Progress Energy

Serial: NPD-MISC-2011-018
November 1, 2011

Mr. Osvaldo Collazo
Chief, North Permits Branch
Department of the Army
Jacksonville District Corps of Engineers
Panama City Regulatory Office
1002 West 23rd Street, Suite 350
Panama City, Florida 32405-3648

Levy Nuclear Plant/PEF
SAJ-2008-00490 (IP-GAH)
Response #4 to Corps Position Letter dated June 23, 2011

References:
1. Letter from Osvaldo Collazo (USACE) to John Elnitsky (PEF), dated June 23, 2011, Reference: SAJ-2008-00490 (IP-GAH)
2. Letter from John Elnitsky (PEF) to Osvaldo Collazo (USACE), dated July 22, 2011, Reference: Levy Nuclear Plant/PEF, SAJ-2008-00490 (IP-GAH), Serial: NPD-MISC-2011-010
3. Letter from Robert Kitchen (PEF) to Osvaldo Collazo (USACE), dated September 20, 2011, Reference: Levy Nuclear Plant/PEF, SAJ-2008-00490 (IP-GAH), Response #1 to Corps Position Letter dated June 23, 2011, Serial: NPD-MISC-2011-014
4. Letter from Robert Kitchen (PEF) to Osvaldo Collazo (USACE), dated October 4, 2011, Reference: Levy Nuclear Plant/PEF, SAJ-2008-00490 (IP-GAH), Response #2 to Corps Position Letter dated June 23, 2011, Serial: NPD-MISC-2011-015
5. Letter from Robert Kitchen (PEF) to Osvaldo Collazo (USACE), dated October 20, 2011, Reference: Levy Nuclear Plant/PEF, SAJ-2008-00490 (IP-GAH), Response #3 to Corps Position Letter dated June 23, 2011, Serial: NPD-MISC-2011-016
6. Letter from Osvaldo Collazo (USACE) to John Elnitsky (PEF), dated September 9, 2011, Reference: SAJ-2008-00490 (IP-GAH)

Dear Mr. Collazo:

The purpose of this letter is to provide the fourth set of responses to your letter dated June 23, 2011 (Reference 1) regarding positions, comments, and requests for information concerning a requested CWA § 404 permit associated with construction of the Progress Energy Florida (PEF) Levy Nuclear Plant (LNP) and various associated integral projects. As stated in our letter dated July 22, 2011 (Reference 2), PEF is working on responses to your requests, and as materials become available, we will provide them to you. Responses have been provided in letters dated

Progress Energy Florida, Inc.
P.O. Box 14042
St. Petersburg, FL 33733

July 22, 2011, September 20, 2011, October 4, 2011, and October 20, 2011 (References 2 through 5, respectively). A response to one of the USACE requests (EPA #12) regarding analysis of alternative sources of water to support the LNP project, is addressed in the enclosure to this letter. We expect all responses to be complete and submitted to your office no later than November 18, 2011.

This letter also provides response to your letter dated September 9, 2011 (Reference 6). In that letter you made two requests for information:

1) PEF has requested that the Corps issue a DA permit that would be valid for twenty years for the construction of LNP and it various associated components. To enable the Corps to assure that the appropriate scope of the proposed project has been identified for the alternative sites analysis, and for evaluation of minimization of wetland impacts on the project site, please verify whether PEF has identified, or will identify in the submittals identified in the schedule of deliverables, the total plan of development for the proposed project and its constituent components. In addition, please provide information as to potential future use of the project site beyond the twenty-year timeframe.

   PEF's Response

   The Levy Nuclear Project as described in PEF's 404 permit application and the subsequent responses to requests for information is the total plan of development for the proposed project and its constituent components.

   As noted in Draft Environmental Impact Statement section 8.1.2, Progress Energy Florida (PEF) prepares annual resource plans for new electrical generating units for a ten year planning horizon. These current plans indicate no new electrical generating units projected as needed during the ten-year period through December 2020 that would be located at the Levy Nuclear Project (LNP) Site.

   Although we cannot forecast potential future uses of the project site, any future plans would be conducted in accordance with Federal, State and local requirements, including consideration of environmental values as warranted.

2) For our LEDPA evaluation the Corps needs additional information in regard to water supply alternatives for the provision of water for LNP operations. Specifically, the Corps requires information, and at a minimum a conceptual, comparative analysis of the potential impacts of the water supply alternatives on the environment, especially potential impacts on the aquatic environment. The State of Florida's Conditions of Certification, as modified on January 25, 2011, identified a list of potential water supply alternatives on page 43: seawater desalination, brackish surface or groundwater, reclaimed water, stormwater, and any other water supply source designated as non-traditional.

   PEF's Response

   Attached to the enclosed response to USACE request (EPA #12) is an analysis of alternative sources of water to support the LNP project which addresses this same request.

If you have any questions regarding this letter, or need additional information, please contact me at (919) 546-6992 or Paul Snead at (919) 546-2836.

Sincerely,

Robert Kitchen
Manager, Nuclear Plant Licensing
New Generation Programs & Projects

Enclosure / Attachment

cc: Gordon Donald Hambrick, USACE
Douglas Bruner, USNRC
David Pritchett, EPA
Paul Gagliano, EPA

Levy Nuclear Plant Units 1 and 2
Response #4 to Corps Position Letter for USACE-SAJ-2008-00490, dated June 23, 2011

RAI #	PEF RAI #	Progress Energy Response
EPA #1	L-0960	Sept. 20, 2011; Serial NPD-MISC-2011-014
EPA #2	L-0961	Sept. 20, 2011; Serial NPD-MISC-2011-014
EPA #3	L-0962	Sept. 20, 2011; Serial NPD-MISC-2011-014
EPA #4	L-0976	Oct. 20, 2011; Serial NPD-MISC-2011-016
EPA #5	L-0975	Oct. 20, 2011; Serial NPD-MISC-2011-016
EPA #6	L-0980	Response pending in a future submittal
EPA #7	L-0978	Oct. 20, 2011; Serial NPD-MISC-2011-016
EPA #8	L-0968	Oct. 4, 2011; Serial NPD-MISC-2011-015
EPA #9	L-0981	Response pending in a future submittal
EPA #10	L-0963	Sept. 20, 2011; Serial NPD-MISC-2011-014
EPA #11	L-0969	Oct. 4, 2011; Serial NPD-MISC-2011-015
EPA #12	L-0984	Response enclosed – see following pages
EPA #13	L-0979	Oct. 20, 2011; Serial NPD-MISC-2011-016
NMFS EFH #1/Corps NMFS #1	L-0970	Oct. 4, 2011; Serial NPD-MISC-2011-015
NMFS EFH #2/Corps NMFS #1	L-0971	Oct. 4, 2011; Serial NPD-MISC-2011-015
NMFS EFH #3/Corps NMFS #2	L-0972	Oct. 4, 2011; Serial NPD-MISC-2011-015
NMFS EFH #4/Corps NMFS #3	L-0973	Oct. 4, 2011; Serial NPD-MISC-2011-015
NMFS EFH #5	L-0974	Oct. 4, 2011; Serial NPD-MISC-2011-015
LEDPA – CORPS #1	L-0964	Sept. 20, 2011; Serial NPD-MISC-2011-014
LEDPA – CORPS #2	L-0985	Pending resolution of USACE GW modeling
LEDPA – CORPS #3	L-0965	Sept. 20, 2011; Serial NPD-MISC-2011-014
LEDPA – CORPS #4	L-0966	Sept. 20, 2011; Serial NPD-MISC-2011-014
CORPS – OTHER #1	L-0967	Oct. 20, 2011; Serial NPD-MISC-2011-016
CORPS – OTHER #2	L-0977	Oct. 20, 2011; Serial NPD-MISC-2011-016
CORPS – OTHER #3	L-0982	Response pending in a future submittal
CORPS – OTHER #4	L-0952	July 22, 2011; Serial NPD-MISC-2011-010
CORPS – OTHER #5	L-0983	Response pending in a future submittal

Levy Nuclear Plant Units 1 and 2
Response #4 to Corps Position Letter for USACE-SAJ-2008-00490, dated June 23, 2011
Cumulative List of Attachments Provided

Attachment	Progress Energy Submittal
July 14, 2011 Meeting Attendees	July 22, 2011; Serial NPD-MISC-2011-010
Proposed Conditions for USACE Approval of Levy as the LEDPA Site	July 22, 2011; Serial NPD-MISC-2011-010
Technical Memorandum 338884-TMEM-129, Rev. 2, Evaluation and Management of Materials Dredged from the Cross Florida Barge Canal for the Construction of Barge Slip, Intake Structure, and Pipeline Facilities Associated with the Levy Nuclear Plant, Florida (on attached CD)	September 20, 2011; Serial NPD-MISC-2011-014
Technical Memorandum 338884-TMEM-130, Rev. 1, Functional Evaluation of Wetlands for the Alternative Sites, Levy Nuclear Plant, Florida (on attached CD)	September 20, 2011; Serial NPD-MISC-2011-014
Technical Memorandum 338884-TMEM-131, Rev. 1, Effects of Temporary Dewatering on Wetlands for the Construction of the Levy Nuclear Plant, Levy County, Florida (on attached CD)	September 20, 2011; Serial NPD-MISC-2011-014
Figure: Site Location Map, showing proposed blowdown pipeline route	October 4, 2011; Serial NPD-MISC-2011-015
Levy Nuclear Plant and Associated Transmission Lines Wetland Mitigation Plan, Comprehensive Design Document, September 2011 (on attached CD)	October 4, 2011; Serial NPD-MISC-2011-015
Technical Memorandum 338884-TMEM-127, Rev. 0, Summary of Available Depth Data for the Cross Florida Barge Canal and Nearshore Environments for the Levy Nuclear Plant, Florida	October 4, 2011; Serial NPD-MISC-2011-015
Levy Nuclear Plant – Transmission Lines, Alternatives Analysis and Avoidance and Minimization (October 2011)	October 20, 2011; Serial NPD-MISC-2011-016
Figure 1 – Preliminary Conceptual Geology, LNP Site	October 20, 2011; Serial NPD-MISC-2011-016
LNP Preliminary Construction Drawings	October 20, 2011; Serial NPD-MISC-2011-016

Attachment	Progress Energy Submittal
LNP Transmission Preliminary Construction Drawings	October 20, 2011; Serial NPD-MISC-2011-016
338884-TMEM-132, Rev. 1, Avoidance and Minimization Analysis for the Levy Nuclear Plant	October 20, 2011; Serial NPD-MISC-2011-016
LNP Fresh Water Alternatives Analysis, WorleyParsons, Revision 0, October 26, 2011	November 1, 2011; Serial NPD-MISC-2011-018

USACE Letter No.: Corps Position Letter USACE-SAJ-2008-00490(IP-GAH)

USACE Letter Date: June 23, 2011

USACE RAI #: EPA #12

Text of USACE RAI:

The DEIS states that up to 2092.9 acres of wetlands could be adversely affected over the course of the 60 years that ground water is pumped to support the LNP project. Provide an analysis of other alternative sources of water to support the LNP project.

PGN RAI ID #: L-0984

PGN Response to USACE RAI:

An analysis of alternative sources of water to support the LNP Project is provided in the attachment. This analysis indicates that the fresh water supply for the Levy Nuclear Plant is designed to be fresh water from groundwater wells, but notes that there are technically feasible alternatives to the use of groundwater at the site if necessary in the future.

Attachment:

LNP Fresh Water Alternatives Analysis, Worley-Parsons, Revision 0, October 26, 2011

WorleyParsons
resources & energy

EcoNomics™

PROGRESS ENERGY

LNP Fresh Water Alternatives Analysis

108008-00083 – PECOLA-2-LI-012-0028

26 October 2011

Reading
2675 Morgantown Road
Reading, PA 19607
USA
Tel: +1 610 855 2000
Fax: +1 610 855 2001

WorleyParsons

resources & energy

EcoNomics

PROGRESS ENERGY
LNP FRESH WATER ALTERNATIVES ANALYSIS

SYNOPSIS

This report documents the ***LNP Fresh Water Alternative Analysis*** undertaken as part of the ***LNP COLA Support Phase III*** project.

Disclaimer

This study report is conceptual in nature and represents the work of WorleyParsons performed to recognized engineering principles and practices appropriate for conceptual engineering work and the terms of reference provided by WorleyParsons' contractual Customer, Progress Energy (the "Customer"). This study report may not be relied upon for detailed implementation or any other purpose not specifically identified within this study report. This study report is confidential and prepared solely for the use of the Customer. The contents of this study report may not be used or relied upon by any party other than the Customer, and neither WorleyParsons, its subconsultants nor their respective employees assume any liability for any reason, including, but not limited to, negligence, to any other party for any information or representation herein. The extent of any warranty or guarantee of this study report or the information contained therein in favor of the Customer is limited to the warranty or guarantee, if any, contained in the contract between the Customer and WorleyParsons.

PROJECT 108008-00083 - LNP FRESH WATER ALTERNATIVES ANALYSIS

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Draft for Review	C. Kertell	J.P. Mitton	J. Archer	21-Sep-11	N/A	
0A	Final Client Review	C. Kertell	E. Toll	J. Archer	14-Oct-11	N/A	
0	Final	C.R. Kertell C. Kertell	E.B. Toll E. Toll	R. Slaviano for J. Archer J. Archer per telecon	28-Oct-11		N/A

CONTENTS

Appendices

1. SUMMARY

The fresh water supply for the Levy Nuclear Plant (LNP) is designed to be fresh water from groundwater wells. Future alternate supplies of fresh water may be required if it is necessary to reduce the rate of groundwater pumping because of any adverse impacts on wetlands or any changes in aquifer characteristics. The purpose of this feasibility study is to assess potentially viable alternate sources of fresh water that can reduce the required rate of pumping of groundwater.

The feasibility study evaluates and ranks alternative fresh water sources for their practicality with respect to technical viability, schedule to develop the source, cost, extent to which they could supplement groundwater pumping, and qualitative assessment of the environmental impacts of the most promising alternatives. The study evaluated the potential for any given source to replace the entire groundwater demand, the potential to partially replace the groundwater demand, and the potential to be combined with other sources to achieve the maximum overall groundwater withdrawal reduction objective.

The following alternate sources of fresh water have the potential to supplement or replace the preferred option of groundwater wells to various degrees, listed in order of their ability to meet the objective:

- Seawater desalination by reverse osmosis (SWRO)
- Stormwater runoff (possibly with additional storage)
- Reclaimed water (municipal wastewater) from adjacent city
- Municipal fresh water supply from adjacent city
- Recycle of process water (service water system cooling tower blowdown and/or demineralized water treatment plant reject)
- Brackish water from deep underground wells

The only alternate source with the potential to replace the entire demand for groundwater pumping on a highly reliable basis is seawater desalination (SWRO). However, even this option would be best employed to supply the normal base demand for fresh water, with groundwater wells used for short-term peak flows and to furnish standby capacity to provide a highly reliable system. The other options, although feasible to varying degrees, are unlikely to be able to supply the entire demand on a reliable basis unless supplemented by groundwater supply or in combination with other sources.

