nitrite (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 13:10		MLH
Odor	TON	4	SM 2150 B	1	09/27/07 08:30		MEJ
pH		6.7 Q5	EPA 150.1		09/26/07 17:08		CYF
Sulfate	mg/l	2,900	EPA 300.0	0.2	09/27/07 13:27		MLH
Foaming Agents	mg/l	0.05 I	SM 5540 C	0.05	09/27/07 13:30		JLS
Total Dissolved Solids	mg/l	4,500	SM 2540 C	10	10/02/07 12:00	09/26/07 16:59	CYF
Metals							
Silver	mg/l	0.01 U	EPA 200.7	0.01	10/04/07 00:49	10/03/07 17:30	PSS
Aluminum	mg/l	0.23 I	EPA 200.7	0.1	10/04/07 00:49		PSS
Arsenic	mg/l	0.0021 I	SM 3113 B	0.001	10/19/07 13:09		AMP
Barium	mg/l	0.01 U	EPA 200.7	0.01	10/04/07 00:49		PSS
Beryllium	mg/l	0.002 U	EPA 200.7	0.002	10/04/07 00:49		PSS
Calcium	mg/l	680	EPA 200.7	0.1	11/20/07 21:03	11/20/07 17:00	PSS
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	10/04/07 00:49		PSS
Chromium	mg/l	0.01 U	EPA 200.7	0.01	10/04/07 00:49		PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	10/04/07 00:49		PSS
Iron	mg/l	4.4	EPA 200.7	0.02	10/04/07 00:49		PSS
Mercury	mg/l	0.0001 U	EPA 245.1	0.0001	10/24/07 15:38	10/20/07 09:20	LCB
Magnesium	mg/l	310	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Manganese	mg/l	0.026 I	EPA 200.7	0.01	10/04/07 00:49	10/03/07 17:30	PSS
Sodium	mg/l	110	EPA 200.7	0.1	10/02/07 14:20	10/02/07 14:00	PSS
Nickel	mg/l	0.001 U	EPA 200.7	0.001	10/04/07 00:49	10/03/07 17:30	PSS
Lead	mg/l	0.001 U	SM 3113 B	0.001	10/06/07 10:53		AMP
Antimony	mg/l	0.001 U	SM 3113 B	0.001	10/23/07 10:24		AMP
Selenium	mg/l	0.001 U	SM 3113 B	0.001	10/17/07 09:23		AMP
Thallium	mg/l	0.001 U	EPA 200.9	0.001	10/18/07 09:34	10/02/07 17:50	AMP
Zinc	mg/l	0.003 U	EPA 200.7	0.003	10/04/07 00:49	10/03/07 17:30	PSS
Microbiology							
Fecal Coliform	Ct/100 ml	1 U	SM 9222 D	1	09/27/07 17:08	09/26/07 13:19	RKB
Total Coliform	Ct/100 ml	1 U	SM 9222 B	1	09/27/07 17:19	09/26/07 13:19	RKB

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75526
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Stage 2 Concentrate**					
Matrix		**Groundwater**					
SAL Sample Number		**75526.01**					
Date/Time Collected		**09/26/07 10:20**					
Date/Time Received		**09/26/07 13:00**					
Radiochemistry							
Gross Alpha (Incl. Uranium)	pCi/l	3.2±3.4 U1	EPA 00-02	3.2	10/18/07 12:47	10/15/07 09:45	MJS
Radium-226	pCi/l	0.2±0.3	EPA 903.1	0.08	10/22/07 14:35	10/15/07 14:30	DF
Radium-228	pCi/l	1.0±0.5 U1	EPA RA-05	1.0	10/27/07 15:50	10/25/07 14:00	DF
Combined Uranium	pCi/l	0.6±0.3 U1	EPA 908.0	0.6	10/19/07 12:31	10/17/07 10:05	MJS

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December 17, 2007
Project No: 75526
Revised

Laboratory Report

Project Name **Manatee County Pilot Study**

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
***	For methods marked with ***, all QC criteria have been met for this method which is equivalent to a SAL certified method.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.
U	Analyte was undetected. Indicated concentration is method detection limit.
U1	Analyte was not detected; indicated concentration is method detection limit. Radiochemistry MDL is sample specific and matrix dependent.

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 75526

Client Name: McKim & Creed	Contact / Phone: Johna Jahn (727) 442-7196
Project Name / Location: Manatee County Pilot Study	Turn Around Time Requested (*Surcharges may apply): 24 Hour* ☐ 48 Hour* ☐ 5 Bus. Days ☐ 10 Bus. Days ☑
Samplers: (Signature)	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool 4°C Misc. Inorganics	250ml P, H_2SO_4 Nutrients	250ml P, HNO_3 Metals	250ml P, NaOH Cyanide	1LG, Cool 4°C Odor	40ml V, HCl 502.2, TTHM	1LG, HCl 525.2,508.1	1LaP, H_2SO_4 549.2	40ml V, HCl 504.1	40ml V, MCAA 531.1	40ml Amber V, Cool 515.3	40ml V, Cool 548.1, 547	1/2 gal, HNO_3 Gross Alpha, R226, R228, Uranium	125 mL Sterile P, Cool Total & Fecal Coliforms		Total number of containers
							PARAMETER / CONTAINER DESCRIPTION																
01	STAGE 2 CONCENTRATE	9/24 2007	1120	GW		X	1	1	1	1	1	2	4	1	3	1	3	2	2	4		27
02	Trip Blank	9-25-07	10:55	R								1										

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
	9-25-07 11:00		9/25/07 1220
Relinquished:	Date/Time:	Received:	Date/Time:
	9/26/07 1300		
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N (N/A)

Samples intact upon arrival? (Y) N N/A

Received on ice? Temp ____ (Y) N N/A

Proper preservatives indicated? (Y) N N/A

Rec'd within holding time? (Y) N N/A

Volatiles rec'd w/out headspace (Y) N N/A

Proper containers used? (Y) N N/A

Instructions / Remarks:

Primary and Secondary Inorganics, VOCs, SOCs, Radiochemistry

Chain of Custody

Results from sampling of RO Pilot Plant Cleaning Solution
Collected on October 19, 2007

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

October 26, 2007
Project No: 76446

Laboratory Report

Project Name: RO Pilot Plant Cleaning Solution Analyses

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Beginning					
Matrix		Wastewater					
SAL Sample Number		76446.01					
Date/Time Collected		10/19/07 11:55					
Date/Time Received		10/19/07 16:00					
Inorganics							
Sulfide	mg/l	0.96	EPA 376.1	0.1	10/23/07 13:00		JLS
Total Phosphorus	mg/l P	0.074	EPA 365.2	0.01	10/24/07 10:31	10/23/07 16:30	VWC
Metals							
Calcium	mg/l	190	EPA 200.7	0.1	10/23/07 13:28	10/23/07 12:00	PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	10/23/07 15:51	10/23/07 09:50	PSS
Iron	mg/l	3.3	EPA 200.7	0.02	10/23/07 15:51	10/23/07 09:50	PSS
Magnesium	mg/l	87	EPA 200.7	0.1	10/23/07 13:28	10/23/07 12:00	PSS
Manganese	mg/l	0.01 U	EPA 200.7	0.01	10/23/07 15:51	10/23/07 09:50	PSS
Dissolved Silica as SiO2	mg/l	13	EPA 200.7	0.02	10/25/07 12:12	10/25/07 12:00	PSS
Strontium	mg/l	18	EPA 6010	0.01	10/23/07 15:51	10/23/07 09:50	PSS
Sample Description		End					
Matrix		Wastewater					
SAL Sample Number		76446.02					
Date/Time Collected		10/19/07 12:45					
Date/Time Received		10/19/07 16:00					
Inorganics							
Sulfide	mg/l	0.1 U	EPA 376.1	0.1	10/23/07 13:00		JLS
Total Phosphorus	mg/l P	0.13	EPA 365.2	0.01	10/24/07 10:31	10/23/07 16:30	VWC
Metals							
Calcium	mg/l	71	EPA 200.7	0.1	10/23/07 13:28	10/23/07 12:00	PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	10/23/07 15:51	10/23/07 09:50	PSS
Iron	mg/l	13	EPA 200.7	0.02	10/23/07 15:51	10/23/07 09:50	PSS
Magnesium	mg/l	32	EPA 200.7	0.1	10/23/07 13:28	10/23/07 12:00	PSS
Manganese	mg/l	0.025 I	EPA 200.7	0.01	10/23/07 15:51	10/23/07 09:50	PSS
Dissolved Silica as SiO2	mg/l	8.4	EPA 200.7	0.02	10/25/07 12:12	10/25/07 12:00	PSS
Strontium	mg/l	7.1	EPA 6010	0.01	10/23/07 15:51	10/23/07 09:50	PSS

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.
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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

October 26, 2007
Project No: 76446

Laboratory Report

Project Name: RO Pilot Plant Cleaning Solution Analyses

Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
U	Analyte was undetected. Indicated concentration is method detection limit.

SOUTHERN ANALYTICAL LABORATORIES, INC.

110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

SAL Project No. 76446

Client Name	Contact / Phone:
McKim & Creed	Ann H. Rocke 727-442-7196
Project Name / Location: RO Pilot Plant Cleaning Solution Analyses	
Samplers: (Signature) Ann H. Rocke	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP Cool 4°C Silica	250mL P HNO_3 Ca, Mg, Fe, Mn, Sr, Cu	1LP, NaOH/Zn Acetate - Sulfide	250mL P H_2SO_4 Total P					No. of Containers (Total per each location)
01	1A SULFIDE Beginning	10/19/07	11:55	WW		X	1	1	1	1					4
02	1B SULFIDE End	10/19/07	12:45	WW		X	1	1	1	1					4
	2A MISC. INORGANICS	10/19/07	11:55	WW											
	2B MISC. INORGANICS	10/19/07	12:45	WW											
	3A NUTRIENTS	10/19/07	11:55	WW											
	3B NUTRIENTS	10/19/07	12:45	WW											
	4A METALS	10/19/07	11:55	WW											
	4B METALS	10/19/07	12:45	WW											

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
LSH	101207 1127	Ann H. Rocke	10-12-07 1400
Ann H. Rocke	10-19-07 1600	J Mason	1600 10-19-07
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact? Y N (N/A)
Samples intact upon arrival? (Y) N N/A
Received on ice? Temp ____ (Y) N N/A
Proper preservatives indicated? (Y) N N/A
Rec'd within holding time? (Y) N N/A
Volatiles rec'd w/out headspace? Y N (N/A)
Proper containers used? (Y) N N/A

Instructions / Remarks

Chain of Custody.xls
Rev.Date 11/19/01

SOUTHERN ANALYTICAL LABORATORIES, INC.