Environmental assessment of the use of groundwater wells to meet short-term peak or standby demands indicates very minor environmental impact. The duration of any drawdown will be brief and within the normal seasonal variability of the wetland hydroperiods. Shallow groundwater levels will recover quickly (within a week or less) to within several inches of non-pumping conditions after pumping is stopped. The area affected by temporary drawdown will be small relative to the undisturbed, surrounding wetland area.

Most wetland impacts that may result from an SWRO plant at the LNP site are associated with siting and construction, rather than operation. Construction of the SWRO plant would have some impact on the surrounding wetlands because some enlargement of the power plant footprint would likely be required, with some increased direct fill of wetlands. Discharge of the SWRO reject along with the cooling tower blowdown would not result in any significant environmental impact.

The stormwater ponds not only collect and release flood flows, but are utilized to help replenish groundwater recharge. The environmental impact of the use of stormwater would be managed by limiting the amount of withdrawal of stormwater from the ponds to leave a minimum volume for this recharge.

In summary, there are technically feasible alternatives to the use of groundwater at the Levy Nuclear Plant site if necessary in the future.

2. INTRODUCTION

The fresh water supply for the Levy Nuclear Plant is designed to be fresh water from groundwater wells. As depicted on Figure 9.2-201, Rev. 3, in the FSAR (Appendix 1), the supply is from four (4) groundwater wells (two per nuclear unit) that deliver water to four (4) of the nuclear plant units' systems as follows:

1. Service Water System (SWS)
2. Demineralized Water Treatment Plant (DTS)
3. Potable Water System (PWS)
4. Fire Protection System (FPS)

The purpose of this feasibility study is to assess potentially viable alternate sources that can provide the fresh water flow capacity requirements either in whole or in part or in combination with other sources, and their potential to achieve the overall objective of reduction of groundwater withdrawal. The feasibility study evaluates the practicality of alternative fresh water sources with respect to their technical viability, schedule to develop the source, cost, and qualitative assessment of the environmental impacts of the highly ranked alternatives.

The following specific alternative sources for the raw water system water supply were evaluated:

1. Municipal fresh water supply from adjacent city
2. Reclaimed water (municipal wastewater) from adjacent city
3. Supply from Crystal River Energy Complex
4. Reduced groundwater demand by use of alternative service water cooling technology
5. Recycle of process water
6. Seawater desalination
7. Fresh surface water
8. Brackish water from deep wells
9. Reduced groundwater demand by using a combination of sources, e.g., groundwater combined with an alternate source, such as stormwater runoff
10. Use of groundwater as a backup supply to an alternative source of fresh water

Brackish water from surface water sources is not evaluated as a separate alternative, but is broadly included as part of the seawater desalination alternative. Water from the Cross Florida Barge Canal, the source for the seawater desalination alternative, is currently brackish, but is expected to increase in salinity during plant operation. Although models indicate that freshwater seepage will mitigate the increase in salinity, and that the water may remain brackish, this analysis adopts the conservative approach of assuming salt water conditions for the desalination alternative.

These alternatives are discussed on a screening basis in this study and evaluated for feasibility and practicality.

3. DISCUSSION

3.1 Design Basis

3.1.1 Raw Water System

The Raw Water System (RWS) consists of two subsystems:

- The freshwater subsystem that supplies strained and filtered groundwater for makeup to the demineralized water treatment system, potable water storage tank, the fire protection system (fire water tanks and yard fire water system), and the service water cooling tower basins.
- The saltwater subsystem that supplies strained water from the Cross Florida Barge Canal (CFBC) for makeup to the circulating water mechanical draft cooling tower basins.

This study addresses only the freshwater subsystem, because of its dependence on the groundwater well pumping source.

The source of water for the LNP site RWS freshwater subsystem is the groundwater aquifer. There are four wells that supply the freshwater. Each well contains a raw water well pump, two for each nuclear plant unit. In addition, the RWS system consists of Unit 1 and Unit 2 pump houses, self-cleaning strainers, and raw water storage tanks. Each pump house contains four raw water booster pumps and appropriate instrumentation and controls.

The RWS is required to meet high reliability (i.e., single active failure) requirements. For the current Levy Nuclear Plant design involving fresh water supply solely from the groundwater well pump system, a single active failure requirements means that no single failure of an active component, such as a pump, motor operated valve, or instrument would result in the system's ability to provide the necessary flow requirements, with water quality requirements as outlined in Section 3.1.3. For the alternative cases where a combination of fresh water systems involving an entire system being redundant to another system, the prevention of a single active failure of the redundant system's function would be required. This would necessitate that all system interconnections between the redundant systems are designed to have redundant shutoff valve capability to prevent a leak in either of the systems from degrading the redundant system's ability to provide the required flows. A raw water storage tank is provided for each unit. Each tank is minimum 30 ft diameter and 30 ft tall, with a nominal capacity of approximately 150,000 gallons.

The flow path for the system is from the groundwater aquifer, through the self-cleaning strainer, to the raw water storage tank, and into the raw water booster pumps. The raw water booster pumps supply freshwater through media filters to a common header for the system services and functions.

Four media filters for each of the nuclear plant units are upstream of the SWS cooling tower makeup, the DTS feed, the fire water storage tanks, the yard fire water system, and the potable water storage tank. Each filter is sized for 50% of the maximum demand from those systems.

3.1.2 Design Flow Rates

Design water demand rates used for this study are based on the Westinghouse AP1000 Standard Plant Water Balance (APP-RWS-M3C-001). Design flow rates from the Westinghouse water balance, on a per unit basis, are as follows:

Service	Normal Demand gpm/(mgd) (per nuclear unit)	Maximum Demand gpm/(mgd) (per nuclear unit)	Simultaneous Max. Demand gpm/(mgd) (per nuclear unit)
Makeup to service water cooling tower (1)	245.3/(0.353)	831/(1.197)	831/(1.197)
Raw water supply to demineralized water treatment system (2)	175/(0.252)	540/(0.778)	175/(0.252)
Potable water supply (3)	17.4/(0.025)	34.7/(0.050)	34.7/(0.050)
Fire water supply (4)	0.4/(0.001)	625/(0.900)	0.4/(0.001)
Total	438.1/(0.631)		1040/(1.500) (cooldown)

The maximum raw water demands are based on the following:

1. Maximum service water flow to tower during a shutdown.
2. Maximum raw water supply to demineralized water system during batch operation of the reverse osmosis/electrodeionization (RO/EDI) system based on single pass operation.
3. Maximum potable water flow during an outage.
4. Normal fire protection is from tanks and maximum flow during or after a fire to refill tanks.

It is noted that the simultaneous maximum raw water demand of 1040 gpm occurs during a shutdown/cooldown and is defined in Design Input Record LNG-CWS-GER-001. The maximum flow demand during a plant shutdown actually decreases over time because the Residual Heat Removal System’s heat removal duty decreases exponentially from its maximum cooldown rate (= difference between normal and maximum demand) to approximately one fifth (1/5) of that starting value. Since the freshwater supply provides make-up water to the Service Water System's cooling tower, which in turn provides cooling for the Component Cooling Water System / Residual Heat Removal heat exchanger, the fresh water make-up flow requirement to the Service Water System decreases proportionally as well. Volumetrically speaking, the plant shutdown results in an incremental cooling water make-up demand of 400,000 gallons per unit over a four (4) day period.

Maximum raw water demand for two units is estimated to be 2080 gpm based on a two-unit shutdown. Nuclear plant units' cooldown frequency can vary from as low as zero to a few times each year.

For evaluating alternate supplies such as municipal water in this assessment, a design margin of 10% along with additional rounding up has been added to the normal raw water demand of 438.1 gpm (0.631 mgd) to result in a study design basis of 500 gpm (0.72 mgd) per unit. A similar margin has not been added to the cooldown flow rate of 1040 gpm per unit because this is a specific calculated event and the peak flow requirements are generally approached through either storage tanks or SWRO equipment. However, design margins (generally 10%) have been added to the capacity of the SWRO systems and/or the storage tanks in various alternatives. Adding design margin to both the flow rate and the equipment sizing was not considered appropriate.

3.1.3 Water Quality Requirements

The raw water supply to the Service Water System cooling tower is required to meet the following requirements:

- Maximum influent temperature - 113 ºF
- Maximum turbidity - < 1.0 NTU
- Silt Density Index (SDI) - < 4.0
- LSI (scaling potential limit) - < +1.5

3.1.4 Source Water Quality

Groundwater quality is assumed to meet the requirements for the service water system following straining and filtration. Alternate water sources will require evaluation for suitability; however, alternate fresh water sources, except for SWRO, are also assumed to be generally satisfactory with similar provision of straining and filtration.

To satisfy water quality requirements, seawater as an alternative source will require desalination prior to use in the service water system. Although salt water would be obtained from the Cross Florida Barge Canal (CFBC), current canal water is brackish and not believed to be indicative of the degree of salinity that would exist in the canal once flow was established for use in the circulating water system. Although models indicate freshwater seepage into the CFBC that would tend to mitigate the increase in salinity, this study adopts the conservative approach of assuming salt water conditions. Accordingly, salt water quality will be based on sampling conducted at the Crystal River Plant Units 4 & 5 intake, as provided in Appendix 2. This sample indicates a chloride concentration of 15,000 mg/l and total dissolved solids of 20,000 mg/l. The discussion of seawater desalination is intended to apply to seawater from the Cross Florida Barge Canal, assuming seawater quality as a future-case operational condition.

3.2 Alternative Fresh Water Supply Sources

The following specific alternative sources for the raw water system water supply were evaluated:

1. Municipal fresh water supply from adjacent city
2. Reclaimed water (municipal wastewater) from adjacent city
3. Supply from Crystal River Energy Complex
4. Reduced groundwater demand by use of alternative service water cooling technology
5. Recycle of process water
6. Seawater desalination
7. Fresh surface water
8. Brackish water from deep wells
9. Reduced groundwater demand by using a combination of sources, e.g., groundwater combined with an alternate source, such as stormwater runoff
10. Use of groundwater as a backup supply to an alternative source of fresh water

3.2.1 Municipal Fresh Water Supply from Adjacent City

One alternative to the use of groundwater from the LNP site is the use of municipal fresh water from an adjacent city. A preliminary survey of the feasibility of this approach was conducted using published and/or online information sources. The survey was conducted with the objective of finding a sole source that had the capability of supplying the entire normal fresh water demand for the LNP site. However, it is possible that a municipal source could be located that could reduce groundwater demand by supplying only a portion of the demand, or that multiple municipal sources could be employed to supply fresh water to the site.

<u>LNP Environmental Report</u>

Due to the proximity limitations of water and wastewater infrastructure, the LNP Environmental Report limited its discussion to those systems and utilities located in the vicinity of the site, as follows:

- Levy County: Levy County does not currently have a county-wide potable water distribution system; as a result, residents are served by public and private wells.
- Marion County: Marion County ensures the availability of water to residents through interlocal agreements with municipalities and franchise agreements with publicly owned and privately owned public water systems. There are 41 county-owned water facilities in Marion County. The county's standard of 150 gallons per person per day (average daily consumption) serves as the basis for future facility design, determination of available facility capacity, and determination of demand created by new development.
- Citrus County: The Citrus County Utilities Division is responsible for the operation of six county-owned water treatment facilities. The county utilities division supplies potable water directly to more than 5000 customers, with agreements in place to supply potable water to the City of Crystal River and Beverly Hills/Rolling Oaks Utilities during emergency situations. Many private wells serve private residences in Citrus County.

  The Citrus County Utilities Division has seven wells at Charles A. Black plants I and II, permitted by SWFWMD to withdraw a combined annual average of 3.24 mgd with a peak monthly withdrawal of 6.48 mgd. These wells have the potential to provide up to 16 mgd, sufficient for the projected future population living within the service area. Future water use estimates show system-wide demand rising to about 11.64 mgd by 2020, representing approximately 25% 0f the county's projected 2020 population of 169,000 people.

Florida Water Management Districts

The State of Florida is divided into five water management districts whose function is to administer flood protection programs and to perform technical investigations into water resources. The districts develop water management plans for water shortages in times of drought and to acquire and manage lands for water management purposes. Regulatory programs delegated to the districts by the Florida Department of Environmental Protection include programs to manage the consumptive use of water, aquifer recharge, well construction, and surface water management.

This alternative water source feasibility analysis relies heavily on information obtained from the website of the Southwest Florida Water Management District (SWFWMD). The Levy Nuclear Plant site is located at the northwestern end of the SWFWMD service area. The plant site borders closely on the Suwannee River Water Management District (SRWMD), which includes portions of Levy County to the northwest of the plant. In addition, areas to the east of the plant in Marion County are part of the St. Johns River Water Management District (SJRWMD). Attached in Appendix 3 is a map of the SWFWMD service area, showing the Levy Nuclear Plant site, county lines, and locations of nearby cities and towns.

Water Supply Required

Estimated normal fresh water requirement for the Levy Nuclear Plant is approximately 1000 gpm (1.44 mgd) for both units. Estimated maximum demand to both units is approximately 2080 gpm (3.0 mgd). For purposes of this initial screening study, it is initially assumed that on-site storage would be provided to handle peak flow rates and that the study would focus on identifying systems with the potential to supply the average flow rate requirement.

For screening purposes, it is assumed that a municipal water supply would not normally dedicate more than 25% of its capacity to a single consumer such as the LNP facility. More likely, no more than 5% to 10% of a system supply would be dedicated to an outside commercial consumer such as LNP. Assuming the maximum 25% figure and a normal demand of 1000 gpm (1.44 mgd), the municipal water supply system would need to have a capacity in the range of 4000 gpm (5.8 mgd) to be considered as a source for the total supply. Assuming a more likely 10% of capacity commitment, the municipal water system would need to have a capacity of at least 10,000 gpm (14.4 mgd).

Corresponding water system capacities to accommodate the maximum demand to both units of 2080 gpm (3.0 mgd) would range from 8300 gpm to 20,800 gpm (12 mgd to 30 mgd).

If the municipal system supplied only the normal flow requirement, raw water storage would be required for the difference between normal and maximum flow rate integrated over the duration of the cooldown (or peak demand) period. The Westinghouse AP1000 DCD section 9.2.2.1.2.2 provides a shutdown time of 96 hours for the increased demand for cooldown. Storage requirement for the increased demand during cooldown has been estimated at 400,000 gallons per nuclear unit, as noted in Section 3.1.2. Adding a 10% margin would provide an increased storage volume of approximately 450,000 gallons per nuclear unit. Combining the 450,000 gallons peak storage with the base storage of 150,000 gallons per nuclear unit would result in a total raw water storage requirement of 600,000 gallons per nuclear unit. Holding the storage tank height constant at 30 ft, required diameter of each storage tank would increase from its current design of 30 ft diameter to 60 ft diameter. The estimated cost of two 60 foot diameter, 30 foot high tanks is approximately $2,000,000.

Review of Municipal Water Supply Systems

The spreadsheet in Appendix 3 lists all water supply systems in Levy, Marion, Citrus, and Sumter Counties, as obtained from the SWFWMD website. The spreadsheet presents the following information:

- Utility name
- Service area (where identified)
- County
- Water district
- River basin (where identified)

- Distance from LNP site (where information can be determined)
- Population in 2010 ("functional" population per SWFWMD)
- Estimated water demand (assuming 150 gallons/capita/day)

Review of the spreadsheet data results in the following observations:

a. The closest cities and towns (within a range of 10 to 12 miles) with water supply systems and their current estimated water demand are as follows:

City/Town	Est. Demand (mgd)	Est. Demand (gpm)
Yankeetown	0.119	83
Inglis	0.257	179
Dunnellon	0.931	646
Crystal River	1.722	1196
Citrus Springs/Pine Ridge	2.248	1561

None of these systems is close to the required capacity of 5.8 mgd assumed necessary to have the required capacity margin to supply the required normal demand of water to Levy Nuclear Plant.

b. There are no systems in Levy County with the ability to supply the plant.

c. There are only two systems that might have the capability to supply the required amount of water. These systems are the Marion County Utilities Department and the Citrus County Utilities Division. Both are listed on the SWFWMD as numerous separate systems serving specific areas, none of which are very large by themselves. There is no evidence to suggest that either or both of these systems are interconnected internally to form a system with sufficient capacity to supply the required flow to LNP. The fact that these are county systems that would be asked to serve a customer in another county might pose additional problems. Online searches for both systems did not result in any additional useful information.

d. Online searches for the City of Ocala (Marion County Utilities Department) indicated that the utility is under severe restraints to locate sufficient water supply for their current and projected future customers. Ability to withdraw additional groundwater is limited, and consideration is being given by the municipality to seawater desalination and/or surface water withdrawal. Additional emphasis is being given to recycle of treated wastewater for irrigation of golf courses, parks, and irrigation of other new developments as a means of reducing water demand.

e. The Marion County Utilities Department appears to be generally centered on Ocala, approximately 30 miles from the Levy Nuclear Plant site. The Citrus County Utilities Division is headquartered in Lecanto, approximately 17 miles from the site. Estimated cost for a 30-mile pipeline, if an adequate supply was available, is in the range of $40,000,000 to $60,000,000.

Conclusions

None of the cities and towns closest to the Levy Nuclear Plant site appears to have any reasonable ability of having the capacity to supply plant fresh water needs as a sole supplier. These cities and towns include Yankeetown, Inglis, Dunellon, Crystal River, and Citrus Springs. Taken together, all of these systems are unlikely to have sufficient capacity to supply the entire normal LNP demand.

There are no systems in Levy County with sufficient capacity to supply the plant.

The largest systems in the general area appear to be the Marion County Utilities Department and the Citrus County Utilities Division. However, both systems are of questionable capacity, remote from the plant site, and under limitations on capacity. As a result, the Marion and Citrus county utilities are not considered to be likely sources for a significant quantity of water, although it is possible that some capacity might be available.

In summary, supply of fresh water from adjacent municipalities is technically feasible, but of limited practicality because of the limited capacity of the nearby systems, current demands on capacity, cost of transmission mains, and inability to guarantee a highly reliable future water supply.

3.2.2 Reclaimed Water (Municipal Wastewater) from Adjacent City

Another alternative to the use of groundwater from the LNP site is the use of reclaimed water (treated municipal wastewater) from an adjacent city, most likely with additional treatment required before use. Note that municipal wastewater, even after treatment, can be highly variable in quality, which would affect the reliability of this source and its suitability as a backup supply. Potable water would still presumably be supplied from onsite fresh water wells, with a normal demand of 17.4 gpm (0.025 mgd) per nuclear unit and a peak demand of 34.7 gpm (0.050 mgd) per nuclear unit.

A preliminary survey of the feasibility of this approach was conducted using published and/or online information sources. Similar to the municipal water supply analysis, the survey was conducted with the objective of finding a sole source that had the capability of supplying the entire normal fresh water demand for the LNP site. However, it is possible that a municipal wastewater source could be located that would reduce groundwater demand by supplying only a portion of the demand, or that multiple municipal sources could be employed to supply fresh water to the site.

Reclaimed Water Supply Required

Reclaimed water volume required to supply raw water for LNP would be similar to the requirements defined for municipal fresh water supply in Section 3.2.1 of this study. Storage requirements to meet maximum demand would also be similar.

Minimum useful supply of treated wastewater would be that required to meet the normal demand, on the order of 1000 gpm (1.44 mgd). This study assumes that on-site storage would be provided to meet peak demands.

For screening purposes, this study assumes that the dependable flow from a municipal sewage treatment plant is no more than 50% of its permitted capacity. Therefore, permitted plant capacity would need to be approximately 2000 gpm, or roughly 3 mgd.

LNP Environmental Report

Due to the proximity limitations of water and wastewater infrastructure, the LNP Environmental Report limited its discussion to those systems and utilities located in the vicinity of the site, as follows:

- Levy County: Approximately 75-80% of Levy County citizens are serviced by wastewater treatment in septic tanks.
- Marion County: Table 2.5-32 of the Environmental Report lists 11 wastewater treatment facilities located in Marion County. None of these facilities are located with 10 miles of the LNP site. Table 2.5-32 of the Environmental Report is presented in Appendix 4.
- Citrus County: The Citrus County Utilities Division provides wastewater treatment for over 2000 customers. Presently, there are three privately owned regional treatment plants and four county-owned facilities. Table 2.5-33 of the Environmental Report, presented in Appendix 4, lists the county-owned facilities, their capacities, and any future plans for expansion. None of these facilities are located within 10 miles of the LNP site.

Florida Department of Environmental Protection (FDEP)

A wider screening of wastewater treatment plants in the area of the LNP site was obtained from online resources of the Florida Department of Environmental Protection (FDEP). Wastewater treatment plants identified by this screening are also presented in Appendix 4. Note that the capacity listed is permitted capacity and that dependable minimum flow rate may be significantly less.

Review of Municipal Wastewater Treatment Systems

The following municipal wastewater treatment plants are the largest in the area, in order of size, although the largest of these are in the Ocala area, at a significant distance from the LNP site, as noted. Note also that Ocala WRF #1 is scheduled for closure in the near future.

Plant Name	City	County	Permitted Capacity (mgd)
Ocala WRF #2 (33 miles from LNP site)	Ocala	Marion	6.5
Ocala WRF #3 (24 miles from LNP site)	Ocala	Marion	5
Ocala WRF #1 (30 miles from LNP site)	Ocala	Marion	2.46
On Top of the World North WWTF	Ocala	Marion	2.23
City of Inverness WWTF	Inverness	Citrus	1.5
City of Crystal River WWTF	Crystal River	Citrus	1.5
MCUD/Silver Springs Shores Emerald	Ocala	Marion	0.998
MCUD/Oak Run	Ocala	Marion	0.8
On Top of the World (Circle Square Woods)	Ocala	Marion	0.75
Sugarmill Woods WWTF	Homosassa	Citrus	0.7

The City of Ocala (Marion County Utilities Department) plans to use 100% of its reclaimed water on recreational and agricultural applications. Current uses of reclaimed water include airport dust reduction, several agricultural sprayfields, irrigation of at least three golf courses, and recreational uses including football, baseball, softball, and soccer fields, as well as walking trails and other open areas. In addition, there is a mandatory commercial and residential irrigation program using reclaimed water for all new construction in areas adjacent to large reclaimed water force mains. Given these projects already in place or planned, the quantity of reclaimed water available from this source is likely limited.

Conclusion

The only systems that might have the capability to supply the required amount of water are the larger Ocala facilities in Marion County. These systems are located at a considerable distance (24 miles to 33 miles) from the Levy plant site and already use their available reclaimed water for local recreational and agricultural applications. There are no wastewater treatment plants of any significant capacity within 10 miles of the Levy plant site. As a result, supply of reclaimed water (municipal wastewater is technically feasible, but of limited practicality because of the limited capacity of nearby systems, current usage of reclaimed water from larger systems for local applications, cost of transmission mains, and inability to guarantee a highly reliable future water supply,

3.2.3 Supply from Crystal River Energy Complex

Another alternative considered to the use of groundwater from the LNP site is the use of fresh water from the nearby Crystal River Energy Complex. This supply might be sufficient to meet the total requirement, sufficient to meet only a portion of the demand, or sufficient to be a backup supply in the event of failure of the primary supply. To explore this possibility, the Crystal River Energy Complex was contacted to determine the extent, if any, to which the Crystal River site has an excess raw fresh water supply that could be used for the LNP.

The response from the Crystal River Energy Complex was that they have no excess fresh water available to support the requirements of the LNP site. The specific response was as follows:

> *"There is no "excess" groundwater available at the Crystal River facility. All currently permitted groundwater withdrawals are necessary to support plant operations, including the recently added air pollution controls (scrubbers) on Units 4 and 5. Additional groundwater withdrawals were required to be permitted to support the "scrubber' projects and only the minimum amount required to support the projects was allowed. Use/permitting of groundwater resources at the Crystal River facility faces many of the same issues/concerns as the use of groundwater at the Levy site."*

3.2.4 Alternative Service Water Cooling Technology

Alternative service water cooling technologies were considered as a means of reducing the demand for fresh water for service water cooling. These technologies would not affect the demand for fresh water for the demineralized water treatment system, the potable water system, or the fire water system. The alternative technologies considered were as follows:

- Heat exchanger in place of cooling tower
- Wet surface air cooler using salt water on open side
- Hybrid (wet/dry) cooling tower for service water

<u>Heat exchanger in place of cooling tower</u>

Service water could be cooled by use of a heat exchanger in place of the cooling tower. The tube side of the heat exchanger would use salt water from the Gulf of Mexico / Cross Florida Barge Canal as the heat sink.

The average Gulf of Mexico water temperature in the summer months is 84 ºF to 86 ºF. Assuming a 10 ºF terminal difference for a salt water to service water heat exchanger, the resulting service water temperature would be 94 ºF to 96 ºF. This performance does not meet the Westinghouse design criteria of 88.5 ºF to 93.5 ºF. Therefore, a service water heat exchanger in place of a cooling tower is not a viable solution because it cannot meet the AP1000 design requirements.

Wet surface air cooler using salt water on open side

In a wet surface air cooler (WSAC) system, warm process fluids or vapors are cooled in a closed-loop tube bundle (the process fluid being cooled never comes in contact with the outside air). Open loop water is sprayed and air is induced over the tube bundle resulting in the cooling effect. Information on the WSAC approach is included in Appendix 5.

Niagara Blower (Resorcon) was contacted and verified that their wet surface air cooler can operate using salt water on the open side. This tower would operate with the service water on the closed side and the salt water on the open side. Two (2) to three (3) cycles of concentration have been used on the salt water side. The service water would be cooled in closed cycle heat exchange tube bundles by the salt water spray over the outside and by the forced draft air flow. The cooling tower bundles are available in ASME Section VIII construction.

The WSAC cooling tower could eliminate the fresh water requirement for the service water cooling tower but would be a departure from the AP1000 Design Control Document (DCD) and the Standard COLA. The WSAC tower would also require a space envelope greater than 50 ft by 310 ft and would add a fan horsepower load of 1000 HP on the diesels. This option for reducing fresh water usage is not recommended because it would entail schedule delays and the NRC may not approve the use of the wet surface air cooler for this application.

Hybrid (wet/dry) cooling tower for service water

Another option for the service water cooling tower to reduce fresh water consumption is a hybrid tower using both dry cooling and evaporative cooling. The DCD provides the following service water flows and heat loads:

Parameter	Cooldown	Normal
Flow (per unit)	21,000 gpm	10,500 gpm
Heat load (per unit)	346×10^6 BTU/hr	193×10^6 BTU/hr
Maximum cold service water temp.	88.5 ºF	93.5 ºF
Hot service water temp. (approx.)	121.4 ºF	130 ºF

Assuming that the dry portion of the cooling tower can achieve a 10 ºF approach to the 96 ºF dry bulb the temperature entering the wet portion of the tower is 106 ºF. This would result in the following heat loads for the wet portion of the tower:

Cooldown: (21,000 GPM)(500)(106 ºF – 88.5 ºF) = 183.75 x 10^6 BTU/hr

Normal: (10,500 GPM)(500)(106 ºF – 93.5 ºF) = 66.625 x 10^6 BTU/hr

Since evaporation is the major heat transfer mechanism in the wet portion of the tower, the water usage would be reduced by the heat load ratio:

Cooldown ratio: (183.75 x 10^6 BTU/hr)/(346 x 10^6 BTU/hr) = 53%

Normal ratio: (66.625 x 10^6 BTU/hr)/(193 x 10^6 BTU/hr) = 34.5%

The Westinghouse AP1000 water balance provides, on a per unit basis, normal service water cooling tower usage of 245 GPM, with a cooldown usage of 831 gpm.

The wet/dry service water cooling tower would therefore yield water usage as follows:

Normal: (245 GPM/unit)(2 units)(0.345 ratio) = 169 gpm

Cooldown: (831 GPM/unit)(2 units)(0.53 ratio) = 880 gpm

Although a wet/dry service water cooling tower would reduce (but not eliminate) the quantity of fresh water required, this option is considered to be not feasible for the following reasons:

- The wet/dry cooling tower would be a departure from the AP1000 DCD and the Standard COLA.
- The tower would be considerably larger than the service water tower currently included in the AP1000 standard design and would require changes to the standard plant layout, which would be another DCD departure.
- Additional fan horsepower would probably be required to achieve the dry surface performance and this would be an additional diesel load.
- Additional NRC concerns and requirements may be imposed during review of the COLA, including assuring that there is adequate space around the tower to obtain the required air flow through the dry section.
- The height and dimensions of the tower could introduce a fall-down hazard to other plant structures or systems.

Conclusion

Three different alternate service water cooling technologies were evaluated as means of reducing the demand for fresh water for service water cooling. None of the alternate service water cooling technologies are considered feasible.

3.2.5 Recycle of Process Water

Two process modifications were considered as methods of reducing fresh raw water demand by recycling of process water, as follows:

- Reclaiming the SWS cooling tower blowdown and restoring the blowdown to influent specifications for SWS re-use, most likely in the SWS cooling tower
- Directing the DTS system RO/EDI reject to the SWS cooling tower basin instead of rejecting to the wastewater system.

Note that the SWS system still requires some blowdown to wastewater in order to remove dissolved solids from the system. This blowdown would occur as reduced volume, but more highly concentrated, blowdown from the treatment of SWS blowdown.

Recycle of SWS Blowdown

Blowdown of the SWS cooling tower is required to maintain total dissolved solids (TDS) and other parameters at acceptable levels for cooling services. Blowdown at normal flow rate is approximately 66 gpm at normal power heat load and four (4) cycles of concentration in the cooling tower. Treatment of the SWS cooling tower blowdown by a reverse osmosis (RO) system would produce approximately 44 to 50 gpm of product water that could be recycled to the SWS cooling tower basin, displacing an equivalent demand for makeup water. The remaining 16 to 22 gpm of RO reject would be directed to wastewater. All flow rates are per each nuclear plant unit.

Blowdown available for recycle would increase to as much as 207 gpm during cooldown, decreasing with time. However, it would not be practical to install this expanded RO capacity for an occasional demand, particularly a varying demand that is not compatible with operation of an RO system.

These systems would also need to have system interconnection provisions to prevent any system single active failure from degrading the functional flow requirements of the fresh water supply sources and this will add some additional cost. In addition, backup to the recycle system would be to increase blowdown to wastewater, with a corresponding increase in SWS cooling tower makeup from well water or other sources that would need to be designed with the required capacity.