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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75522
Revised

Laboratory Report

Project Name: **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		Total Permeate					
Matrix		Groundwater					
SAL Sample Number		75522.01					
Date/Time Collected		09/26/07 11:25					
Date/Time Received		09/26/07 13:00					
Volatile Organic Compounds (Primary DW)							
1,1,1-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
1,1,2-Trichloroethane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
1,1-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
1,2,4 Trichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
1,2-Dichloroethane	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
1,2-Dichloropropane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
Benzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Carbon tetrachloride	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
cis-1,2-Dichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Dichloromethane	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Ethylbenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Monochlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
o-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
para-Dichlorobenzene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Styrene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Tetrachloroethylene	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Toluene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
trans-1,2-Dichloroethylene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Trichloroethylene	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Vinyl chloride	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Xylenes (Total)	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
m/p-xylenes	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
o-xylene	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Trihalomethane Analyses							
Bromodichloromethane	ug/l	0.3 U	EPA 502.2	0.3	09/28/07 02:05		JRW
Bromoform	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Chloroform	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Dibromochloromethane	ug/l	0.5 U	EPA 502.2	0.5	09/28/07 02:05		JRW
Total Trihalomethanes	ug/l	0.2 U	EPA 502.2	0.2	09/28/07 02:05		JRW
Chlorinated Pesticides (Primary DW)							
Date Extracted		10/01/07	EPA 508.1			10/01/07 09:00	SMR
Chlordane	ug/l	0.05 U	EPA 508.1	0.05	10/05/07 03:53	10/01/07 09:00	DB
Toxaphene	ug/l	0.5 U	EPA 508.1	0.5	10/05/07 03:53	10/01/07 09:00	DB
Polychlorinated biphenyls (PCBs)	ug/l	0.2 U	EPA 508.1	0.2	10/05/07 03:53	10/01/07 09:00	DB
Chlorinated Herbicides (Primary DW)							
Date Extracted		10/02/07	EPA 515.3			10/02/07 09:00	JLR
Dalapon	ug/l	1 U	EPA 515.3	1	10/09/07 15:01	10/02/07 09:00	BTJ

FDOH Laboratory No. E84129
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December 17, 2007
Project No: 75522
Revised

Laboratory Report

Project Name **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Total Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**75522.01**					
Date/Time Collected		**09/26/07 11:25**					
Date/Time Received		**09/26/07 13:00**					
Chlorinated Herbicides (Primary DW)							
2,4-D	ug/l	1 U	EPA 515.3	1	10/09/07 15:01	10/02/07 09:00	BTJ
Pentachlorophenol	ug/l	0.1 U	EPA 515.3	0.1	10/09/07 15:01	10/02/07 09:00	BTJ
2,4,5-TP (Silvex)	ug/l	0.25 U	EPA 515.3	0.25	10/09/07 15:01	10/02/07 09:00	BTJ
Dinoseb	ug/l	0.5 U	EPA 515.3	0.5	10/09/07 15:01	10/02/07 09:00	BTJ
Picloram	ug/l	0.75 U	EPA 515.3	0.75	10/09/07 15:01	10/02/07 09:00	BTJ
Semivolatile Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 525.2			10/01/07 09:00	SMR
Alachlor	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 18:47	10/01/07 09:00	BTJ
Atrazine	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 18:47	10/01/07 09:00	BTJ
Benzo(a)pyrene	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 18:47	10/01/07 09:00	BTJ
Di(2-ethylhexyl)adipate	ug/l	0.3 U	EPA 525.2	0.3	10/01/07 18:47	10/01/07 09:00	BTJ
Di(2-ethylhexyl)phthalate	ug/l	1.0 U	EPA 525.2	1.0	10/01/07 18:47	10/01/07 09:00	BTJ
Endrin	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 18:47	10/01/07 09:00	BTJ
Heptachlor	ug/l	0.08 U	EPA 525.2	0.08	10/01/07 18:47	10/01/07 09:00	BTJ
Heptachlor Epoxide	ug/l	0.1 U	EPA 525.2	0.1	10/01/07 18:47	10/01/07 09:00	BTJ
Hexachlorobenzene	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 18:47	10/01/07 09:00	BTJ
Hexachlorocyclopentadiene	ug/l	0.2 U	EPA 525.2	0.2	10/01/07 18:47	10/01/07 09:00	BTJ
Lindane	ug/l	0.06 U	EPA 525.2	0.06	10/01/07 18:47	10/01/07 09:00	BTJ
Methoxychlor	ug/l	0.05 U	EPA 525.2	0.05	10/01/07 18:47	10/01/07 09:00	BTJ
Simazine	ug/l	0.07 U	EPA 525.2	0.07	10/01/07 18:47	10/01/07 09:00	BTJ
Pesticide Analyses (Primary DW)							
Date Extracted		09/28/07	EPA 549.2			09/28/07 13:00	JLR
Diquat	ug/l	1 U	EPA 549.2	1	10/02/07 15:20	09/28/07 13:00	JKS
Pesticide Analyses (Primary DW)							
Date Extracted		10/01/07	EPA 504.1			10/01/07 11:30	KAA
Dibromochloropropane	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 00:34	10/01/07 11:30	DB
Ethylene Dibromide (EDB)	ug/l	0.005 U	EPA 504.1	0.005	10/02/07 00:34	10/01/07 11:30	DB
Carbamate Pesticides (Primary DW)							
Carbofuran	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 00:07		JKS
Oxamyl (Vydate)	ug/l	0.5 U	EPA 531.1	0.5	10/03/07 00:07		JKS
Pesticide Analyses (Primary DW)							
Glyphosate	ug/l	10 U	EPA 547	10	10/03/07 22:22		JKS
Pesticide Analyses (Primary DW)							
Date Extracted		09/29/07	EPA 548.1			09/29/07 09:30	JLR
Endothall	ug/l	20 U	EPA 548.1	20	10/04/07 19:49	09/29/07 09:30	DB

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

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McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75522
Revised

Laboratory Report

Project Name **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Total Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**75522.01**					
Date/Time Collected		**09/26/07 11:25**					
Date/Time Received		**09/26/07 13:00**					
Inorganics							
Chloride	mg/l	33	EPA 300.0	0.05	09/27/07 02:37		MLH
Color	CU	5 U	SM 2120 B	5	09/27/07 11:30		CYF
Cyanide	mg/l	0.005 U	SM 4500 CN	0.005	10/02/07 16:00	10/01/07 13:00	MCD
Fluoride	mg/l	1.6	EPA 300.0	0.01	09/27/07 02:37		MLH
Total Hardness as CaCO3	mg/l	51	SM 2340B	0.5	10/01/07 17:59	10/01/07 13:00	PSS
Nitrate (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 02:37		MLH
Nitrite (as N)	mg/l	0.01 U	EPA 300.0	0.01	09/27/07 02:37		MLH
Odor	TON	120	SM 2150 B	1	09/27/07 08:30		MEJ
pH		5.8 Q5	EPA 150.1		09/26/07 17:08		CYF
Sulfate	mg/l	16	EPA 300.0	0.2	09/27/07 02:37		MLH
Foaming Agents	mg/l	0.05 U	SM 5540 C	0.05	09/27/07 13:30		JLS
Total Dissolved Solids	mg/l	110	SM 2540 C	10	10/01/07 17:05	09/26/07 16:59	CYF
Metals							
Silver	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09	09/27/07 17:00	PSS
Aluminum	mg/l	0.1 U	EPA 200.7	0.1	09/27/07 18:09		PSS
Arsenic	mg/l	0.001 U	SM 3113 B	0.001	10/19/07 13:09		AMP
Barium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Beryllium	mg/l	0.002 U	EPA 200.7	0.002	09/27/07 18:09		PSS
Calcium	mg/l	11	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Cadmium	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09	09/27/07 17:00	PSS
Chromium	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Copper	mg/l	0.005 U	EPA 200.7	0.005	09/27/07 18:09		PSS
Iron	mg/l	0.059 I	EPA 200.7	0.02	09/27/07 18:09		PSS
Mercury	mg/l	0.0001 U	EPA 245.1	0.0001	10/24/07 15:38	10/20/07 09:20	LCB
Magnesium	mg/l	5.7	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Manganese	mg/l	0.01 U	EPA 200.7	0.01	09/27/07 18:09		PSS
Sodium	mg/l	13	EPA 200.7	0.1	10/01/07 17:59	10/01/07 13:00	PSS
Nickel	mg/l	0.001 U	EPA 200.7	0.001	09/27/07 18:09		PSS
Lead	mg/l	0.001 U	SM 3113 B	0.001	10/06/07 10:53		AMP
Antimony	mg/l	0.001 U	SM 3113 B	0.001	10/23/07 10:24		AMP
Selenium	mg/l	0.001 U	SM 3113 B	0.001	10/17/07 09:23		AMP
Thallium	mg/l	0.001 U	EPA 200.9	0.001	10/18/07 09:34		AMP
Zinc	mg/l	0.003 U	EPA 200.7	0.003	09/27/07 18:09		PSS
Microbiology							
Fecal Coliform	Ct/100 ml	1 U	SM 9222 D	1	09/27/07 17:08	09/26/07 13:19	RKB
Total Coliform	Ct/100 ml	23	SM 9222 B	1	09/27/07 17:19	09/26/07 13:19	RKB

FDOH Laboratory No. E84129
NELAP Accredited

Francis I. Daniels, Laboratory Director
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.
110 BAYVIEW BOULEVARD, OLDSMAR, FL 34677 813-855-1844 fax 813-855-2218

McKim & Creed, PA
1365 Hamlet Ave.
Clearwater, FL 33756-

December 17, 2007
Project No: 75522
Revised

Laboratory Report

Project Name **Manatee County Pilot Study**

Parameters	Units	Results	Method	Detection Limit	Date/Time Analyzed	Date/Time Prep	Analyst
Sample Description		**Total Permeate**					
Matrix		**Groundwater**					
SAL Sample Number		**75522.01**					
Date/Time Collected		**09/26/07 11:25**					
Date/Time Received		**09/26/07 13:00**					
Radiochemistry							
Gross Alpha (Incl. Uranium)	pCi/l	2.5±1.4 U1	EPA 900.0	2.5	10/14/07 09:41	10/10/07 09:30	MJS
Radium-226	pCi/l	0.3±0.6	EPA 903.1	0.1	10/22/07 14:35	10/12/07 13:30	DF
Radium-228	pCi/l	0.9±0.5 U1	EPA RA-05	0.9	10/27/07 15:50	10/25/07 14:00	DF
Combined Uranium	pCi/l	0.5±0.3 U1	EPA 908.0	0.5	10/19/07 12:30	10/17/07 10:05	MJS

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Footnotes

*	Test results presented in this report meet all the requirements of the NELAC standards.
**	A statement of estimated uncertainty of test results is available upon request.
***	For methods marked with ***, all QC criteria have been met for this method which is equivalent to a SAL certified method.
I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
Q5	Analysis should be performed "immediately" in the field. Lab analysis was performed at a later time.
U	Analyte was undetected. Indicated concentration is method detection limit.
U1	Analyte was not detected; indicated concentration is method detection limit. Radiochemistry MDL is sample specific and matrix dependent.