Recycle of DTS reject to SWS Cooling Tower

The DTS system operates in a batch mode, with a raw water feed of 540 gpm to produce 360 gpm of product demineralized water. The DTS system reject of 180 gpm is directed to the wastewater system, but could likely be directed to the SWS cooling tower basin, displacing demand for raw water makeup. Note that this source is available only when the DTS system is in operation, and that on an average annual basis the corresponding flow rates would be approximately 175 gpm of DTS system influent to produce 117 gpm of product water and 58 gpm of reject. All flow rates are per each nuclear plant unit. This modification would not involve any substantial capital cost and would reduce average annual demand.

Because this source is available only during DTS system operation, its water supply source availability factor is not high nor is it able to completely satisfy the peak flow requirements.

Conclusion

Treatment and recycle of SWS cooling tower blowdown and recycle of DTS system reject are potential means of reducing average normal demand for raw water makeup. Potential reduction in normal demand is 44 gpm for the SWS cooling tower blowdown, plus 58 gpm for the DTS reject, for a total of 102 gpm on an average basis, per each nuclear plant unit. This represents approximately 23% of the normal raw water demand. Although this reduction in raw water demand is measureable, it is not sufficient in itself to provide an alternate to the use of groundwater wells, but might be used in some combination with other alternative solutions to reduce demand. As a result, it is not recommended as a primary alternative, but may be considered in further development of the details of various alternatives.

3.2.6 Seawater Desalination

Seawater desalination is a technically feasible, although costly, alternative for supply of fresh water for the Levy Nuclear Plant. Salt water would be obtained from the Cross Florida Barge Canal by installing additional pumps in the raw water intake structure supplying water to the circulating water cooling tower. Desalination would be provided by seawater reverse osmosis (SWRO) technology, with the SWRO reject discharged along with the cooling tower blowdown. Fresh water recovery would be 45% of the salt water feed rate, based on salt water characteristics as listed in Appendix 2. Product water would meet the service water quality requirements listed in Section 3.1.3 of this study and would have total dissolved solids of less than 400 ppm.

Conceptual design recommendations and budgetary pricing for a SWRO system were requested from a manufacturer of water treatment systems. The discussion presented in this section of the study applies to providing SWRO for the entire plant demand, including both normal demand and peak demand. Options for providing SWRO to meet only the normal demand, in combination with groundwater supply and/or other options to meet peak demand, are presented in subsequent sections. The basis for the proposed system is outlined in an email request for quotation included in Appendix 6, as follows:

- Assume two (2) nuclear plant units, each with a separate SWRO system
- Assume ability to supply both average and maximum service water demand in accordance with Section 3.1.2 of this study
- Assume product water quality requirements in accordance with Section 3.1.3 of this study
- Assume salt water characteristics in accordance with Appendix 2
- Assume that each SWRO system (one for each nuclear plant unit) to have three (3) 50% trains sized at 600 gpm each; one (1) train for normal flow, two (2) trains for maximum flow, and one (1) train standby

A budgetary proposal was received from Anderson-WPT, a unit of Degremont Technologies North America. The proposal is included in Appendix 6.

The recommended system, based on 45% recovery, includes the following major components for each of the two SWRO systems:

- Filters:
    - Four (4) – 9'-0" diameter horizontal filters, rubber lined, FRP/CPVC internals, FRP/PVC face piping, anthracite, sand, and garnet media
    - Each filter 867 gpm normal, 889 gpm maximum; 2667 total flow with three filters operating; 4100 gpm backwash flow rate each filter, using feed water for backwash
    - Filter chemical feed systems, including sodium hypochlorite, sulfuric acid, ferric chloride, and polymer
    - Two (2) filter air scour blowers, each 100% capacity
- Cartridge Filters:
    - Three (3) cartridge filters, two operating at maximum flow, one standby; rubber lined housing and polypropylene cartridges, FRP face piping
    - Cartridge filter capacity 1334 gpm each
- RO Feed Pumps:
    - Six (6) pumps; duplex wetted parts, energy recovery devices
    - Each pump 667 gpm @ 800 psig, 400 HP; four pumps operating at maximum demand, two pumps standby

- Seawater Reverse Osmosis Systems (SWRO):
    - Three (3) SWRO trains, each train to have two (2) 50% capacity units
    - Each SWRO train to have salt water feed rate of 1334 gpm to produce 600 gpm of fresh water at 45% recovery
    - Each SWRO train to have 36 housings with 256 Filmtec membranes (7 membranes per housing), with duplex high pressure and CPVC low pressure piping
    - Each SWRO unit includes an ERT (Energy recovery turbine) which takes unused pressure in the reject to boost inlet pump pressure.
- Clean-In-Place (CIP) System:
    - One (1) CIP, with FRP tank, cartridge filter, and forwarding pump
    - CIP system also used to flush RO units
- Control Panel

Although each individual SWRO unit is not "single active failure" proof in itself, the overall system proposed meets single active failure criteria because the system includes a complete spare train, i.e., the system includes three (3) 50% capacity trains. In addition, each train consists of two (2) 50% capacity units capable of independent operation, so that a single active failure results in the loss of only one unit, not the entire train.

Estimated electrical demand to produce 1200 gpm fresh water per unit is 960 KW.

Each unit's SWRO system would be housed in a building with approximate dimensions of 80 ft x 100 ft, two buildings required.

Budgetary equipment cost for SWRO systems to supply both plant units, not including installation, is $13,000,000. Budgetary installed cost of the SWRO systems, including buildings, is $26,000,000.

The SWRO system would require additional canal pumps in a larger intake pump house structure. Estimated cost of this modification is $5,000,000.

Conclusion

Seawater desalination by reverse osmosis (SWRO) is a feasible alternate source of fresh water with the potential to replace the entire demand for groundwater on a highly reliable basis. SWRO is also a feasible source to supply the normal base demand for fresh water in combination with groundwater wells for short-term peak flows and standby capacity, as discussed in Section 3.2.9.

3.2.7 Fresh Surface Waters

Fresh surface waters in the vicinity include the Withlacoochee River and Lake Rousseau. The Withlacoochee River and Lake Rousseau are both designated as Outstanding Florida Water (OFW) and are therefore afforded a high degree of regulatory protection. The primary water source to Lake Rousseau is the upstream portion of the Withlacoochee River that stretches into the Green Swamp, which is a major groundwater recharge area. Flow to the downstream portions of the Withlacoochee River is through the Inglis Bypass Channel from Lake Rousseau.

The allocation of consumptive use of fresh surface waters is regulated in Florida to maintain minimum flow and levels (MFLs). The Southwest Florida Water Management District (SWFWMD) determines the MFL using scientific methods; however, to date, no MFLs have been promulgated near Levy County because of the low population density. Most supply regulation by the SWFWMD has focused on the Tampa Bay region and locations farther south with higher population density. The policy in the Tampa area has been to limit withdrawal of surface water to no more than 10 percent of the flow when rates exceed the MFL target. Determining if Lake Rousseau could be used as a source would require hydrologic evaluations and modeling to determine the safe yield of the system. Limitations could be MFLs in the lake and potential impacts to the lower Withlacoochee River.

The surface area of the lake is approximately 4,200 acres; however, the average depth may not be adequate to support a withdrawal. Further evaluation would be required to establish the potential flow rate available. The OFW designation will afford the Withlacoochee River and Lake Rousseau the state's highest level of regulatory protection with regard to water quantity, quality, and natural features. Consequently, while there might be some water available during high flow, access to this water may be restricted, particularly during low-flow conditions. Due to concerns over both demonstrated long-term availability and regulatory restrictions, neither the Withlacoochee River nor Lake Rousseau is considered to be reliable long-term source of fresh water.

3.2.8 Brackish Water from Deep Wells

Groundwater at the LNP site is contained in three aquifers: the surficial aquifer, the Upper Floridan aquifer, and the Lower Floridan aquifer. The water quality in the Floridan aquifer is expected to become more brackish with depth. The Upper Floridan aquifer extends from about 50 feet to 500 feet and contains fresh water. This is the aquifer interval proposed for the fresh water wellfield.

A brackish water wellfield would target the Lower Floridan aquifer. There is more uncertainty about the characteristics of the Lower Floridan aquifer because of the few existing deep wells in the region. There is some evidence in the region of a middle semi-confining unit between the Upper and Lower Floridan intervals. If present, a semi-confining unit would restrict vertical fluid movement and could dampen the drawdown effects in the surficial aquifer resulting from pumping the Lower Floridan aquifer. The top of the Lower Floridan aquifer is expected to occur at approximately 800 feet and the aquifer could extend to approximately 1,800 feet.

The issues related to the use of the Upper Floridan aquifer for fresh water supply relate to the groundwater model-simulated drawdown in the surficial aquifer resulting from pumping. Pumping from deeper zones could be simulated but the same models would be used that have been debated for predicting potential wetland impacts. There is no site-specific information that identifies the depth or specific water quality of any deeper aquifer zones or the occurrence or characteristics of the middle semi-confining interval. Therefore, any simulation of withdrawals would likely raise the same questions of wetland impacts. For this reason, use of brackish groundwater, although feasible, is not considered a practical alternative.

3.2.9 Reduced Groundwater Demand by Combination of Sources

One concept considered is to use groundwater for only part of the service water demand, on the assumption that reduced groundwater withdrawal would mitigate unexpected wetland impact. For purposes of this study, that would involve use of one of the alternatives previously discussed, together with the use of fresh water wells, in some combination. The feasibility of this approach requires consideration of the following factors, not all of which can be resolved in this preliminary feasibility study:

- What level of groundwater withdrawal will be acceptable to the regulatory agencies, i.e., what percentage of the service water demand can be provided by other sources in combination with wells?
- What is the feasibility of each alternate source?
- How reliable is each alternate source?
- What are the costs of the alternate sources?
- What are the environmental impacts of the alternate sources?
- What are the regulatory obstacles to the alternate sources?

<u>Fresh Water Wells Combined with Municipal Fresh Water Supply</u>

As discussed previously, there is little indication that any nearby municipal water supply has the size and capability to provide any significant portion of the new water demand for LNP. The result would be only very limited reduction in demand from on-site wells. The larger municipal systems in the area are at substantial distances, requiring lengthy transmission lines. In addition, the vast majority, if not all, of the municipal supplies draw their water from the same groundwater aquifer as do the wells proposed for LNP. The only difference with respect to the aquifer would be localized effects on groundwater levels. This approach is considered feasible, but of limited practicality because of unavailability of capacity and because it does not mitigate overall effects on the groundwater aquifer.

Fresh Water Wells Combined with Supply from Crystal River Energy Complex

Crystal River Energy Complex personnel have indicated that they have no excess capacity whatsoever that could be shared with Levy Nuclear Plant. Therefore, this approach is not feasible.

Fresh Water Wells Combined with Alternate Cooling Technology

Use of a hybrid (wet/dry) cooling tower would reduce the demand for makeup to the service water cooling tower, but would have no effect on other demands for fresh water. Use of alternate service water cooling technology would affect design flow rates as follows, with all flows on a per unit basis:

Service	Normal Demand gpm/(mgd) (per nuclear unit		Simultaneous Maximum Demand gpm/(mgd) (per nuclear unit)	
	Current Design	Alternate Cooling Technology	Current Design	Alternate Cooling Technology
Makeup to service water cooling tower	245.3/(0.353)	84.5/(0.122)	831/(1.197)	440/(0.634)
Raw water supply to demineralized water treatment system	175/(0.252)	175/(0.252)	175/(0.252)	175/(0.252)
Potable water supply	17.4/(0.025)	17.4/(0.025)	34.7/(0.050)	34.7/(0.050)
Fire water supply	0.4/(0.001)	0.4/).001)	0.4/(0.001)	0.4/(0.001)
Total	438.1/(0.631)	277.3/(0.400)	1040/(1.500) (cooldown)	650/(0.937) (cooldown)

This feasibility study will add a design margin of 10% and round up to assume the following raw water demand rates for the purpose of preliminary evaluation of alternatives, including any necessary treatment systems:

Raw Water Demand (Two Units)	Current Design	Alternate Cooling Technology
Normal raw water demand	1000 gpm (500 gpm/unit)	600 gpm (300 gpm/unit)
Maximum raw water demand	2080 gpm (1040 gpm/unit)	1440 gpm (720 gpm/unit)

In summary, use of alternate cooling water technology in combination with fresh water wells would reduce normal fresh water demand from for two units from 1000 gpm to 600 gpm and would reduce maximum demand from 2080 gpm to 1440 gpm. However, this approach is considered to be not feasible because the use of alternate cooling technology is considered not feasible, for the reasons previously discussed.

Fresh Water Wells Combined with Seawater Desalination

Seawater desalination is a technically feasible alternative to supply the entire service water requirement of the plant, and would also be technically feasible to supply a portion of the demand in combination with fresh water wells. The SWRO technology lends itself better to baseline operation, rather than as peaking or standby capacity. Therefore, the alternatives considered for this option are as follows:

- Install SWRO technology to meet normal demand, to be supplemented by fresh water wells to meet peak demand. This option would provide two SWRO trains of approximately 500 gpm each for each unit, one operating and one standby. SWRO capital cost would be approximately 70% of the cost of providing the entire demand (including peak demand) by desalination. Required fresh water well capacity would be approximately 700 gpm for each unit, or 1400 gpm total. However, the fresh water wells would be pumped only when demand exceeded normal service water requirements.

- Install SWRO technology to meet normal demand, to be supplemented by fresh water wells to meet peak demand and also standby capacity. This option would provide one SWRO train of approximately 500 gpm for each unit, operating continuously. SWRO capital cost would be approximately 40-50% of the cost of providing the entire demand by desalination. Required fresh water well capacity would be the full plant capacity, although the wells would be used only when demand exceeded normal service water requirements, or when the SWRO units were out of service. Although the SWRO train would not be single active failure proof itself, the overall raw water system would remain single active failure proof because the groundwater wells would provide standby supply for the entire required capacity. This would necessitate that all system interconnections between the redundant systems be designed to have redundant shutoff valve capability to prevent a malfunction in either of the systems from degrading the redundant system's ability to provide the required flows. This single active failure concept would also apply to other alternative combinations of SWRO and groundwater wells or storage.

  Each unit's SWRO system would be housed in a building with approximate dimensions of 45 ft x 90 ft, two buildings required.

  Budgetary equipment cost for two (2) single-train SWRO units, one to supply each nuclear plant unit, is $7,000,000. Budgetary installed cost of the SWRO systems, including buildings, is $13,000,000.

- Install SWRO technology to meet normal and peak demand, to be supplemented by fresh water wells only for standby capacity. This option would provide two SWRO trains of approximately 600 gpm each for each unit, one operating and one standby to meet maximum demand. SWRO capital cost would be approximately 75% of the cost of providing the entire demand by desalination. Required fresh water well capacity would be approximately 600 gpm for each unit, or 1200 gpm total, to provide capacity equivalent to one SWRO train. However, the fresh water wells would be pumped only when one or more SWRO units were out of service.

Fresh Water Wells Combined with Stored Stormwater Runoff

Stormwater runoff collected from the plant site could be used in conjunction with fresh water wells to reduce the demand for fresh water. The most likely application would be to use fresh water wells to supply normal demand, while using stored stormwater runoff to meet peak demands for plant shutdown.

To the extent that stormwater runoff is available, the stormwater might also be used to offset a portion of the normal demand. The LNP Environmental Report indicates an average annual daily flow of 890 gpm of stormwater used as makeup to the circulating water system. This source could be diverted to the service water system, where even allowing for some infiltration losses, it could supply a substantial portion of the base demand of 1000 gpm. However, the amount of stormwater runoff available to offset a portion of the normal demand is highly variable on a year-to-year and month-to-month basis. As a result, stormwater runoff by itself is not a reliable source to meet base demand and should be considered only in combination with other sources.

The plant site design already provides for storm water runoff ponds. However, these ponds are sized to accommodate the design stormwater runoff, requiring them to be maintained at a normal low level in order to provide capacity to accept storm runoff. Any storage of stormwater for service water supply would likely be separate from and in addition to the existing storm water runoff design. However, the existing storm water collection system and ponds could be used to collect the runoff to fill the service water storage tanks or ponds.

The sizing basis for storage would be similar to that discussed previously for using municipal water supply combined with fresh water wells. As noted in Section 3.2.1 of this study, the stormwater runoff storage would be required for the difference between normal and maximum flow rate integrated over the duration of the cooldown (or peak demand) period. DCD section 9.2.2.1.2.2 provides a shutdown time of 96 hours for the increased demand for cooldown. Storage requirement for the increased demand during cooldown has been estimated at 400,000 gallons per nuclear unit. Adding a 10% margin would provide a storage volume of approximately 450,000 gallons per nuclear unit. Adding the 450,000 gallons peak storage to the base storage of 150,000 gallons per nuclear unit would result in a total raw water storage requirement of 600,000 gallons per nuclear unit. Holding the storage tank height constant at 30 ft, required diameter of each storage tank would increase from 30 ft to 60 ft diameter.

It would be difficult to justify stormwater runoff collection as being dependable enough to function without backup. Therefore, the well water system would need to be designed to furnish the full demand of the plant, although normally pumped at a lower rate.

Seawater Desalination Combined with Stored Stormwater Runoff

Stormwater runoff collected from the plant site could be used in conjunction with a desalination system to reduce the design capacity of the desalination system. The most likely application would be to use seawater desalination to supply normal demand, while using stored stormwater runoff to meet peak demands for plant shutdown. To the extent that stormwater runoff is available, the runoff water might also be used to provide a portion of the normal demand and thus reduce operating costs for the desalination system. All sizing considerations for the stored stormwater runoff would be similar to those previously described for combining fresh water wells with stored stormwater runoff.

3.2.10 Groundwater as Backup Supply

Another concept considered is to use groundwater as a backup supply for the normal and peak raw water demand, assuming that one of the alternatives explored was capable of providing the full required raw water supply on a normal basis, but would not have inherent backup capacity to assure reliability. Groundwater demand would be reduced because groundwater withdrawal would not be continuous, presumably mitigating any unexpected wetland impact. For purposes of this study, that would involve use of one of the alternatives previously discussed, together with the use of fresh water wells only in a backup capacity.

On this basis, the most practical alternative is seawater desalination, with fresh water wells as a backup supply. None of the other alternatives are considered to be practical alternatives for satisfying the entire fresh water demand on a normal, continuous basis. This alternative would reduce the capital cost of the fresh water desalination system by reducing the degree of redundancy required.

3.3 Environmental Considerations

CH2M HILL was requested to qualitatively address environmental concerns for preferred options for fresh water supply for the Levy Nuclear Plant. Substantial portions of the report prepared by CH2M HILL are included in the text of this Section 3.3.

CH2M HILL provided an environmental assessment of the most highly-ranked options, including seawater reverse osmosis (SWRO), stormwater runoff (including runoff storage), and groundwater wells, primarily for providing peak demands and/or standby capacity for other sources. The options evaluated were as follows:

EXHIBIT 1
Proposed Freshwater Supply Options
LNP Freshwater Alternatives Analysis Design Information

Option Number	Normal Demand	Simultaneous Maximum Demand	Standby Capacity
Baseline Case	Groundwater	Groundwater	Groundwater
1	SWRO (1 train/unit)	Groundwater	Groundwater
2	SWRO (1 train/unit)	Storage	Groundwater
3	SWRO (3 trains/unit)	SWRO	SWRO
Flows	876 gpm	2,080 gpm (3.0 mgd)	Up to peak demand
Flows + 10% and rounding	1,000 gpm (1.44 mgd)	No additional contingency added	Up to peak demand

Notes:
gpm = gallons per minute
mgd = million gallons per day
Storage = a tank and supplemental stormwater from onsite ponds
SWRO = seawater reverse osmosis (membrane desalting of additional Cross Florida Barge Canal {CFBC} water)

This section reviews the environmental considerations of the preferred alternative water supply options described in Exhibit 1. Each of the options contains some combination of seawater reverse osmosis (SWRO), storage, groundwater as a backup supply, and storage with a stormwater supplement. It is assumed that the stormwater would be of suitable quality for use after filtration, however, that is yet to be determined. Additional treatment may be required for the stormwater source. A brief discussion is added about long-distance pumping in the case that another source of water could be made available from another location (for example, Ocala area).

The baseline case, as presented in the Environmental Report (ER) and other application documentation, proposes to use groundwater as the sole supply source. The environmental issues associated with this will not be repeated in this document, as the emphasis of this report is on the alternatives. This alternatives analysis is intended to provide input in the event that wetland impacts are detected after operation begins or are predicted from revised groundwater modeling. This analysis would be one input used to evaluate the following: 1) if the unexpected wetland impact can be avoided by an alternate water source; 2) if wetland impacts can be mitigated by revising the wetland mitigation plan; or 3) some combination thereof. This evaluation is intended to address federal regulatory acceptance of the Levy Nuclear Plant site's viable alternatives.

3.3.1 Seawater Reverse Osmosis (SWRO)

Desalination with membrane technology takes the natural ions out of the source water. Treated water is "recovered," and concentrated source water not passing through the membranes is "rejected." This reject waste stream has higher concentrations of salts and other ions that will not pass through the membranes, and the amount of rejection may vary by chemical constituent. For a membrane system with complete rejection, the concentration factor (CF) of the ions can be calculated as: CF = 1 / (1 – R), where R is the recovery fraction. As noted in Section 3.2.6, the proposed recovery is 45 percent so the reject water would be 1.82 times more concentrated in minerals than the original concentration.

The reject water constitutes a new waste stream to be dealt with. For example, the two LNP units (LNP Units 1 and 2) require about 84,780 gallons per minute (gpm) of brackish water from the Cross Florida Barge Canal (CFBC) for makeup water to the cooling system. The simultaneous maximum raw water demand is about 2,080 gpm for both units. Since some of the water is rejected, an alternative freshwater system demand for a system fully treated by SWRO will be 2,080/0.45 = 4,622 gpm. From this supply, 55 percent is rejected, or 2,542 gpm would be concentrated reject returned to the cooling system for disposal. The 4,622 gpm of additional water supply from the CFBC represents a 5.45 percent increase in water withdrawal.

The intake structure will need to be enlarged, which could have some minor impacts on wetlands at the shoreline. The water quality within the CFBC is highly variable depending on the tidal flushing and stormwater discharges. A 5.45 percent increase in the flow removed would not be expected to have a significant water quality effect in the CFBC, as it is directly connected to the Gulf of Mexico.

The cooling basin makeup water will be used in the tower and recycled until evaporation concentrates the cooling water further. The blowdown from the cooling system will occur after the cooling water concentrates to a level, which can result in scaling of equipment. The LNP blowdown discharge is pumped into the much larger cooling system discharge at the Crystal River Energy Complex (CREC), where the proposed LNP contribution is only about 4.5 percent of the total discharge. The proposed cooling system at the LNP will recycle between 1.5 and 2 times. The disposal option for the SWRO reject water is to place the reject discharge into the blowdown pipeline directly (for example, in the pump station). Since the cooling towers would concentrate the CFBC makeup water by almost the same amount as the SWRO, there would be little difference in salt concentrations. The cooling system blowdown water quality will not be expected to change measurably as a result of the SWRO reject discharge. Furthermore, the increase in flow is very small with respect to the total discharge in the CREC; a 5.45-percent increase to 4.5 percent of CREC flow is a 0.25-percent change in flow in the CREC. This means that there should be minimal effect on any National Pollutant Discharge Elimination System (NPDES) permitting issues associated with the blowdown. Permitting considerations are further discussed in Section 3.3.5.

The main environmental effect of the SRWO system is that more room will be required for the filtration building, membrane trains, and chemical equipment near the power plant. It is assumed that the proposed pipelines are of sufficient size to carry the increase in source water from the CFBC. If not, pipeline wetland impacts are considered temporary in nature and should not be a major change in permitting and mitigation requirements. Since the SWRO will be located on the raised power pad (for flood protection), more room is required for the new treatment systems and the pad may need to be expanded.

Most wetland impacts that may result from a reverse osmosis plant at the LNP site are expected to be associated with siting and construction, rather than operation. Wetlands cover a large fraction of the LNP site, and are distributed in an intergraded mosaic with uplands across the area. Construction of the plant and any related facilities, such as pipelines, water storage structures, or stormwater features, is likely to cause direct impacts to wetlands unless there is room for the new facilities on the pad without further expansion of the filled area. Wetland disturbance can be minimized by siting the SWRO facility in close proximity to other LNP structures to reduce fragmentation of onsite habitats, and collocating facilities to the extent possible. The manufacturer reported that an SWRO building would require about 4,050 square feet per train (up to 8,000 square feet for three trains).

It is beyond the scope of a screening analysis to quantify the potential area impacts to surrounding wetlands if the power plant footprint is enlarged, even if this is a small amount; however, it is reasonable to assume that a high percentage of the increase will have direct fill in wetlands. Similarly, any expansion of the intake pump station will affect the wetlands along the banks of the CFBC. In general, the extent of the wetlands along the CFBC shoreline is small and the impact there would be small too. All of the area discussed could easily be mitigated, if needed, since the area impacts are small (maybe an acre or less of permanent fill).

3.3.2 Supplemental Groundwater Use

The options for the alternative water supply either eliminate groundwater use altogether or reduce the amount of groundwater use from a constant source to an intermittent, backup supply used only if the SWRO is unavailable. Intermittent use of groundwater would have less impact on wetlands than the baseline case and is a type of alternative mitigation action.

Options 1 and 2 continue the use of the wellfield for various degrees of backup or redundancy to the SWRO system. In Option 1, the wellfield would be used as a backup to the SWRO system to meet peak demand and to provide standby capacity to meet normal and peak demands if the SWRO system is out of service. In Option 2, the wellfield would be used for standby only if the SWRO system is out of service. In Option 2, storage would be used to meet peak demands. Option 3 eliminates the wellfield; therefore, there is no potential for wetland impacts from groundwater drawdown resulting from pumping the Floridan aquifer.

Using the wellfield only for peak demands and as a standby to the SWRO system results in long periods of time with no groundwater withdrawals. During these times, there would be no potential for wetlands impacts. Temporary drawdown would result when peak demands require pumping or during planned or unplanned shutdown of the SWRO system. Further evaluation of the wellfield withdrawals required an estimate of the frequency and duration of events that could result in peak demand or standby operation. Using experience drawn from other nuclear power plants and SWRO systems, the following assumptions were developed.

Annual and Unplanned SWRO System Maintenance (Options 1 and 2 Standby)

The SWRO units are expected to require annual maintenance, with infrequent 1-day duration for minor maintenance, to up to 4 weeks for major activities such as replacing piping or pumps. During this time, it is expected that the groundwater wells will be used to meet normal demands (1,000 gpm or 1.44 mgd) while the SWRO units are down.

Nuclear Power Plant Cooldown Events (Option 1 Peak Demand)

Peak demand conditions are assumed for a nuclear power plant shutdown. Under normal circumstances, the SWRO would be used to supply the normal demand and the wellfield would be needed to make up the difference between normal and peak demands. The most conservative condition would be for the SWRO system to be out of service during a plant shutdown and both nuclear power units are taken offline at the same time. For this condition, the wellfield would be needed to meet the full peak demand for both units, or about 2,080 gpm (3.0 mgd). It is estimated that these cooldown events may occur several times per year and could last up to 4 days.

Potential Drawdown Impacts

Based on the demands described above, the longest expected duration of wellfield pumping would be during a planned SWRO maintenance shutdown. The highest wellfield pumping rate could occur if both nuclear units shut down simultaneously and the SWRO was out of service. This temporary condition could result in pumping up to 3.0 mgd for up to 4 days.

Pumping the wellfield for either of these conditions would result in small drawdown in the Upper Floridan aquifer. The surficial aquifer water levels near wetlands would have only a reduced portion of the Upper Floridan aquifer drawdown due to the expected lag caused by the vertical hydraulic conductivity of the subsurface material. Since the Floridan aquifer has a relatively high transmissivity, the water level in the Upper Floridan aquifer would recover to surrounding background levels within several days of shutting down the pumps. The water level in the surficial aquifer would lag the drawdown and recovery in the Floridan aquifer by some amount of time but would only last several weeks in duration. The recovery of surficial groundwater levels would be accelerated by any rainfall events that occurred during that time period. Since the groundwater is expected to recover so quickly, if another event occurred that would require the use of the wellfield, there would be another short-term drawdown event but not a long-term cumulative drawdown that could impact a wetland. This short-term lowering of surficial aquifer water levels is not expected to adversely affect adjacent wetland systems for the following reasons:

- The duration of the drawdown will be brief, and within the normal seasonal variability of the wetland hydroperiods.
- Shallow groundwater levels will recover quickly (within several weeks) to within several inches of non-pumping conditions after pumping is stopped.
- The area affected by temporary drawdown will be small relative to the undisturbed, surrounding wetland area.

Therefore, because these short-term water withdrawals have no potential for wetland impacts, it is reasonable to expect that such short-term uses would comply with the permits issued by the State of Florida and to be issued by the U.S. Army Corps of Engineers (USACE).

3.3.3 Storage

Locating additional storage at the plant site will likely not require an expansion of the raised pad, thereby eliminating additional direct fill into surrounding wetlands. The storage requirements are estimated to require only a small diameter increase to the existing water storage tanks. However, if new tanks do require more room than is available, then an enlarged power plant site will have the same impacts as those associated with a larger footprint for the SWRO.

Using stormwater as source water may require a different type of filter than the groundwater supply. The stormwater ponds not only collect and release flood flows but are used to help replenish groundwater recharge. The withdrawal of water from the ponds must be limited to leave a minimum volume for this recharge. Also, the ponds will occasionally overflow during large storms, so the amount of available water depends on the pond size, overflow elevations, and historic floodplain storage that needs to be mitigated. Similarly, the availability of stormwater will be variable and prolonged droughts will still require groundwater backup to the SWRO system.

3.3.4 Long-Distance Pipelines

Although not considered a highly practical alternative, alternative supplies from long distances may become feasible in the future. A long-distance pipeline will require right-of-way (ROW) acquisition for the pipeline and pump stations. Small storage tanks may also be required at re-pumping stations. It is reasonable to assume that any long-distance pipeline would have wetland impacts. While there is more flexibility for locating pump stations, there may be either a wetland impact or protected species mitigation required (for example, gopher tortoise relocation is a state requirement, plus potentially other federally protected species to avoid). There could be multiple stream crossings and there are significant water and natural resources between the LNP site and potential alternative supplies (such as in the Ocala region) that would need to be avoided or impacts minimized to the extent practicable. Pipeline impacts are often considered temporary and the amount of mitigation required may be small. However, any determination of the amount of potential impact cannot be determined *a priori*.