FDOH Laboratory No. E84129
NELAP Accredited

Approved By: **Francis I. Daniels, Laboratory Director**
Leslie C. Boardman, Q. A. Manager

SOUTHERN ANALYTICAL LABORATORIES, INC.

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SAL Project No. 75522

Client Name: McKim & Creed	Contact / Phone: Johna Jahn (727) 442-7196
Project Name / Location: Manatee County Pilot Study	Turn Around Time Requested (*Surcharges may apply): 24 Hour* ☐ 48 Hour* ☐ 5 Bus. Days ☐ 10 Bus. Days ☑
Samplers: (Signature) Tony Wood	

Matrix Codes: DW-Drinking Water WW-Wastewater SW-SurfaceWater SL-Sludge SO-Soil GW-Groundwater SA-Saline Water O-Other R-Reagent Water

PARAMETER / CONTAINER DESCRIPTION

SAL Use Only Sample No.	Sample Description	Date	Time	Matrix	Composite	Grab	1LP, Cool 4°C Misc. Inorganics	250ml P, H_2SO_4 Nutrients	250ml P, HNO_3 Metals	250ml P, NaOH Cyanide	1LG, Cool 4°C Odor	40ml V, HCl 502.2, TTHM	1LG, HCl 525.2,508.1	1LaP, H_2SO_4 549.2	40ml V, HCl 504.1	40ml V, MCAA 531.1	40ml Amber V, Cool 515.3	40ml V, Cool 548.1, 547	~~1L gen Nuc~~ Gross Alpha, R226, R228, Uranium	125 mL Sterile P, Cool Total & Fecal Coliforms		Total number of containers
01	Total Perm date	9/26	1125	GW		X	1	1	1	1	1	2	4	1	3	1	3	2	2	4		27
02	Trip Blank	9-25-07	10:55	R								1										

Containers Prepared/ Relinquished:	Date/Time:	Received:	Date/Time:
JH/C	9-25-07 11:00	Tony Wood	9/25/07 1200
Relinquished: Tony Wood	Date/Time: 9/26/07 1300	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:
Relinquished:	Date/Time:	Received:	Date/Time:

Seal intact?	Y N (N/A)	Instructions / Remarks:
Samples intact upon arrival?	(Y) N N/A	Primary and Secondary Inorganics, VOCs, SOCs, Radiochemistry
Received on ice? Temp	(Y) N N/A	
Proper preservatives indicated?	(Y) N N/A	
Rec'd within holding time?	(Y) N N/A	
Volatiles rec'd w/out headspace	(Y) N N/A	
Proper containers used?	(Y) N N/A	

Chain of Custody.xls
Rev.Date 11/19/01

Chain of Custody

APPENDIX B

Mass/Flow Balance Calculations

MANATEE COUNTY
3 MGD RO WTP MASS/FLOW BALANCE CALCULATIONS

	Hardness			Chloride			Sulfate			TDS			Alpha		
Units	**Input**	**Name**	**Output**	**Input**	**Name**	**Output**	**Input**	**Name**	**Output**	**Input**	**Name**	**Output**	**Input**	**Name**	**Output**
mg/L	475	HDNS_RAW		68	CL_RAW		305	SULFATE_RAW		675	TDS_RAW		24	ALPHA_RAW	
mgd		Q_RAW	3.60		Q_RAW	3.50		Q_RAW	3.40		Q_RAW	3.43		Q_RAW	1.54
mg/L	475	HDNS_BYPASS		68	CL_BYPASS		305	SULFATE_BYPASS		675	TDS_BYPASS		24	ALPHA_BYPASS	
mgd		Q_BYPASS	0.83		Q_BYPASS	1.55		Q_BYPASS	1.42		Q_BYPASS	1.65		Q_BYPASS	2.00
mg/L	475	HDNS_FEED		68	CL_FEED		305	SULFATE_FEED		675	TDS_FEED		24	ALPHA_FEED	
mgd		Q_FEED	2.78		Q_FEED	1.95		Q_FEED	1.98		Q_FEED	1.77		Q_FEED	-0.46
mgd		Q_PERM	2.37		Q_PERM	1.65		Q_PERM	1.78		Q_PERM	1.55		Q_PERM	1.20
mgd		Q_CONC	0.40		Q_CONC	0.30		Q_CONC	0.20		Q_CONC	0.23		Q_CONC	-1.66
mg/L	50	HDNS_PERM		33	CL_PERM		16	SULFATE_PERM		110	TDS_PERM		0	ALPHA_PERM	
mg/L	160	HDNS_DIST		50	CL_DIST		144	SULFATE_DIST		402	TDS_DIST		15	ALPHA_DIST	
mgd	3.20	Q_DIST		3.20	Q_DIST		3.20	Q_DIST		3.2	Q_DIST		3.20	Q_DIST	
mg/L	2972	HDNS_CONC		260	CL_CONC		2900	SULFATE_CONC		4500	TDS_CONC		6.6	ALPHA_CONC	

Water quality projections based on anticipated ratio of Upper Floridan and Intermediate Aquifer wells.
Based on Table above, Hardness is limiting factor.

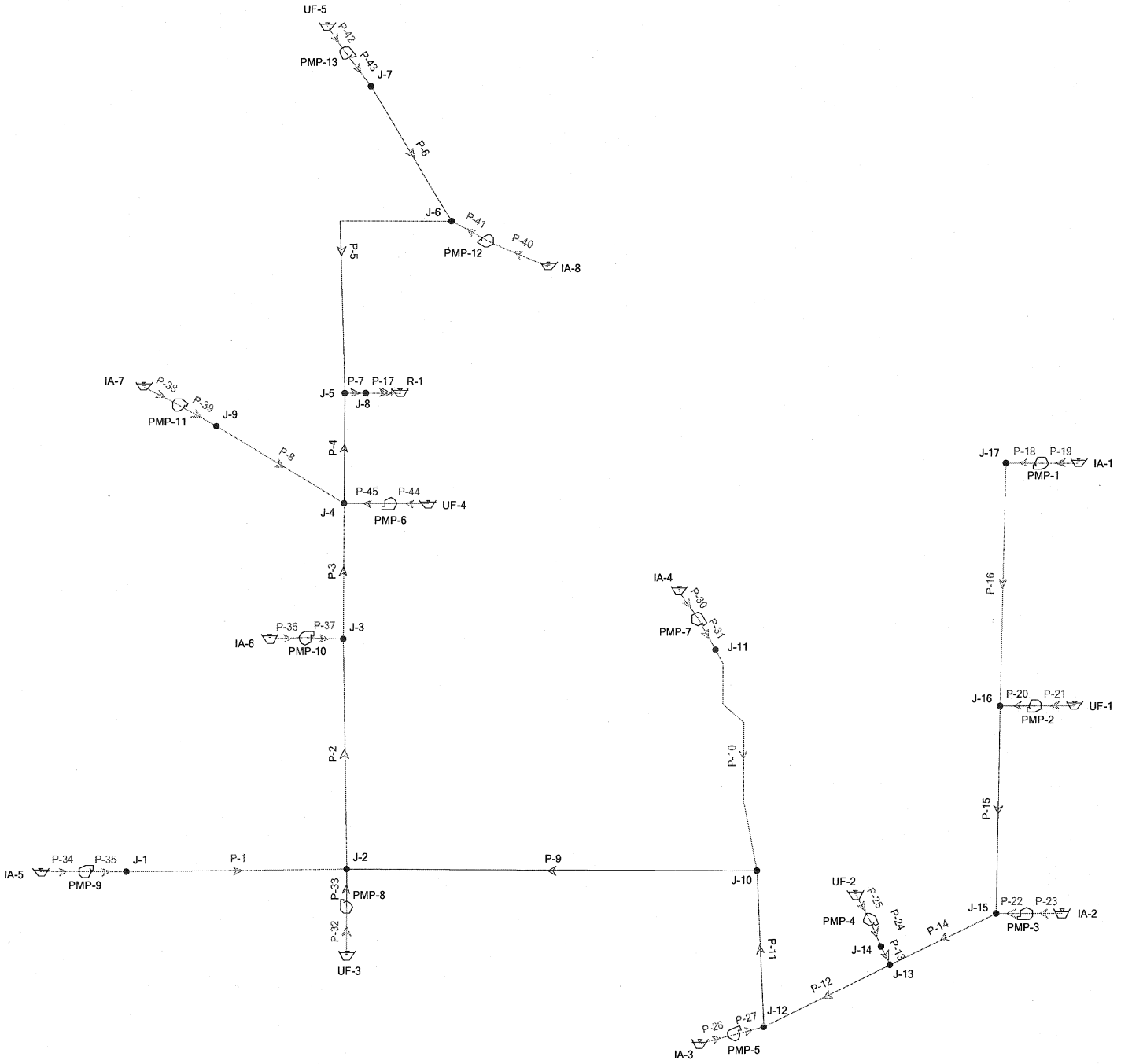
	Design Flows and Concentrations		
Units	**Input**	**Name**	**Output**
mg/L	475	HDNS_RAW	
mgd		Q_RAW	3.95
mg/L	475	HDNS_BYPASS	
mgd		Q_BYPASS	0.95
mg/L	475	HDNS_FEED	
mgd		Q_FEED	3.00
mgd		Q_PERM	2.25
mgd		Q_CONC	0.75
mg/L		HDNS_PERM	27
mg/L	160	HDNS_DIST	
mgd	3.20	Q_DIST	
mg/L		HDNS_CONC	1819