3.3.5 Permitting Considerations

The primary permitting agencies include the U.S. Nuclear Regulatory Commission (NRC), the USACE, and the State of Florida. Water supply issues are important to the NRC for the LNP operations and safety, including redundancy. The feasible options address these concerns. The USACE is concerned about impacts to water resources, especially wetlands. The feasible options considered are not expected to appreciably change the water resources in the CFBC or the blowdown discharge at the CREC. However, some of these feasible alternatives may require some taking of wetlands to implement an alternative water supply. Estimated fill requirements are small and could be mitigated as needed. The U.S. Fish and Wildlife Service (FWS) would review any permits, but no additional concerns regarding protected species are expected to arise from the preferred alternatives. Using the wellfield for peak or standby demands may require a modification to the state consumptive use permit. Other sources of water such as brackish groundwater or reclaimed water may require state consumptive use permitting.

The Conditions of Certification (COCs) issued by the State of Florida require that federal and state permits be obtained according to a schedule tied to construction. Changes to the water supply after operations commence would need to be processed by the state as well. Similarly, the federal NPDES permit for the LNP site will also be issued by the state under delegated authority, which would need to reflect the configuration of the reject water disposal, if implemented.

Some permitting considerations must be accounted for if any changes are made to the source water. As discussed above, the stormwater ponds are used to help mitigate lost onsite historic floodplain storage. Pumping from the ponds must consider the elevation and volume of stormwater to remain in the ponds to avoid dewatering the landscape. Changing the general alignment of the plant site needs to be done to minimize wetland fill but it is reasonable to assume that some additional fill in wetlands will be required. It is not anticipated that SWRO plant reject water will adversely affect the water quality of the LNP blowdown; however, a more detailed analysis of the reject water on the CREC discharge will be required to modify the NPDES permit.

The largest direct impact on permitting an alternative supply, regardless of the selected option, is likely the USACE 404 permit. Progress Energy Florida (PEF) is preparing extensive documentation on the wetland impacts and developing a mitigation plan to address these impacts. If there are changes to the site to implement a new water supply, even small, these need to be considered and documented. The feasible options considered here all are likely to have some direct impact by placing fill in wetlands. The 404 permit condition to require an alternate water supply be used needs to consider whether additional compensation for the baseline wetland impact is more practical than causing additional direct impacts of the alternative supply. In the cases of the groundwater options in this evaluation, they are considerably more favorable to limiting potential wetland impacts since the wellfield would only be used as a backup to the SWRO system.

4. CONCLUSIONS

The fresh water supply for the Levy Nuclear Plant is designed to be fresh water from groundwater wells. Several alternative fresh water sources were evaluated for their practicality with respect to technical viability, schedule to develop the source, cost, extent to which they could supplement groundwater pumping, and qualitative assessment of their environmental impacts. The study evaluated the potential for any given source to replace the entire groundwater demand, the potential to partially replace groundwater demand, and the potential to be combined with other sources to achieve the overall groundwater withdrawal reduction objective.

The following alternate sources of fresh water were determined to have the potential to supplement or replace the preferred option of groundwater wells to various degrees, listed in order of their ability to meet the objective:

- Seawater desalination by reverse osmosis (SWRO)
- Stormwater runoff (possibly with additional storage)
- Reclaimed water (municipal wastewater) from adjacent city
- Municipal fresh water supply from adjacent city
- Recycle of process water (service water system cooling tower blowdown and/or demineralized water treatment plant reject)
- Brackish water from deep underground wells

The following alternatives were determined to be not feasible:

- Supply from the Crystal River Energy Complex
- Reduced groundwater demand by use of alternative service water cooling technology
- Fresh surface waters

Seawater desalination (SWRO) is the only source with the potential to replace the entire demand for groundwater pumping on a highly reliable basis. However, this option would be best employed to supply the normal base demand for fresh water, with groundwater wells used for short-term peak flows and to furnish standby capacity to provide a highly reliable system. The other alternatives, although feasible to varying degrees, are unlikely to be able to supply the entire demand on a reliable basis unless supplemented by groundwater supply or in combination with other sources.

Stormwater runoff, possibly with the provision of additional storage beyond the current stormwater ponds, has the potential to provide peak flow requirements and/or to offset a portion of the baseline normal fresh water demand, although capacity to offset the baseline demand is not available at all times and therefore not reliable.

Reclaimed water (municipal wastewater) and/or municipal fresh water supplies from adjacent cities are possible alternatives, but all nearby municipalities have very small systems that are unlikely to be able to provide a significant source of supply. Larger systems, primarily in the Ocala area (Marion County Utilities Department) are possible, but these systems already have fresh water supply limitations of their own and are increasingly using more reclaimed water for their own purposes to offset the demand for fresh water. The cost and environmental impact of building lengthy pipelines, on the order of 30 miles, are additional limiting considerations.

Recycle of process water is a feasible alternative for reducing (but not eliminating) the groundwater demand. However, this alternative has significant technical and regulatory limitations because it represents a deviation from the standard nuclear plant design.

Brackish water from deep underground wells would present the same issues with respect to wetlands impact as the current design for fresh water wells.

Environmental assessment of the use of groundwater wells to meet short-term peak or standby demands indicates very minor environmental impact. The duration of any drawdown will be brief and within the normal seasonal variability of the wetland hydroperiods. Shallow groundwater levels will recover quickly (within a week or less) to within several inches of non-pumping conditions after pumping is stopped. The area affected by temporary drawdown will be small relative to the undisturbed, surrounding wetland area.

Most wetland impacts that may result from an SWRO plant at the LNP site are associated with siting and construction, rather than operation. Construction of the SWRO plant would have some impact on the surrounding wetlands because some enlargement of the power plant footprint would likely be required, with some increased direct fill in wetlands. Discharge of the SWRO reject along with the cooling tower blowdown would not result in any significant environmental impact.

The stormwater ponds not only collect and release flood flows, but are utilized to help replenish groundwater recharge. The environmental impact of the use of stormwater would be managed by limiting the amount of withdrawal of stormwater from the ponds to leave a minimum volume for this recharge.

5. RECOMMENDATIONS

The fresh water supply for the Levy Nuclear Plant is designed to be fresh water from groundwater wells. The following alternate sources of fresh water are recommended as feasible alternate sources to supply fresh water for the Levy Nuclear Plant:

- Seawater desalination by reverse osmosis (SWRO)
- Stormwater runoff (possibly with additional storage)
- Reclaimed water (municipal wastewater) from adjacent city
- Municipal fresh water supply from adjacent city
- Recycle of process water (service water system cooling tower blowdown and/or demineralized water treatment plant reject)
- Brackish water from deep underground wells

The highest ranked option is the use of seawater desalination to meet normal demand, with the use of groundwater wells to meet peak demand and to provide standby or backup capacity. This approach would minimize the maintenance and operation requirements for the SWRO system. This would also minimize the incremental cost of desalination and eliminate the cost of larger storage tanks. Availability of groundwater capacity to meet full plant demand, if necessary, would ensure a highly reliable system, and the annual demand for groundwater would be significantly reduced.

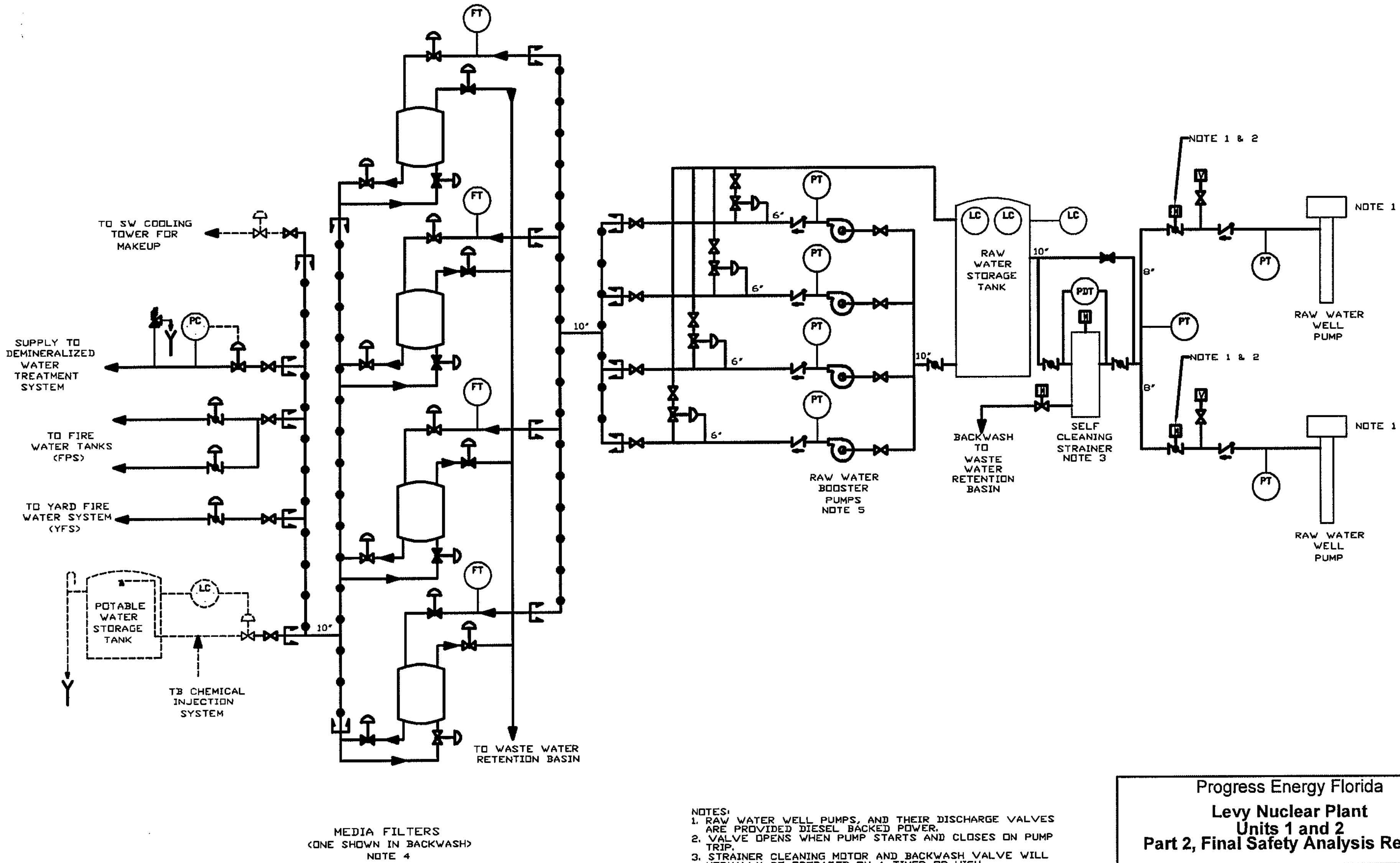
The other options listed are applicable to varying degrees to reduce the groundwater demand, but depend on supplementation by groundwater supply and/or combination with other sources to meet the entire demand.

In summary, there are technically feasible alternatives to the use of groundwater at the Levy Nuclear Plant site if necessary in the future.

6. REFERENCES

1. Levy Nuclear Plant Units 1 and 2, COL Application, Part 2, Final Safety Analysis Report, Rev. 2, Chapter 9.2.11, "Raw Water System"
2. Levy Nuclear Plant Units 1 and 2, COL Application, Part 3, Environmental Report, Rev. 2, Chapter 2, "Environmental Description"
3. Conceptual Design and Calculations for Levy Circulating Water and Raw Water Systems, LNG-CWS-GER-001, July 15, 2009.
4. Cooling Water Systems Design Input, LNG-CWS-GER-002, May 2008.
5. Raw Water Pump Sizing Calculation, LNG-MP1F-ZOC-001, July 2009.
6. Circulating Water Chemical Analysis Calculation, LNG-CWS-GEC-002, January 2008.
7. U.S. Army Corps of Engineers, Review letter and attachments, June 23, 2011.
8. Westinghouse Electric Company, AP1000 Standard Plant Water Balance, APP-RWS-M3C-001
9. Severn Trent Analytical Report 660-7246-1, March 2006.
10. LNP Freshwater Alternatives Environmental Impacts Analysis, CH2M HILL, October 2011

Appendix 1 - Raw Water System Flow Diagram



NOTES:
1. RAW WATER WELL PUMPS, AND THEIR DISCHARGE VALVES ARE PROVIDED DIESEL BACKED POWER.
2. VALVE OPENS WHEN PUMP STARTS AND CLOSES ON PUMP TRIP.
3. STRAINER CLEANING MOTOR AND BACKWASH VALVE WILL NORMALLY BE OPERATED ON A TIMER OR HIGH DIFFERENTIAL PRESSURE.
4. FILTER BACKWASH IS INITIATED FROM A TIMER AND THE VALVES WILL FAIL IN THE POSITION THAT MAINTAINS THE DISCHARGE FLOW ON AN AIR OR ELECTRICAL FAILURE.
5. RAW WATER BOOSTER PUMPS ARE PROVIDED WITH DIESEL BACKED POWER.