Concentrations in Distribution System and Concentrate Stream		
Concentrations	**Dist**	**Conc**
Hardness (mg/L)	160	1819
Chloride (mg/L)	46	164
Sulfate (mg/L)	104	1166
TDS (mg/L)	287	2337
Alpha (mg/L)	6	80

APPENDIX C

Hydraulic Modeling and Candidate Pumps

Scenario: 700 gpm UF & 150 gpm IA Submersible



Scenario: 700 gpm UF & 150 gpm IA Submersible
Steady State Analysis
Reservoir Report

Label	Elevation (ft)	Zone	Inflow (gpm)	Calculated Hydraulic Grade (ft)
R-1	115.00	Zone	1,747.74	115.00
IA-1	-50.00	Zone	-152.91	-50.00
UF-1	-50.00	Zone	-704.72	-50.00
IA-2	-50.00	Zone	-151.04	-50.00
UF-2	-50.00	Zone	-708.10	-50.00
IA-3	-50.00	Zone	-151.27	-50.00
IA-4	-50.00	Zone	-154.25	-50.00
UF-3	-50.00	Zone	-713.79	-50.00
IA-5	-50.00	Zone	-153.18	-50.00
IA-6	-50.00	Zone	-150.83	-50.00
IA-7	-50.00	Zone	-151.78	-50.00
IA-8	-50.00	Zone	-149.54	-50.00
UF-5	-50.00	Zone	-710.94	-50.00
UF-4	-50.00	Zone	-695.40	-50.00

Scenario: 700 gpm UF & 150 gpm IA Submersible
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)	Pressure Head (ft)
J-1	31.00	Zone	Demand	0.00	Fixed	0.00	127.46	41.73	96.46
J-2	34.00	Zone	Demand	0.00	Fixed	0.00	124.87	39.32	90.87
J-3	30.00	Zone	Demand	0.00	Fixed	0.00	119.58	38.76	89.58
J-4	30.00	Zone	Demand	0.00	Fixed	0.00	117.25	37.75	87.25
J-5	0.00	Zone	Demand	0.00	Fixed	0.00	116.88	50.57	116.88
J-6	29.00	Zone	Demand	0.00	Fixed	0.00	130.73	44.01	101.73
J-7	27.00	Zone	Demand	0.00	Fixed	0.00	135.42	46.91	108.42
J-8	30.00	Zone	Demand	0.00	Fixed	0.00	116.12	37.26	86.12
J-9	29.00	Zone	Demand	0.00	Fixed	0.00	118.66	38.79	89.66
J-10	0.00	Zone	Demand	0.00	Fixed	0.00	129.11	55.86	129.11
J-11	33.00	Zone	Demand	0.00	Fixed	0.00	132.32	42.97	99.32
J-12	33.00	Zone	Demand	0.00	Fixed	0.00	135.58	44.38	102.58
J-13	0.00	Zone	Demand	0.00	Fixed	0.00	140.78	60.91	140.78
J-14	25.00	Zone	Demand	0.00	Fixed	0.00	141.58	50.44	116.58
J-15	24.00	Zone	Demand	0.00	Fixed	0.00	145.01	52.36	121.01
J-16	26.00	Zone	Demand	0.00	Fixed	0.00	159.26	57.66	133.26
J-17	28.00	Zone	Demand	0.00	Fixed	0.00	161.60	57.80	133.60

Scenario: 700 gpm UF & 150 gpm IA Submersible
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Upstream Structure Hydraulic Grade (ft)	Downstream Structure Hydraulic Grade (ft)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-1	1,064.00	6.0	Ductile Iro	130.0	false	3.00	Open	153.18	127.46	124.87	2.59	2.43	1.74
P-2	1,115.00	16.0	Ductile Iro	130.0	false	1.00	Open	2,889.26	124.87	119.58	5.30	4.75	4.61
P-3	400.00	16.0	Ductile Iro	130.0	false	1.00	Open	3,040.09	119.58	117.25	2.32	5.81	4.85
P-4	50.00	20.0	Ductile Iro	130.0	false	1.00	Open	3,887.27	117.25	116.88	0.37	7.50	3.97
P-5	900.00	8.0	Ductile Iro	130.0	false	3.00	Open	860.47	130.73	116.88	13.85	15.39	5.49
P-6	450.00	8.0	Ductile Iro	130.0	false	1.00	Open	710.94	135.42	130.73	4.69	10.42	4.54
P-7	105.00	20.0	Ductile Iro	130.0	false	1.00	Open	4,747.74	116.88	116.12	0.76	7.24	4.85
P-8	600.00	6.0	Ductile Iro	130.0	false	1.00	Open	-151.78	117.25	118.66	1.40	2.34	1.72
P-9	1,700.00	16.0	Ductile Iro	130.0	false	2.00	Open	2,022.28	129.11	124.87	4.23	2.49	3.23
P-10	1,300.00	6.0	Ductile Iro	130.0	false	4.00	Open	154.25	132.32	129.11	3.22	2.47	1.75
P-11	749.00	12.0	Ductile Iro	130.0	false	1.00	Open	-1,868.03	129.11	135.58	6.48	8.65	5.30
P-12	700.00	12.0	Ductile Iro	130.0	false	1.00	Open	-1,716.77	135.58	140.78	5.20	7.42	4.87
P-13	50.00	8.0	Ductile Iro	130.0	false	1.00	Open	708.10	141.58	140.78	0.80	15.98	4.52
P-14	550.00	10.0	Ductile Iro	130.0	false	3.00	Open	1,008.66	145.01	140.78	4.23	7.70	4.12
P-15	1,003.00	8.0	Ductile Iro	130.0	false	1.00	Open	-857.62	145.01	159.26	14.25	14.21	5.47
P-16	1,000.00	6.0	Ductile Iro	130.0	false	1.00	Open	152.91	161.60	159.26	2.34	2.34	1.74
P-17	200.00	20.0	Ductile Iro	130.0	true	1.00	Open	4,747.74	116.12	115.00	1.12	5.59	4.85
P-18	200.00	6.0	Ductile Iro	130.0	false	3.00	Open	152.91	162.20	161.60	0.60	2.99	1.74
P-19	1.00	10.0	Ductile Iro	130.0	false	0.28	Open	152.91	-50.00	-50.00	0.00	1.88	0.62
P-20	400.00	8.0	Ductile Iro	130.0	false	3.00	Open	704.72	164.02	159.26	4.76	11.91	4.50
P-21	1.00	16.0	Ductile Iro	130.0	false	0.28	Open	704.72	-50.00	-50.01	0.01	5.83	1.12
P-22	200.00	6.0	Ductile Iro	130.0	false	3.00	Open	151.04	145.59	145.01	0.58	2.92	1.71
P-23	1.00	10.0	Ductile Iro	130.0	false	0.28	Open	-151.04	-50.00	-50.00	0.00	1.84	0.62
P-24	400.00	8.0	Ductile Iro	130.0	false	3.00	Open	-708.10	141.58	146.38	4.81	12.02	4.52
P-25	1.00	16.0	Ductile Iro	130.0	false	0.28	Open	708.10	-50.00	-50.01	0.01	5.88	1.13
P-26	1.00	10.0	Ductile Iro	130.0	false	0.28	Open	151.27	-50.00	-50.00	0.00	1.85	0.62
P-27	50.00	6.0	Ductile Iro	130.0	false	3.00	Open	151.27	135.83	135.58	0.25	4.99	1.72
P-30	1.00	10.0	Ductile Iro	130.0	false	0.28	Open	154.25	-50.00	-50.00	0.00	1.92	0.63
P-31	200.00	6.0	Ductile Iro	130.0	false	3.00	Open	154.25	132.93	132.32	0.61	3.04	1.75
P-32	1.00	16.0	Ductile Iro	130.0	false	0.28	Open	713.79	-50.00	-50.01	0.01	5.97	1.14
P-33	300.00	8.0	Ductile Iro	130.0	false	3.00	Open	713.79	128.77	124.87	3.90	13.01	4.56
P-34	212.00	6.0	Ductile Iro	130.0	false	0.28	Open	153.18	-50.00	-50.50	0.50	2.36	1.74
P-35	200.00	6.0	Ductile Iro	130.0	false	3.00	Open	153.18	128.06	127.46	0.60	3.00	1.74
P-36	1.00	6.0	Ductile Iro	130.0	false	0.28	Open	150.83	-50.00	-50.01	0.01	14.97	1.71
P-37	200.00	6.0	Ductile Iro	130.0	false	3.00	Open	150.83	120.16	119.58	0.58	2.91	1.71
P-38	1.00	6.0	Ductile Iro	130.0	false	0.28	Open	151.78	-50.00	-50.02	0.02	15.15	1.72
P-39	200.00	6.0	Ductile Iro	130.0	false	3.00	Open	151.78	119.25	118.66	0.59	2.95	1.72
P-40	1.00	60.0	Ductile Iro	130.0	false	0.28	Open	149.54	-50.00	-50.00	0.00	0.00	0.02
P-41	550.00	6.0	Ductile Iro	130.0	false	3.00	Open	149.54	132.07	130.73	1.34	2.44	1.70
P-42	1.00	16.0	Ductile Iro	130.0	false	0.28	Open	710.94	-50.00	-50.01	0.01	5.93	1.13
P-43	400.00	8.0	Ductile Iro	130.0	false	3.00	Open	710.94	140.26	135.42	4.84	12.11	4.54
P-44	1.00	16.0	Ductile Iro	130.0	false	0.28	Open	695.40	-50.00	-50.01	0.01	5.67	1.11
P-45	400.00	8.0	Ductile Iro	130.0	false	3.00	Open	695.40	121.90	117.25	4.65	11.62	4.44

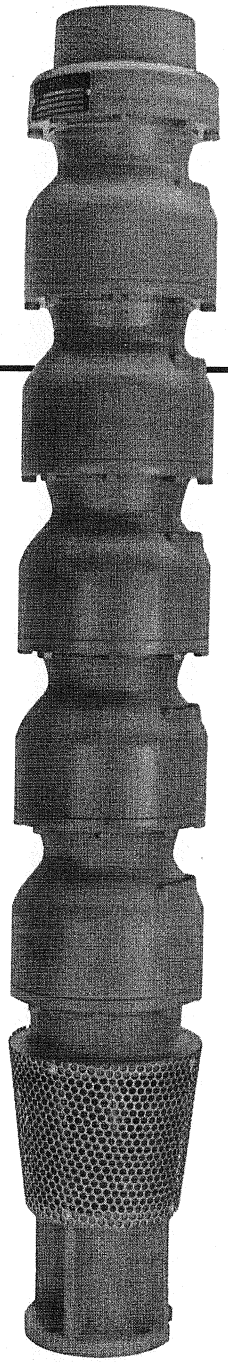
Scenario: 700 gpm UF & 150 gpm IA Submersible
Steady State Analysis
Pump Report

Label	Elevation (ft)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Discharge (gpm)	Pump Head (ft)	Calculated Water Power (Hp)
PMP-1	-50.00	On	-50.00	162.20	152.91	212.20	8.19
PMP-2	-50.00	On	-50.01	164.02	704.72	214.03	38.08
PMP-3	-50.00	On	-50.00	145.59	151.04	195.60	7.46
PMP-4	-50.00	On	-50.01	146.38	708.10	196.39	35.11
PMP-5	-50.00	On	-50.00	135.83	151.27	185.83	7.10
PMP-6	-50.00	On	-50.01	121.90	695.40	171.91	30.18
PMP-7	-50.00	On	-50.00	132.93	154.25	182.93	7.12
PMP-8	-50.00	On	-50.01	128.77	713.79	178.78	32.22
PMP-9	-50.00	On	-50.50	128.06	153.18	178.56	6.91
PMP-10	-50.00	On	-50.01	120.16	150.83	170.17	6.48
PMP-11	-50.00	On	-50.02	119.25	151.78	169.26	6.49
PMP-12	-50.00	On	-50.00	132.07	149.54	182.07	6.87
PMP-13	-50.00	On	-50.01	140.26	710.94	190.27	34.15

GOULDS PUMPS

316 Stainless Steel Submersible Turbine Pumps

5"-11" Diameter For 6" and larger wells



SPECIFICATIONS – 3450 RPM

Model	Max. PSI	Max. TDH	Max. Stage	Operating Range GPM	Best Efficiency Range	Horsepower Range	Discharge Connections	Minimum Well Size
5CNLC	460	1063	18	60 – 180	115	5 – 30	4"	6"
5CNHC	450	1040	17	60 – 200	140	5 – 50	4"	6"
5TNLC	475	1097	20	80 – 225	175	5 – 30	4"	6"
5TNHC	460	1063	20	150 – 300	240	5 – 50	4"	6"
6CNLC	455	1051	13	100 – 225	160	5 – 40	4"	8"
6CNHC	450	1040	13	150 – 300	225	10 – 50	4"	8"
7CNLC	425	982	8	275 – 430	350	10 – 75	4",6"	8"
7CNHC	405	936	8	300 – 600	450	15 – 100	4", 6"	8"
7TNLC	412	952	8	300 – 650	550	10 – 75	4". 6"	8"
7TNHC	395	913	9	375 – 800	600	15 – 100	4", 6"	8"
9CNLC	495	1144	6	400 – 875	600	30 – 150	6"	10"
9CNHC	490	1132	6	550 – 1200	900	50 – 150	6"	10"
9TNLC	530	1224	7	700 – 1400	1050	40 – 150	6"	10"
9TNHC	462	1067	6	900 – 1700	1300	50 – 150	6"	10"
11CNLC	545	1259	4	500 – 1700	1200	75 – 150	6", 8"	12"

FEATURES

■ **Discharge Adapter:** Several discharge sizes available with NPT or Flanged design in 316 SS.

■ **Discharge Bearing:** Extra long sealed top bronze bearing insures positive shaft alignment and stabilization for extended life. Standard bronze bearings are of a superior quality Bismuth alloy to ensure tensile strength, yield strength, and percentage elongation results.

■ **Intermediate Bowl:** High efficiency design in cast 316 stainless steel.

■ **Impellers:** Designed for maximum efficiency with wide range hydraulic coverage.

■ **Thrust Washer:** Designed for extra margin of safety against possible momentary upthrust occurring at start-up.

■ **Intermediate Bowl Bearings:** Reliable long life Bismuth bronze bearing is standard. Optional rubber or other materials available.

■ **Taper Locks:** Accurately machined in 316SS to insure positive locking of impeller to pump shaft.

■ **Suction Inlet:** Contoured for smooth flow entrance. Protected by an oversized 304 stainless steel strainer to prevent entrance of damaging solids.

■ **Motor Adapter:** Cast 316 stainless steel for corrosion resistance, increased strength and positive motor alignment. Permits easy access to pump/motor coupling.

■ **Pump to Motor Coupling:** Large stainless steel coupling accurately matched for perfect alignment, balance and power transmission.

■ **Pump Shaft:** 316 stainless steel provides strength and excellent corrosion resistance. Ground and polished for smooth bearing surface.

■ **Powered for Continuous Operation:** All ratings are within the working limits of the motor manufacturer. Pump can be operated continuously without fear of damage to the motor.

■ **Submersible Motor:**

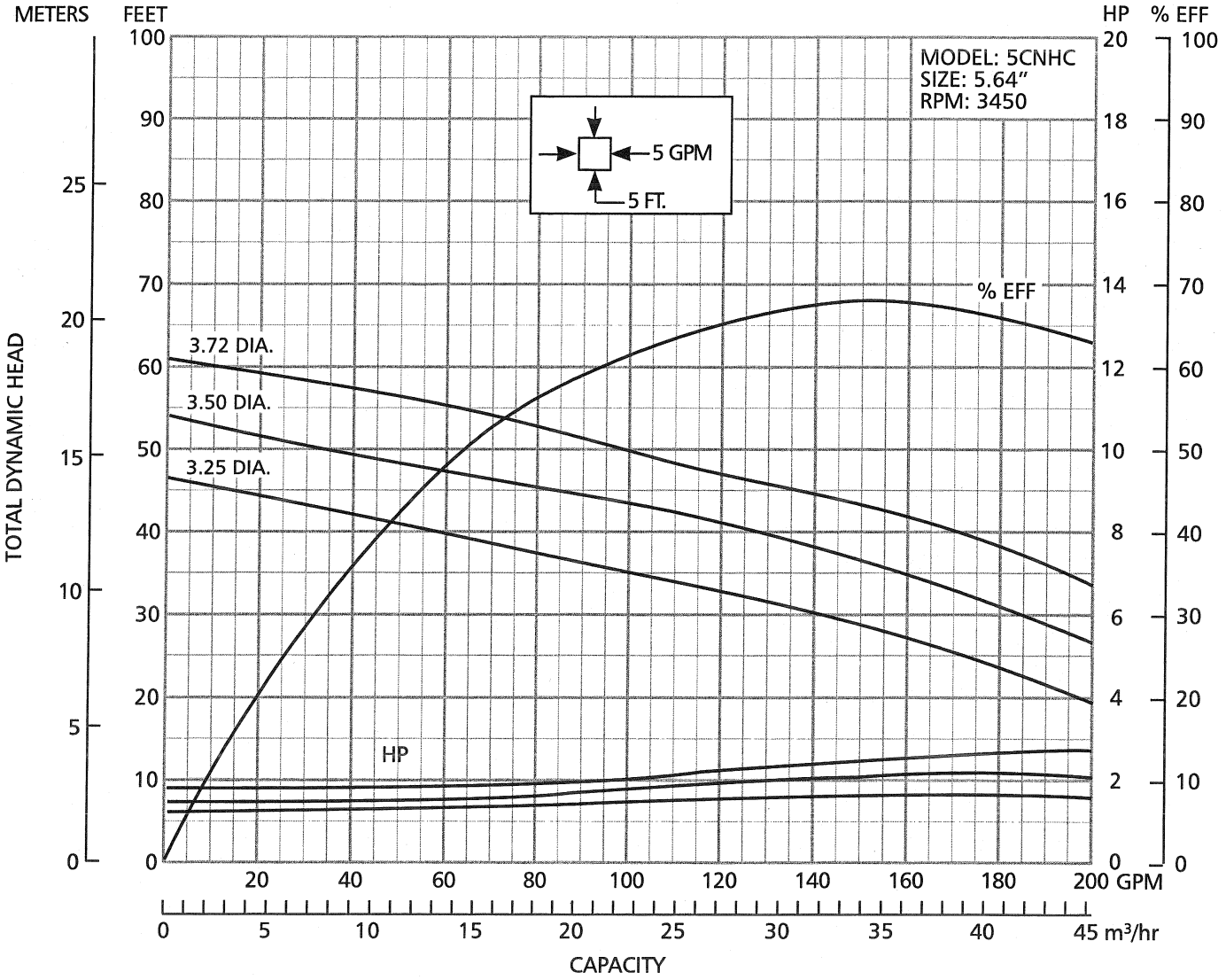
- 316 stainless steel corrosion resistant construction
- 316 stainless steel splined shaft
- Hermetically sealed windings
- Anti-track self-healing resin system
- Water lubrication
- Kingsbury type thrust bearing
- Pressure equalizing diaphragm
- Sand fighter slinger
- UL 778 recognized.

Goulds Pumps

ITT Industries

Model 5CNHC 316 Stainless Steel Pump

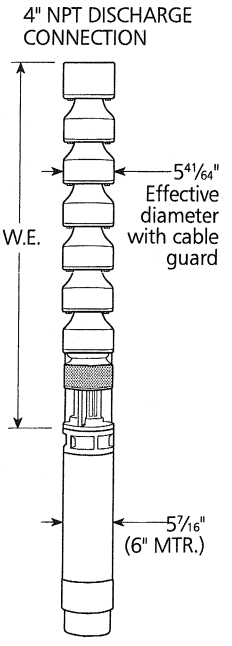
Single Stage Performance Curve



Characteristics based upon pumping clear non-aerated water.
Rating point only is guaranteed. Column and other losses not included.