Progress Energy Florida

Levy Nuclear Plant Units 1 and 2 Part 2, Final Safety Analysis Report

Raw Water System

FIGURE 9.2-201

Rev. 3

Appendix 2 - Salt Water Analysis

EXECUTIVE SUMMARY - Detections

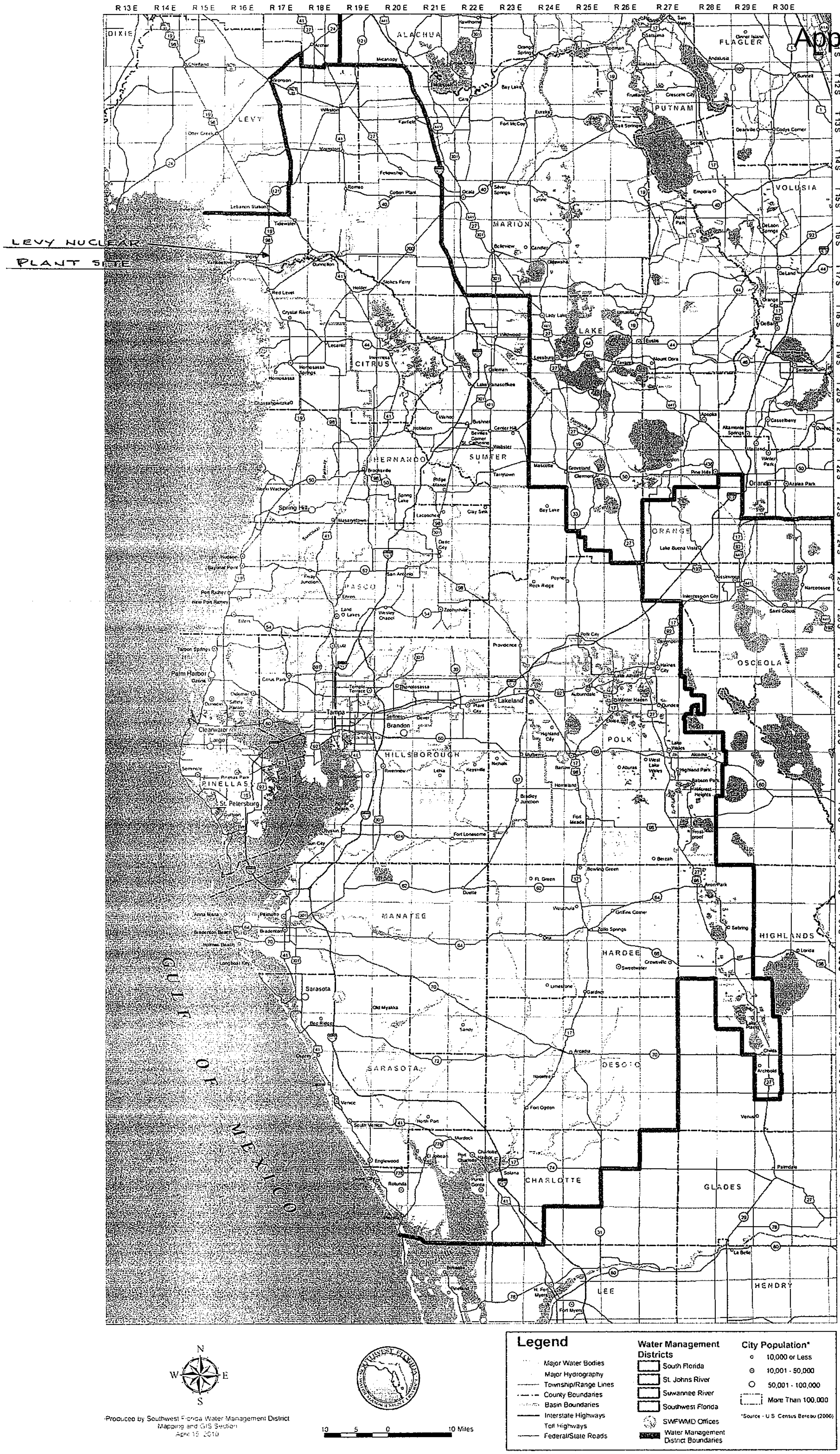
Client: Progress Energy

Job Number: 660-7246-1

Lab Sample ID / Analyte	Client Sample ID	Result / Qualifier		Reporting Limit	Units	Method
660-7246-1	**UNITS 4&5 INTAKE**					
Lithium		0.055		0.0025	mg/L	200.7 Rev 4.4
Mercury		0.00029		0.00020	mg/L	7470A
pH		8.24			SU	150.1
Total Dissolved Solids		20000		5.0	mg/L	160.1
Alkalinity		11		1.0	mg/L	2320B
Chloride		15000		50	mg/L	325.2
Nitrate Nitrite Nitrogen		0.021	I	0.050	mg/L	353.2
Nitrite Nitrogen		0.011	I	0.050	mg/L	353.2
Sulfate		2000		250	mg/L	375.4
Fluoride		0.59		0.20	mg/L	4500-F_C
Dissolved						
SiO2, Silica		1400		500	ug/L	200.7 Appx C
Total Recoverable						
Aluminum		0.79	I	1.0	mg/L	6010B
Barium		0.0094	I	0.050	mg/L	6010B
Boron		3.1		0.25	mg/L	6010B
Calcium		280		2.5	mg/L	6010B
Magnesium		860		2.5	mg/L	6010B
Strontium		5.1		0.050	mg/L	6010B
Sodium		8400		10	mg/L	6010B

Appendix 3 - Municipal Water Supply Sources

Appendix 3



LEVY NUCLEAR PLANT SITE
R 13 E R 14 E R 15 E R 16 E R 17 E R 18 E R 19 E R 20 E R 21 E R 22 E R 23 E R 24 E R 25 E R 26 E R 27 E R 28 E R 29 E R 30 E
T 12 S T 13 S T 14 S T 15 S T 16 S T 17 S T 18 S T 19 S T 20 S T 21 S T 22 S T 23 S T 24 S T 25 S T 26 S T 27 S T 28 S T 29 S T 30 S T 31 S T 32 S T 33 S T 34 S T 35 S T 36 S T 37 S T 38 S T 39 S T 40 S T 41 S T 42 S T 43 S T 44 S
DIXIE
ALACHUA
FLAGLER
PUTNAM
LEVY
VOLUSIA
MARION
LAKE
CITRUS
HERNANDO
SUMTER
ORANGE
PASCO
OSCEOLA
POLK
PINELLAS
HILLSBOROUGH
MANATEE
HARDEE
HIGHLANDS
SARASOTA
DESOTO
CHARLOTTE
GLADES
LEE
HENDRY
GULF OF MEXICO
Ocala
Orlando
Tampa
Lakeland
Clearwater
St. Petersburg
Brandon
Sarasota
Bradenton
Spring Hill
Palm Harbor
Sebring
Venice
Crystal River
Inverness
Dunnellon
Inglis
Yankeetown
Arcadia
Wauchula
Bartow
Winter Haven
Leesburg
Kissimmee
Punta Gorda
Port Charlotte
Fort Myers
N
E
S
W
Legend
Major Water Bodies
Major Hydrography
Township/Range Lines
County Boundaries
Basin Boundaries
Interstate Highways
Toll Highways
Federal/State Roads
Water Management Districts
South Florida
St. Johns River
Suwannee River
Southwest Florida
SWFWMD Offices
Water Management District Boundaries
City Population*
10,000 or Less
10,001 - 50,000
50,001 - 100,000
More Than 100,000
*Source - U.S. Census Bureau (2000)
10 5 0 10 Miles
Produced by Southwest Florida Water Management District
Mapping and GIS Section
April 15, 2010

Appendix 3

Levy Nuclear Plant								
Municipal Water Supply Alternative								
Utility Name	Service Area	County	Water District (Note 1)	River Basin	LNP Distance (miles)	Population-2010 (Note 2)	Est. Demand (gpd) (Note 3)	Est. Demand (gpm) (Note 3)
Levy County								
City of Williston	City of Williston	Levy	SWFWMD	Withlacoochee	24	2,951	442,650	307
Town of Yankeetown	Not specified	Levy	SWFWMD	Withlacoochee	5	792	118,800	83
Town of Inglis	Not specified	Levy	SWFWMD	Withlacoochee	3	1,716	257,400	179
Oak Avenue Water System Inc.	Not specified	Levy	SWFWMD	Withlacoochee	unknown	48	7,200	5
Outside Utility Service Areas	Domestic Self Supply	Levy	SWFWMD	Withlacoochee	N/A	19,249	2,887,350	2,005
Outside Utility Service Areas	Domestic Self Supply	Levy	SRWMD	unknown	N/A	18,421	2,763,150	1,919
Total - Levy County						43,177	6,476,550	4,498
Marion County								
County Wide Utility Co. Inc.	Not specified	Marion	SWFWMD	unknown	unknown	940	141,000	98
Marion County Utilities	Salt Springs	Marion	SJRWMD	unknown	unknown	235	35,250	24
Marion County Utilities	Silver Springs W & V	Marion	SJRWMD	unknown	unknown	681	102,150	71
Marion County Utilities	Deer Path	Marion	SJRWMD	unknown	unknown	12,696	1,904,400	1,323
Marion County Utilities	S.Lake Weir	Marion	SJRWMD	unknown	unknown	468	70,200	49
Marion County Utilities	Stonecrest	Marion	SJRWMD	unknown	unknown	3,927	589,050	409
Marion County Utilities	Spruce Creek Golf & CC	Marion	SJRWMD	unknown	unknown	12,362	1,854,300	1,288
Marion County Utilities	Spruce Creek South	Marion	SJRWMD	unknown	unknown	2,804	420,600	292
Marion County Utilities Dept.	Marion Oaks	Marion	SJRWMD	unknown	unknown	141	21,150	15
Marion County Utilities Dept.	Marion Oaks	Marion	SWFWMD	unknown	unknown	16,778	2,516,700	1,748
On Top of World Communities, Inc.	Not specified	Marion	SWFWMD	unknown	unknown	6,064	909,600	632
Marion Utilities Inc.	Not specified	Marion	SWFWMD	unknown	unknown	132	19,800	14
Rainbow Springs Utilities LC	Not specified	Marion	SWFWMD	unknown	unknown	2,646	396,900	276
Utilities Inc.of Florida	Golden Hills	Marion	SWFWMD	unknown	unknown	979	146,850	102
Marion County Utilities Dept.	Oak Run	Marion	SWFWMD	unknown	unknown	10,878	1,631,700	1,133
Marion County Utilities Dept.	Dunellon Airport	Marion	SWFWMD	unknown	unknown	0	0	0
Marion County Utilities Dept.	Samira Villas	Marion	SWFWMD	unknown	unknown	2	300	0
Sateke Village Utilities HOA Inc.	Not specified	Marion	SWFWMD	unknown	unknown	87	13,050	9
Sun Communities Operating LP	Saddle Oak MHP	Marion	SWFWMD	unknown	unknown	551	82,650	57
Marion Utilities Inc.	Not specified	Marion	SWFWMD	unknown	unknown	969	145,350	101
Century Fairfield Village Ltd	Not specified	Marion	SWFWMD	unknown	unknown	511	76,650	53
Marion Landing Homeowners Assoc.	Marion Landings	Marion	SWFWMD	unknown	unknown	1,018	152,700	106
Marion County Utilities	Quail Meadows	Marion	SWFWMD	unknown	unknown	753	112,950	78
Marion County Utilities	The Fountains	Marion	SWFWMD	unknown	unknown	241	36,150	25
Marion County Utilities	Ashley Farms	Marion	SWFWMD	unknown	unknown	29	4,350	3
City of Dunellon	Not specified	Marion	SWFWMD	Withlacoochee	10	6,205	930,750	646
Marion Utilities Inc.	Not specified	Marion	SWFWMD	unknown	unknown	1,270	190,500	132
Windstream Utilities Company2371	Not specified	Marion	SWFWMD	unknown	unknown	2,371	355,650	247
Upchurch Marinas Inc.	Sweetwater Oaks MHP	Marion	SWFWMD	unknown	unknown	459	68,850	48
Marion Utilities Dept.	Golden Ocala	Marion	SJRWMD	unknown	unknown	1,854	278,100	193
Marion Utilities Dept.	Golden Ocala	Marion	SWFWMD	unknown	unknown	57	8,550	6
Marion Utilities Dept.	Not specified	Marion	SWFWMD	unknown	unknown	928	139,200	97
Civic Assoc. of Rio Vista Utilities	Rio Vista Utilities	Marion	SWFWMD	unknown	unknown	411	61,650	43
Foxwood Mobile Home Park	Foxwood Farms	Marion	SWFWMD	unknown	unknown	780	117,000	81
Marion County Utilities Dept.	Not specified	Marion	SWFWMD	unknown	unknown	128	19,200	13
Del Webb Spruce Creek Comm.	Not specified	Marion	SWFWMD	unknown	unknown	6,482	972,300	675

Levy Nuclear Plant
Municipal Water Supply Alternative

Utility Name	Service Area	County	Water District (Note 1)	River Basin	LNP Distance (miles)	Population-2010 (Note 2)	Est. Demand (gpd) (Note 3)	Est. Demand (gpm) (Note 3)
Outside Utility Service Areas	Domestic Self Supply	Marion	SJRWMD	unknown	unknown	195,857	29,378,550	20,402
Outside Utility Service Areas	Domestic Self Supply	Marion	SWFWMD	unknown	unknown	47,233	7,084,950	4,920
Total - Marion County						339,927	50,989,050	35,409
Citrus County								
City of Crystal River	City of Crystal River	Citrus	SWFWMD	Coastal Rivers	12	11,482	1,722,300	1,196
City of Inverness	Not specified	Citrus	SWFWMD	Withlacoochee	24	24,950	3,742,500	2,599
Floral City Water Association	Floral City Water Association	Citrus	SWFWMD	Withlacoochee	30	7,035	1,055,250	733
Citrus County Water Resources	Citrus Springs/Pine Ridge	Citrus	SWFWMD	Withlacoochee	10	14,988	2,248,200	1,561
Rolling Oaks Utilities, Inc.	Beverly Hills Community	Citrus	SWFWMD	unknown	unknown	10,228	1,534,200	1,065
Homosassa Special Water District	Homosassa Special W.D.	Citrus	SWFWMD	Coastal Rivers	18	5,158	773,700	537
Gulf Highway Land Corporation	Cinnamon Ridge	Citrus	SWFWMD	unknown	unknown	557	83,550	58
Citrus County & WRWSA	Not specified	Citrus	SWFWMD	unknown	unknown	61,358	9,203,700	6,391
Citrus County Water Resources	Oak Forest	Citrus	SWFWMD	unknown	unknown	405	60,750	42
Citrus County Water Resources	Sugarmill Woods	Citrus	SWFWMD	unknown	unknown	11,550	1,732,500	1,203
Citrus County Water Resources	Lakeside Estates	Citrus	SWFWMD	unknown	unknown	487	73,050	51
Walden Woods of Sugarmill, Inc.	Not specified	Citrus	SWFWMD	unknown	unknown	0	0	0
Coello Water Association	Not specified	Citrus	SWFWMD	unknown	unknown	3,731	559,650	389
Citrus County Water Resources	Point O' Woods	Citrus	SWFWMD	unknown	unknown	760	114,000	79
Royal Oaks of Citrus HOA Inc.	Not specified	Citrus	SWFWMD	unknown	unknown	368	55,200	38
Constate Utilities Inc.	Constate Utilities	Citrus	SWFWMD	unknown	unknown	630	94,500	66
Citrus County Water Resources	Rosemont/Rolling Green	Citrus	SWFWMD	unknown	unknown	404	60,600	42
Citrus County Utilities Division	Golden Terrace	Citrus	SWFWMD	unknown	unknown	162	24,300	17
Citrus County Utilities Division	Apache Shores	Citrus	SWFWMD	unknown	unknown	395	59,250	41
Oak Pond LLC	Not specified	Citrus	SWFWMD	unknown	unknown	0	0	0
Tarawood of Floral City	James Ohlinger	Citrus	SWFWMD	Withlacoochee	30	141	21,150	15
South Dunellon Water Association	Not specified	Citrus	SWFWMD	Withlacoochee	12	469	70,350	49
Outside Utility Service Areas	Domestic Self Supply	Citrus	SWFWMD	unknown	unknown	4,597	689,550	479
Total - Citrus County						159,855	23,978,250	16,652
Sumter County								
Lake Panasoffkee Water Assoc.	Not specified	Sumter	SWFWMD	Withlacoochee	40	5,187	778,050	540
Continental Country Club RO Inc.	Not specified	Sumter	SWFWMD	Withlacoochee	unknown	1,477	221,550	154
City of Bushnell	City of Bushnell	Sumter	SWFWMD	Withlacoochee	42	4,719	707,850	492
City of Webster	Not specified	Sumter	SWFWMD	Withlacoochee	46	1,398	209,700	146
Cedar Acres Inc.	Oakland Hills Subdivision	Sumter	SWFWMD	Withlacoochee	unknown	667	100,050	69
City of Wildwood	Not specified	Sumter	SWFWMD	Withlacoochee	40	402	60,300	42
City of Center Hill	Not specified	Sumter	SWFWMD	Withlacoochee	48	1,625	243,750	169
Sumter WCA/Villages/Sumter Utilities	The Villages	Sumter	SWFWMD	Withlacoochee	unknown	128	19,200	13
Sumter WCA/Villages/Sumter Utilities	Not specified	Sumter	SWFWMD	Withlacoochee	unknown	56,777	8,516,550	5,914
Sumter WCA/Villages/Sumter Utilities	The Villages/Marion County	Sumter	SJRWMD	Withlacoochee	unknown	9,256	1,388,400	964
Sumter WCA/Villages/Sumter Utilities	The Villages/Lake County	Sumter	SJRWMD	Withlacoochee	unknown	10,590	1,588,500	1,103
American Television Network Inc.	Red Barn Mobile Home Park	Sumter	SWFWMD	Withlacoochee	unknown	2	300	0
City of Coleman	City of Coleman	Sumter	SWFWMD	Withlacoochee	40	1,097	164,550	114