SPECIFICATIONS

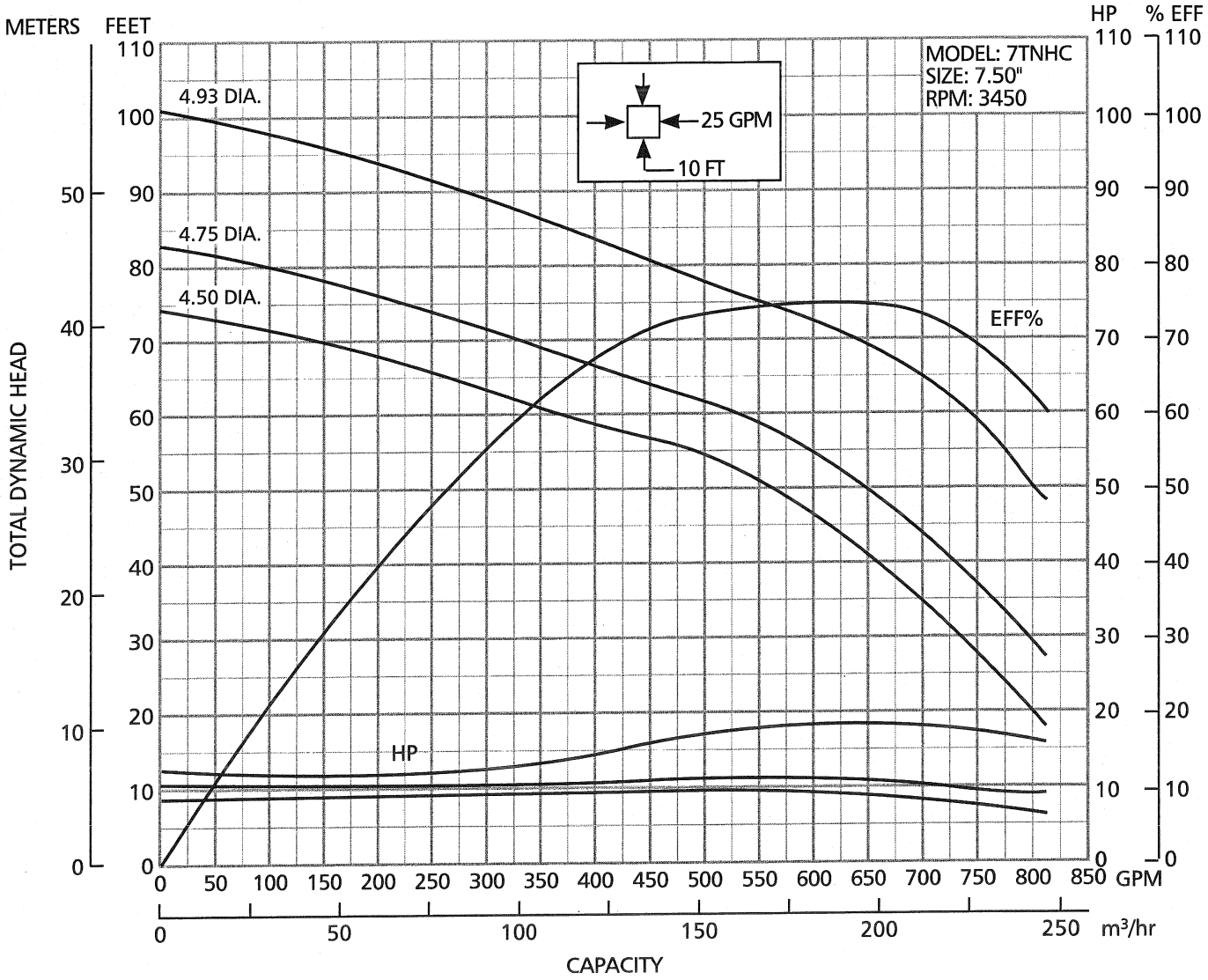
- **RPM:** 3450, 60 Hz
- **Max. O.D. with Cable Guard:** 5.64"
- **Minimum Well Size:** 6"
- **Available Discharge Size:** 4"
- **Available Motor Size:** 6"
- **Bowl Connection:** Bolted
- **Impeller:** Enclosed Type
- **Bearing Material:** Bronze, other materials available.
- **Thrust Constant (K):** 1.2 lbs./ft.
- **Specific Speed:** 2140
- **Maximum Shutoff Head:** 450 PSI / 1040 Feet
- **Maximum Number of Stages:** 17
- **Efficiency Correction:** 1 Stage deduct 4.0
  2 Stages deduct 3.0
  3 Stages deduct 1.5



Curves reflect typical performance, refer to factory for certification.

Model 7TNHC 316 Stainless Steel Pump

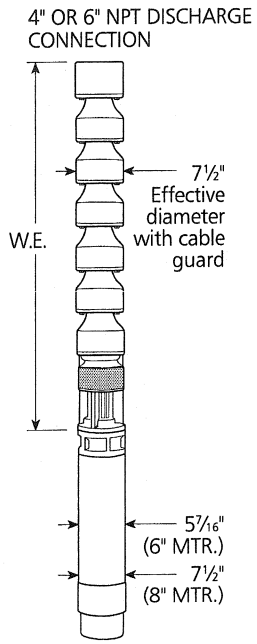
Single Stage Performance Curve



Characteristics based upon pumping clear non-aerated water.
Rating point only is guaranteed. Column and other losses not included.

SPECIFICATIONS

- **RPM:** 3450, 60 Hz
- **Max. O.D. with Cable Guard:** 7.50"
- **Minimum Well Size:** 8"
- **Available Discharge Size:** 4" & 6"
- **Available Motor Size:** 6", 8"
- **Bowl Connection:** Bolted
- **Impeller:** Enclosed Type
- **Bearing Material:** Bronze, other materials available.
- **Thrust Constant (K):** 4.56 lbs./ft.
- **Specific Speed:** 3619
- **Maximum Shutoff Head:** 395 PSI / 913 Feet
- **Maximum Number of Stages:** 9
- **Efficiency Correction:** 1 Stage deduct 3.0
  2 Stages deduct 2.0
  3 Stages deduct 1.0



Curves reflect typical performance, refer to factory for certification.

MATERIALS OF CONSTRUCTION *(Drawing 1)*

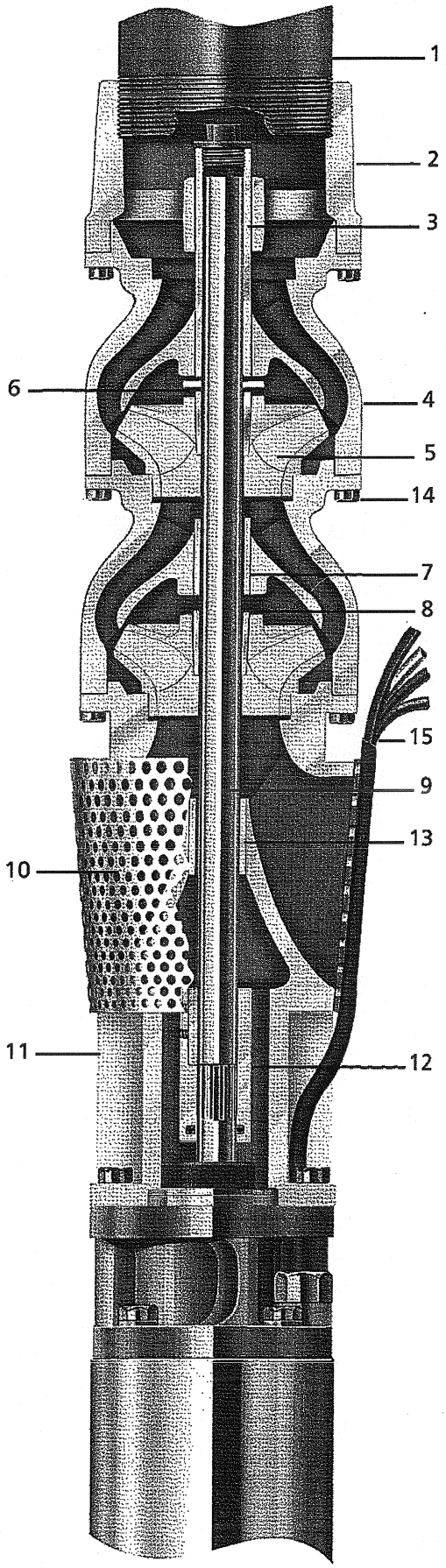
Item	Nomenclature	Material	Specifications
1	Column Pipe		By Others
2	Discharge Adapter	316 SS	A744 CF8M
3	Discharge Bearing	Bronze	B584 C90300
4	Intermediate Bowl	316 SS	A744 CF8M
5	Impeller	316 SS	A744 CF8M
6	Thrust Washer	DPE	Polyethylene
7	Intermediate Bowl Bearing	Bronze	B584 C90300
8	Taper Lock	316 SS	A276 S31600
9	Pump Shaft	316 SS	A276 S31600
10	Suction Inlet Screen	304 SS	A240 S30400
11	Motor Adapter	316 SS	A744 CF8M
12	Coupling	316 SS	A276 S31600
13	Motor Adapter Bearing	Bronze	B584 C90300
14	Bolts	316 SS	A276 S31600
15	Cable Guard	304 SS	A240 S30400

Other bearing materials available upon request. Contact factory.

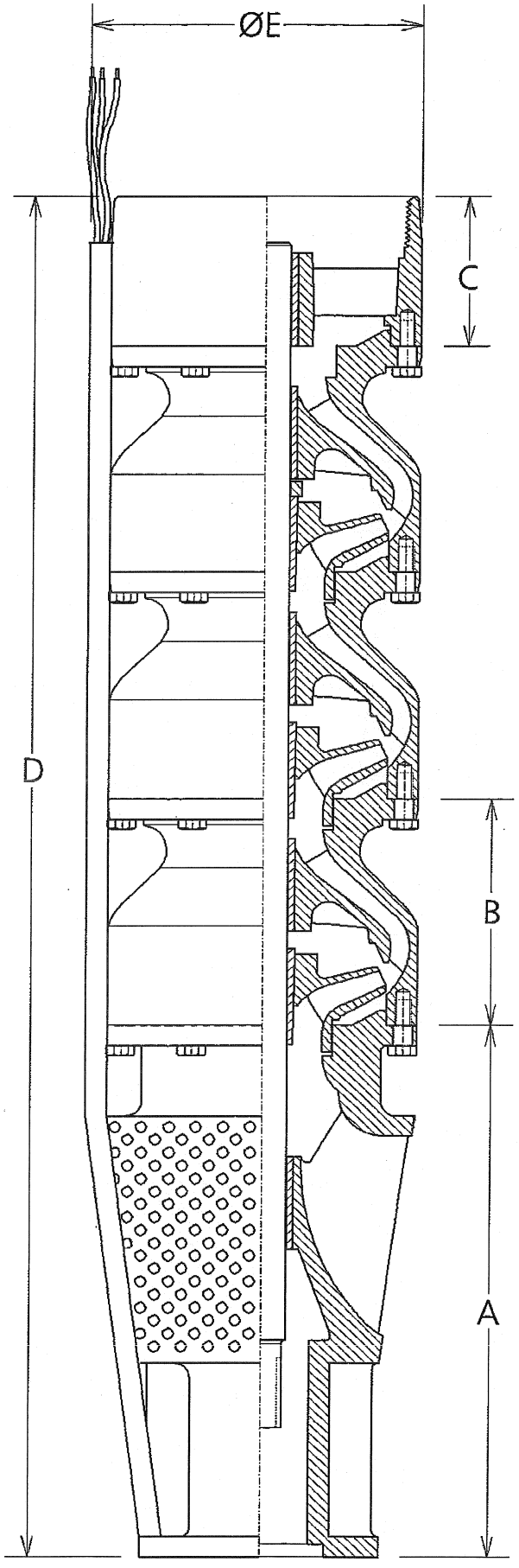
5"-11" COMPONENTS *(Drawing 2)*

Model	NEMA	"A" (in.)	"B" (in.)	"C" (in.)	"D" (in.)	"E" (in.)	Disc Size - NPT (in.)	First STG Wt. - lbs.	Additional STG Wt. - lbs.
5CN	6	10.6	4.6	3.1	18.3	5.6	4"	62	16
5TN	6	10.6	4.8	3.1	18.4	5.6	4"	62	16
6CN	6	10.6	5.1	3.8	19.4	6.3	4"	69	21
7CN	6	12.9	6.4	3.6	22.9	7.5	4", 6"	94	35
	8	14.6	6.4	3.6	24.6	7.5	4", 6"	102	35
7TN	6	12.9	7.1	3.6	23.6	7.5	4", 6"	98	39
	8	14.6	7.1	3.6	25.3	7.5	4", 6"	106	39
9CN	6	14.0	8.0	4.5	26.5	9.5	6"	208	68
	8	16.3	8.0	4.5	28.8	9.5	6"	216	68
	10	16.3	8.0	4.5	28.8	9.5	6"	216	68
9TN	6	14.0	9.0	4.5	27.5	9.5	6"	214	74
	8	16.3	9.0	4.5	29.8	9.5	6"	222	74
	10	16.3	9.0	4.5	29.8	9.5	6"	222	74
11CN	8	13.3	9.8	5.1	28.2	11.5	6", 8"	356	125
	10	13.3	9.8	5.1	28.2	11.5	6", 8"	356	125

DRAWINGS



Drawing 1



Drawing 2

APPENDIX D

Design Data

MANATEE COUNTY ERIE ROAD RO WATER TREATMENT PLANT
DESIGN DATA

A. DESIGN FLOW

Influent	MGD
Total from wells	3.95
To RO Units	3.00
To Bypass	0.95

Permeate & Bypass	MGD
Total Permeate	2.25
Filtered Bypass	0.95
Total Blended Water	3.20
Total Reject	0.75

B. MULTI-MEDIA FILTERS

Quantity	6 (5 in operation, 1 standby)
Hydraulic Loading, each filter	549 gpm
Hydraulic Loading, 5 filters	2,743 gpm
Diameter, each filter	12 feet
Surface Area, each filter	113 $feet^2$
Surface Area, 5 filters	565 $feet^2$
Filters' Design Hydraulic Loading	4.86 gpm/ft^2

Filter Bed Composition	
Anthracite Depth	10-inches
Filter Sand Depth	20-inches
Gravel Depth	10-inches
Total Depth	40-inches

Air Flow Required for Air/Water Wash sequence, each filter:	339 scfm
Air/Water Wash Pneumatic Loading, each filter:	3 $scfm/ft^2$

Filter Backwash & Rinse to Waste Flows

Event	Flowrate (gpm)	Time (min)	Volume (Gal)	Total Volume to Backwash Tank (Gal)
Backwash Ramp-up	300	0.5	150	150
Backwash Ramp-up	600	0.5	300	450
Backwash Ramp-up	900	0.5	450	900
Backwash	1,400	8.0	11,200	12,100
Backwash Ramp-down	900	0.5	450	12,550
Backwash Ramp-down	600	0.5	300	12,850
Backwash Ramp-down	300	0.5	150	13,000
Backwash Ramp-down	150	0.5	75	13,075
Rinse to Waste Ramp-up	150	1.0	150	13,225
Rinse to Waste	200	20.0	4,000	17,225
Rinse to Waste Ramp-down	150	1.5	225	17,450
Rinse to Waste Ramp-down	100	1.5	150	17,600

C. CARTRIDGE FILTER VESSELS

Quantity	3
Hydraulic Loading, each vessel	1.0 mgd (694 gpm)
Design Feed Pressure	30 psi
Feedwater pH	5.9-6.1
Max. Clean Element Headloss	1 psi
Max. Fouled Element Headloss	10 psi
Cartridge Filter Material	Continuously Wound Polypropylene
Typical Cartridge Filter Dimensions	30" length x 1" I.D. x 2 7/16" O.D.
Cartridge Filter Vessel Material	304 SS
Cartridge Filter Vessel Pressure Rating	150 psig @ 100°F per ASME Boiler and Pressure Vessel Code, Section VIII, Division 1

D. HIGH PRESSURE FEEDWATER PUMPS

Quantity	3
Design Capacity, each	700 gpm
Design TDH	280 feet
Total Capacity (3 pumps)	2,100 gpm

Pump Efficiency	80%
Motor Efficiency	95%
Horsepower, each	75 hp
Motor Drive	VFD
Fabrication Material	316L SS
Type of Pump	Vertical Turbine Can Pump

E. REVERSE OSMOSIS MEMBRANE TREATMENT SYSTEM

Design Flow	
Number of Skids	3
Feed Rate, each skid	1.0 mgd
Reject Flow, each skid	0.25 mgd
Permeate Flow, each skid	0.75 mgd
Feed Rate, 3 skids	3.0 mgd
Reject Flow, 3 skids	0.75 mgd
Permeate Flow, 3 skids	2.25 mgd
Design Recovery Rate	75%
Maximum Feed Pressure	150 psi (347 Feet TDH)
Type of Membrane	Thin Film Composite for low pressure water softening
Vessel Material	Fiberglass
Design Vessel Pressure Rating	300 psi
Number of Vessels, per skid	21
Typical Vessel Array	14:7
Number of Elements per Vessel	6
Number of Elements per Skid	126
Total Element Area per Skid	50,400 square feet
Average Flux	14.87 gfd
Membrane Replacement Rate	20% per year
Membrane Design Life	3 years
Design Flux Decline	7% per year

F. HIGH SERVICE DISTRIBUTION SYSTEM PUMPS

Number of Pumps	4 (2 large and 2 small)

Large Pumps

Number of Pumps	2
Capacity, each pump	2,250 gpm
Capacity, 2 pumps	4,500 gpm
Total Dynamic Head	185 feet
Pump Efficiency	80%
Motor Efficiency	95%
Horsepower, each pump	150
Type of drive	1 Pump VFD; 2nd Pump Constant Speed

Small Pumps

Number of Pumps	2
Capacity, each pump	1,125 gpm
Capacity, 2 pumps	2,250 gpm
Total Dynamic Head	185 feet
Pump Efficiency	80%
Motor Efficiency	95%
Horsepower, each pump	75
Type	Constant Speed

G. WASTE BACKWASH STORAGE TANK (SIZED TO HOLD 2 FILTER BACKWASHES)

Dimensions	25′ L x 25′ W x 9′ SWD
Total Volume	42,075 gallons

Waste Backwash Storage Tank Pumps

Number of pumps	2
Type	Submersible
Capacity, each pump	200 gpm
Total Dynamic Head	100 feet
Pump Efficiency	70%
Motor Efficiency	95%
Horsepower, each pump	15
Type of speed	Single

CHEMICAL FEED DESIGN DATA

A. DESIGN FLOW

Influent	MGD
Total from wells	3.95
To RO Units	3.00
To Bypass	0.95

Permeate & Bypass	MGD
Total Permeate	2.25
Filtered Bypass	0.95
Total Blended Water	3.20
Total Reject	0.75

B. SODIUM HYPOCHLORITE FEED SYSTEMS

Potable Water Disinfection

Water Flow	3.2 mgd
Chlorine Feed Concentration	10 mg/l
Sodium Hypochlorite Concentration	12.5%
Weight of Chlorine in Sodium Hypochlorite Solution	1 lb/gal
Chlorine Demand	267 lbs/day
Sodium Hypochlorite Demand	267 gpd

Feed Upstream of Multi-Media Filters

Water Flow	3.95 mgd
Chlorine Feed Concentration	6 mg/l
Chlorine Demand	198 lbs/day
Sodium Hypochlorite Demand	198 gpd
Both Sodium Hypochlorite Demands	465 gpd

Sodium Hypochlorite Bulk Storage Tanks

Number of tanks	2
Dimensions, each tank	10′-0″ Dia. x 12′-0″ SWD
Overall height	13′-5″
Nominal Volume, each tank	7,000 gallons
Volume, 2 tanks	14,000 gallons
Number of days of storage provided at Design Capacity	30 days

Chemical Feed Pumps for Potable Water Disinfection

Potable Water Pre-storage Sodium Hypochlorite Feed Pumps

Number of pumps	3 (2 in operation, 1 on standby)
Maximum water flow disinfected by one pump	1.6 mgd
Max. Chlorine concentration	10 mg/L
Max. Chlorine demand, one pump	132 lbs/day 132 gals/day (5.5 gph)
Max. Capacity, each pump	5.5 gph (132 gpd)
Max. Capacity, 2 pumps	11.0 gph (264 gpd)
Max. Pressure	150 psi

Post-Storage Pumps

Peak Potable Water Demand = 2 x ADF = 2 x 3.2 mgd = 6.4 mgd

Number of pumps	4 (3 in operation, 1 on standby)
Maximum water flow disinfected by one pump	2.13 mgd
Max. chlorine concentration	10 mg/l
Max. chlorine demand, one pump	178 lbs/day 178 gals/day (7.4 gph)
Max. capacity, each pump	7.4 gph (178 gals/day)
Max. capacity, 3 pumps	22.2 gph (534 gals/day)
Max. pressure	150 psi

Chemical Feed Pumps Upstream of Multi-Media Filters

Max. Chlorine Demand	198 lbs/day
	198 gals/day (8.25 gph)
Number of pumps	3 (2 in operation, 1 on standby)
Maximum Capacity, each pump	4.13gph (99 gpd)
Maximum Capacity, 2 pumps	8.25 gph (198 gpd)
Maximum pressure	150 psi

C. AQUA AMMONIA FEED SYSTEM

Average Daily Potable Water Flow	3.2 mgd
Ammonia Feed Concentration	2.22 mg/l
Aqua Ammonia Solution Concentration	19%
Weight of Ammonia in Solution	1.21 lbs/gal
Ammonia Demand	59.2 lbs/day
19% Aqua Ammonia Solution Demand	48.9 gpd (2.04 gph)

Aqua Ammonia Bulk Storage Tanks

Number of tanks	2
Dimensions, each tank	4'-0" Dia. x 7'-10" SWD
Overall Height	10'-0" H
Nominal Volume, each tank	736 gal
Total Volume, 2 tanks	1,472 gal
Days of Storage Provided at Design Capacity	30 days

Chemical Feed Pumps for Potable Water Disinfection

Potable Water Pre-Storage Aqua Ammonia Feed Pumps

Number of pumps	3 (2 in operation, 1 on standby)
Max. Potable Water Flow disinfected by one pump	1.6 mgd
Max. Aqua Ammonia Concentration	2.22 mg/l
Max. Aqua Ammonia Demand (one pump)	29.6 lbs/day
	24.5 gpd (1.02 gph)
Max. Capacity, each Pump	1.02 gph (24.5 gpd)
Max. Capacity, 2 Pumps	2.04 gph (49.0 gpd)

Max. Pressure	150 psi

Potable Water Post-Storage Aqua Ammonia Feed Pumps

Number of pumps	4 (3 in operation, 1 on standby)
Average Daily Potable Water Flow	3.2 mgd
Peak Potable Water Demand = 2 x ADF = 2 x 3.2 mgd = 6.4 mgd	
Max. Water Flow Disinfected by One Chemical Pump	2.13 mgd
Max. Aqua Ammonia Concentration	2.22 mg/l
Max. Aqua Ammonia Feed Rate (one pump)	39.4 lbs/day 32.6 gpd (1.36 gph)
Max. Capacity, each Pump	1.4 gph (33.6 gpd)
Max. Capacity, 3 Pumps	4.2 gph (100.8) gpd)
Max. Pressure	150 psi

D. FERRIC CHLORIDE FEED SYSTEM

Design Flow

Raw Water Flow	3.95 mgd
Ferric Chloride Concentration	2 mg/l
Ferric Chloride Solution Concentration	40%
Weight of Ferric Chloride in 40% Solution	4.74 lbs/gal
Ferric Chloride Demand	65.9 lbs/day
40% Ferric Chloride Solution Demand	13.9 gpd (0.58 gpm)

Ferric Chloride Bulk Storage Tanks

Quantity	2
Type	Tote
Volume each	225 gallons
Total Volume	450 gallons
Days of Storage Provided at Design Flow	30+ days

Chemical Feed Pumps

Number of Pumps	3 (2 in operation, 1 on standby)
Maximum Raw Water Flow Receiving Ferric chloride from One Chemical Feed Pump	1.98 mgd
Maximum Ferric chloride Concentration	2.0 mg/l
Maximum Ferric Chloride Demand (One Pump)	33.0 lbs/day 6.96 gpd (0.29 gph)
Maximum Capacity, Each Pump	0.3 gph (7.2 gpd)
Maximum Capacity, 2 Pumps	0.6 gph (14.4 gpd)
Maximum Pressure	150 psi

E. ANTISCALANT FEED SYSTEM

Water Flow	3.0 mgd
Antiscalant Concentration	2.25 mg/l
Specific Weight of Antiscalant	8.34 lbs/gal
Antiscalant Demand	56.3 lbs/day
Antiscalant Solution Demand	6.75 gpd (0.28 gph)

Bulk Storage Tanks

Quantity	2
Type	Tote
Volume, each	200 gallons
Total Volume	400 gallons
Days of Storage Provided at Design Flow	~60 days

Chemical Feed Pumps

Number of Pumps	3 (2 in operation, 1 on standby)
Maximum Filtered Water Flow Receiving Antiscalant from One Feed Pump	1.5 mgd
Maximum Antiscalant Concentration	4.0 mg/L
Maximum Antiscalant Demand, One Pump	50.0 lbs/day 6.0 gpd (0.25 gph)
Maximum Capacity, Each Pump	0.25 gph (6 gpd)

Maximum Capacity, 2 Pumps	0.50 gph (12 gpd)
Maximum Pressure	150 psi

F. SULFURIC ACID FEED SYSTEM

Water Flow	3.0 mgd
Sulfuric Acid Concentration	94 mg/l
Specific Weight of Concentrated Sulfuric Acid in 93% Solution	14.19 lbs/gal
Sulfuric Acid Demand	2,352 lbs/day
Sulfuric Acid Solution Demand	166 gpd (6.92 gph)

Sulfuric Acid Bulk Storage Tanks

Quantity	2
Material	Steel
Dimensions, each Tank	8'-0" Dia. x 7'-6" SWD
Nominal Storage Capacity, each Tank	2,800 gallons
Total Storage Capacity, 2 Tanks	5,600 gallons
Days of Storage Provided at Design Flow	~34 days

Chemical Feed Pumps for pH Adjustment

Number of Pumps	3 (2 in operation, 1 on standby)
Maximum Water Flow for pH Adjustment by One Pump	1.5 mgd
Maximum Sulfuric Acid Concentration	94 mg/l
Maximum Sulfuric Acid Demand (One Pump)	82.9 gpd (3.45 gph)
Maximum Capacity, Each Pump	3.7 gph (88.8 gpd)
Maximum Capacity, 2 Pumps	7.4 gph (177.6 gpd)
Maximum Pressure	150 psi

G. SODIUM BISULFITE FEED SYSTEM

Water Flow	3.0 mgd
Sodium Bisulfite Concentration	6 mg/l
Sodium Bisulfite Solution Concentration	38%
Weight of Sodium Bisulfite in 38% Solution	4.12 lbs/gal

Sodium Bisulfite Demand	150 lbs/day
38% Sodium Bisulfite Solution Demand	36.4 gpd (1.52 gph)

Bulk Storage Tanks

Quantity	2
Dimensions, each tank	4'-0" Dia. x 6'-0" SWD
Nominal Storage Capacity, each tank	564 gallons
Total Storage Capacity, 2 tanks	1,128 gallons
Days of Storage Provided at Design Flow	30 days

Chemical Feed Pumps for Chlorine Removal

Number of Pumps	3 (2 in operation, 1 on standby)
Maximum Filtered Water Flow Receiving Sodium Bisulfite from One Chemical Feed Pump	1.5 mgd
Maximum Sodium Bisulfite Concentration	6 mg/l
Maximum Sodium Bisulfite Demand (One Pump)	75 lbs/day 18.2 gpd (0.76 gph)
Maximum Capacity, Each Pump	0.83 gph (19.9 gpd)
Maximum Capacity, 2 Pumps	1.66 gph (39.8 gpd)
Maximum Pressure	150 psi

H. SODIUM HYDROXIDE FEED SYSTEM

Water Flow	3.2 mgd
Sodium Hydroxide Concentration	50 mg/l
Sodium Hydroxide Solution Concentration	50%
Weight of Sodium Hydroxide in 50% Solution	6.38 lbs/gal
Sodium Hydroxide Demand	1,334 lbs/day
50% Sodium Hydroxide Solution Demand	209 gpd (8.71 gph)

Bulk Storage Tanks

Quantity	2
Dimensions, each Tank	7'-0" Dia. x 11'-0" SWD
Nominal Storage Capacity, each Tank	3,167 gallons
Total Storage Capacity, 2 Tanks	6,334 gallons
Days of Storage Provided at Design Flow	30 days

Chemical Feed Pumps for pH Adjustments

Number of Pumps	3 (2 in operation, 1 on standby)
Maximum Potable Water Flow Receiving Sodium Hydroxide from One Chemical Feed Pump	1.6 mgd
Maximum Sodium Hydroxide Concentration	50 mg/l
Maximum Sodium Hydroxide Demand (One Pump)	667 lbs/day 104.5 gpd (4.35 gph)
Maximum Capacity, Each Pump	4.35 gph (105 gpd)
Maximum Capacity, 2 Pumps	8.7 gph (209 gpd)
Maximum Pressure	150 psi

I. POLYPHOSPHATE FEED SYSTEM

Water Flow	3.2 mgd
Polyphosphate Concentration	7.5 mg/l
Polyphosphate Solution Concentration	36%
Weight of Polyphosphate in 36% Solution	11.1 lbs/gal
Polyphosphate Demand	200 lbs/day
36% Polyphosphate Solution Demand	18.0 gpd (0.75 gph)

Bulk Storage Tanks

Quantity	2
Dimensions, each Tank	4'-0" Dia. x 6'-0" SWD
Nominal Storage Capacity, each Tank	550 gallons
Total Storage Capacity, 2 Tanks	1,100 gallons
Days of Storage Provided at Design Flow	30 days

Chemical Feed Pumps for Polyphosphate

Number of Pumps	3 (2 in operation, 1 on standby)
Maximum Potable Water Flow Receiving Polyphosphate from One Chemical Feed Pump	1.6 mgd
Maximum Polyphosphate Concentration	7.5 mg/l
Maximum Polyphosphate Demand	

(One Pump)	100 lbs/day
	9 gpd (0.375 gph)
Maximum Capacity, Each Pump	0.375 gph (9 gpd)
Maximum Capacity, 2 Pumps	0.75 gph (18 gpd)
Maximum Pressure	150 psi

J. FLUORIDE FEED SYSTEM

Water Flow	3.2 mgd
Fluoride Concentration	1.0 mg/l
Fluoride Solution Concentration	25%
Weight of Fluoride in 25% Solution	10.43 lbs/gal
Fluoride Demand	27 lbs/day
25% Fluoride Solution Demand	2.6 gpd (0.11 gph)

Bulk Storage Tanks

Quantity	2
Dimensions, each Tank	100 gal. Tote
Nominal Storage Capacity, each Tank	100 gallons
Total Storage Capacity, 2 Tanks	200 gallons
Days of Storage Provided at Design Flow	30+ days

Chemical Feed Pumps for Fluoride

Number of Pumps	3 (2 in operation, 1 on standby)
Maximum Potable Water Flow Receiving Fluoride from One Chemical Feed Pump	1.6 mgd
Maximum Fluoride Concentration	1 mg/l
Maximum Fluoride Demand (One Pump)	27 lbs/day
	2.6 gpd (0.11 gph)
Maximum Capacity, Each Pump	0.15 gph (3.6 gpd)
Maximum Capacity, 2 Pumps	0.30 gph (7.2 gpd)
Maximum Pressure	150 psi

Manatee County
Erie Road RO Water Treatment Plant
Basis of Design Report

Prepared by:

McKIM&CREED

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