Appendix 3

Levy Nuclear Plant

Municipal Water Supply Alternative

Utility Name	Service Area	County	Water District (Note 1)	River Basin	LNP Distance (miles)	Population-2010 (Note 2)	Est. Demand (gpd) (Note 3)	Est. Demand (gpm) (Note 3)
Outside Utility Service Areas	Domestic Self Supply	Sumter	SWFWMD	Withlacoochee	unknown	43,811	6,571,650	4,564
Total - Sumter County						137,136	20,570,400	14,285

Notes:

1. Water Management Districts (WMD):
   - SWFWMD = Southwest Florida WMD
   - SJRWMD = St. Johns River WMD
   - SRWMD = Suwannee River WMD
2. Population estimate based on SWFWMD website
3. Estimated demand assumes 150 gallons/capita/day

Appendix 4 - Reclaimed Water (Municipal Wastewater) Treatment Systems

Table 2.5-32
Marion County Wastewater Treatment Facilities

Facility Name	Permitted Capacity (mgd)	Annual Average Flow (mgd)
Silver Springs Shores WRF	1.500	1.010
Silver Springs Regional WWTF	0.450	0.155
Salt Springs WTP	0.080	0.047
NW Sub-Regional WWTF	0.015	0.008
Stone Crest WWTP	0.225	0.171
Spruce Creek South WWTF	0.450	0.121
Lock Harbor WWTF	0.024	0.006
Oak Run WWTP	0.800	0.407
Spruce Creek Preserve WWTF	0.095	0.045
Marion Oaks WWTF	0.225	0.226
Summer Glen WWTF	0.200	0.081

Notes:

mgd = million gallons per day
WRF = water reclamation facility
WTP = water treatment plant
WWTF = wastewater treatment facility

Table 2.5-33
Citrus County Wastewater Treatment Facilities

Wastewater Facility	Gallons Per Day	Expansion plans	Service Area (ac.)
Brentwood	500,000	1.5 million gpd in 2008	21,000
Meadowcrest	500,000	1.5 million gpd in 2007	13,000
Canterbury	95,000	Proposed to be connected to Brentwood system	30,000
South Dunnelon	46,000		

Notes:

ac. = acre
gpd = gallons per day

Sources: References 2.5-043, 2.5-165, 2.5-166, 2.5-167, and 2.5-168

Wastewater Plants

COUNTY	NAME	CITY	PERMITTED CAPACITY (MGD)
MARION	Ocala, WRF #1	Ocala	2.46
MARION	Belleview, City of	Belleview	0.58
MARION	Ocala WRF #2	Ocala	6.5
MARION	Associated Grocers of Florida	Ocala	0.2
MARION	Rolling Greens MHP	Ocala	0.25
MARION	Spruce Creek South	Summerfield	0.45
MARION	Silver Springs Regional	Silver Springs	0.45
MARION	Marion Correctional Institute WWTF	Lowell	0.65
LEVY	Chiefland WWTF	Chiefland	0.475
CITRUS	Brentwood Regional WWTF	Hernando	0.5
CITRUS	Meadowcrest WWTF	Lecanto	0.5
CITRUS	Inverness City of WWTF	Inverness	1.5
CITRUS	Crystal River City of WWTF	Crystal River	1.5
CITRUS	Beverly Hills WWTF	Beverly Hills	0.575
CITRUS	Citrus Springs WWTF	Citrus Springs	0.2
CITRUS	Sugarmill Woods WWTF	Homosassa	0.7
LEVY	Williston WWTF	Williston	0.45
MARION	MCUD/ Marion Oaks WWTF	Ocala	0.225
MARION	On Top of The World (Circle Square Wood	Ocala	0.75
MARION	Rainbow Springs Fifth Replat WWTF	Dunnellon	0.23
MARION	MCUD/Oak Run	Ocala	0.8
MARION	Dunnellon City of	Dunnellon	0.25
MARION	Summerglen WWTF	Ocala	0.2
MARION	Ocala WRF #3	Ocala	5
MARION	MCUD/Silver Springs Shores Emerald	Ocala	0.998
MARION	On Top of the World North WWTF	Ocala	2.23

Appendix 5 - Wet Surface Air Cooler (WSAC)

Appendix 5

From: Toll, Edward B. (Reading)
Sent: Thursday, July 14, 2011 9:28 AM
To: Kertell, Charles R. (Reading); Archer, John C. (Reading)
Subject: FW: Worley Parsons Reading, PA - WSAC for fresh water savings at Nuclear Plant in Florida
Attachments: WS11-147 WSAC_orig.pdf; OTS 053, REV 09, SEA-CURE Condenser Tubing.pdf; Advantages of Wet Surface Air Coolers.pdf

Attached is information on a closed cycle cooling tower for the SW function. It would use salt water in place of fresh water but note the size (four 50x78ft cells = 50 x 310ft) and motor horsepower (8X125)

E. B. Toll
WorleyParsons Group Inc
610-855-3162
edward.b.toll@worleyparsons.com

From: Bill.Altier@JenningsAlberts.com [mailto:Bill.Altier@JenningsAlberts.com]
Sent: Wednesday, July 13, 2011 4:47 PM
To: Toll, Edward B. (Reading)
Cc: CMarchetta@niagarablower.com; Jeff.Kerner@JenningsAlberts.com
Subject: RE: Worley Parsons Reading, PA - WSAC for fresh water savings at Nuclear Plant in Florida

Hi Ed-

Here is our initial preliminary WSAC™ design selection for your Army Corps of Engineers nuclear power plant project in Florida. Interestingly it is a very similar bundle and WSAC™ design to an order that Niagara has well underway for a Clean Fuels project that your Worley Parsons Monrovia office is currently working on with Exxon Mobil at their SAMREF Saudi Arabia refinery where they are using Red Sea water as make up.

Note there (4) WSAC™cells required for your heat load of 346 MM BTU/Hr at approx 80ftx50ft for EACH cell. Please let us know if there is any way to shoe horn these 4 WSAC™ cells into the available plot space?

Attached please find:

- first page datasheet and dimensional outline.
- Flyer on recommend sea cure tubes for the bundles for the most effective resistance to higher cycles of chlorides. This material is in lieu of Titanium.
- Quick summary on some WSAC™ advantages

Notes:

- Alloy tube sheet with carbon steel painted headers.
- Delivery on a project like this will be 30+ weeks.

Please review and advise any questions.

Thanks again,
Bill Altier
Jennings Alberts, Inc. rep for NIAGARA Blower Heat Transfer Solutions

Appendix 5

www.niagarablower.com
PO Box 503
Pipersville, PA 18947
215.348.0256 / fax 3530
New website under development at www.jenningsalberts.com

JENNINGS | ALBERTS
Innovative Industrial Process Solutions

From: Toll, Edward B. (Reading) [mailto:Edward.Toll@WorleyParsons.com]
Sent: Tuesday, July 12, 2011 10:09 AM
To: Bill Altier
Subject: RE: Worley Parsons Reading, PA - WSAC for possible fresh water savings at Nuclear Plant in Florida

All we have is a site arrangement drawing and the space scales at 75' x 75'. I would treat these dimensions as subject to change so I would not put a lot of effort into trying to match them.

E. B. Toll
WorleyParsons Group Inc
610-855-3162
edward.b.toll@worleyparsons.com

From: Bill.Altier@JenningsAlberts.com [mailto:Bill.Altier@JenningsAlberts.com]
Sent: Tuesday, July 12, 2011 9:31 AM
To: Toll, Edward B. (Reading)
Subject: RE: Worley Parsons Reading, PA - WSAC for possible fresh water savings at Nuclear Plant in Florida

Thanks Ed.

PS do you have any rough dimensions on the actual available plot plan footprint? ______length by ________width?

Thanks again,
Bill Altier

Jennings Alberts, Inc. rep for NIAGARA Blower Heat Transfer Solutions www.niagarablower.com
PO Box 503
Pipersville, PA 18947
215.348.0256 / fax 3530
New website under development at www.jenningsalberts.com

JENNINGS | ALBERTS
Innovative Industrial Process Solutions

Appendix 5

From: Toll, Edward B. (Reading) [mailto:Edward.Toll@WorleyParsons.com]
Sent: Monday, July 11, 2011 8:39 AM
To: Bill Altier
Subject: RE: Worley Parsons Reading, PA - WSAC for possible fresh water savings at Nuclear Plant in Florida

A square configuration or rectangle will work

E. B. Toll
WorleyParsons Group Inc
610-855-3162
edward.b.toll@worleyparsons.com

From: Bill.Altier@JenningsAlberts.com [mailto:Bill.Altier@JenningsAlberts.com]
Sent: Thursday, July 07, 2011 4:27 PM
To: Toll, Edward B. (Reading)
Subject: Worley Parsons Reading, PA - WSAC for possible fresh water savings at Nuclear Plant in Florida

Hi Ed-

It was nice to speak with you.

We are in the process of working with Niagara Blower Heat Transfer Solutions engineering in providing you with a preliminary WSAC™ design to determine if we can fit into your evidently tight site plot plan available space and therefore be a practical solution help you to reduce the plants fresh water usage water footprint. Per the voice mail – it would be great if you could better define the potential available space_________(L x W x H) since we can sometimes work up a design that could fit where our 'standard' arrangement does not fit.

Preliminarily sizing basis:

21,000 GPM
$346x10^6$ BTU/Hr i.e. 346,000,000 BTU/Hr
81 WB
96 DB

Please review and advise.

Thanks again,
Bill Altier
Jennings Alberts, Inc. rep for NIAGARA Blower Heat Transfer Solutions www.niagarablower.com
PO Box 503
Pipersville, PA 18947
215.348.0256 / fax 3530
New website under development at www.jenningsalberts.com

JENNINGS | ALBERTS
Innovative Industrial Process Solutions

From: Marchetta, Chuck [mailto:CMarchetta@niagarablower.com]
Sent: Thursday, July 07, 2011 2:02 PM
To: Jeff Kerner
Cc: Bill Altier; Vogel, Mark
Subject: Worley Parsons Reading, PA

Jeff,
I received a call today from Ed Toll from Worley Parsons out of Reading PA. He is calling about a sea water study for a Nuclear plant in Florida.
Preliminarily he would like to know a selection for the following:
21,000 GPM
$346x10^6$
81WB
96DB

Edward.b.toll@worleyparsons.com

I have to confirm the heat load because I 'm not sure if there was a decimal point in there somewhere. How do you want to proceed?

Regards,
Chuck Marchetta
Niagara Blower Heat Transfer Solutions
Wet Surface Air Cooler Division
716-875-2000
www.niagarablower.com

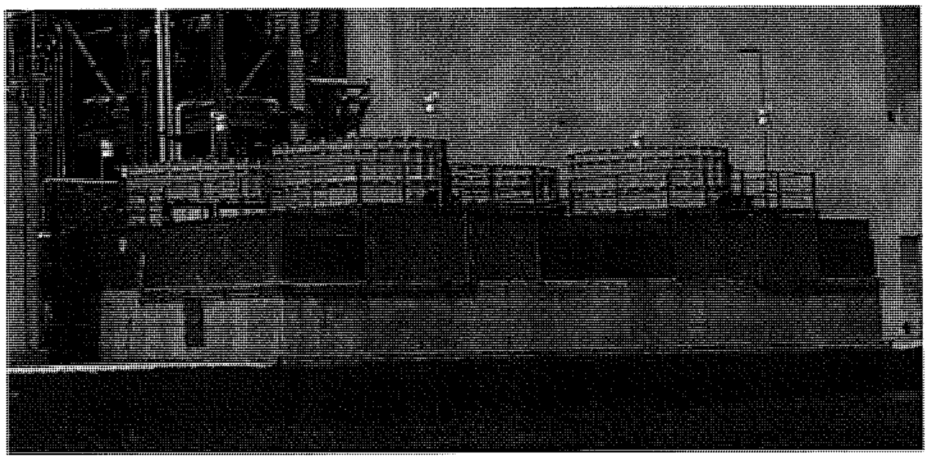
Filtered by AppRiver.

*** WORLEYPARSONS GROUP NOTICE *** "This email is confidential. If you are not the intended recipient, you must not disclose or use the information contained in it. If you have received this email in error, please notify us immediately by return email and delete the email and any attachments. Any personal views or opinions expressed by the writer may not necessarily reflect the views or opinions of any company in the WorleyParsons Group of Companies."

Filtered by AppRiver.

NIAGARA
Niagara Blower Heat Transfer Solutions
673 Ontario St., Buffalo, NY 14207
Phone: (716) 875-2000 ~ Fax: (716) 875-1077
sales@niagarablower.com / www.niagarablower.com

Advantages of WSAC™ closed-loop, evaporative coolers



- Process fluid is contained in a closed-loop; never exposed to the environment or recirculating spray water.
- Rugged industrial design utilizes 12 gauge steel and/or concrete. Construction is fireproof and has been known to last over 30 years. Niagara can also offer FRP designs.
- WSAC units can run at higher cycles of concentration than cooling towers, resulting in reduced makeup water requirements and blowdown. These reductions are accredited to smooth tube materials, wide spacing, high flow/ low pressure spray nozzle design, and the absence of plastic fill.
- Makeup water can come from almost any source (including cooling tower blowdown, R/O, plant discharge, etc.).
- A wide variety of tube materials and component configurations can be optimizes for each heat transfer application based on the stream to be cooled or condensed (inside the tubes) and the quality of the spray water (outside the tubes).
- WSACs have the ability to achieve closer approach temperatures (5-10°F to the wet bulb) than most other cooling technologies.
- Intrinsic freeze protection is achieved when sprays operate year round.
- Partial dry operation designs are available to reduce plume & overall water consumption.
- WSAC co-current flow of air and water:
  *Dramatically reduces the possibility of scaling
  *Eliminates the possibility of tube bundle icing
  *Offers less drift and plume due to the 180°turn
- Lower pump HP than a cooling tower due to quantity of spray required and reduced head
- Single source thermal responsibility
- Water treatment can be easily achieved. Niagara recommends consulting a water treatment professional.
- Easy maintenance:
  *Easily accessible & removable spray system
  *Pressure washable tubes
- Serpentine tube bundles can be designed for operating pressures up to 2500 psi.

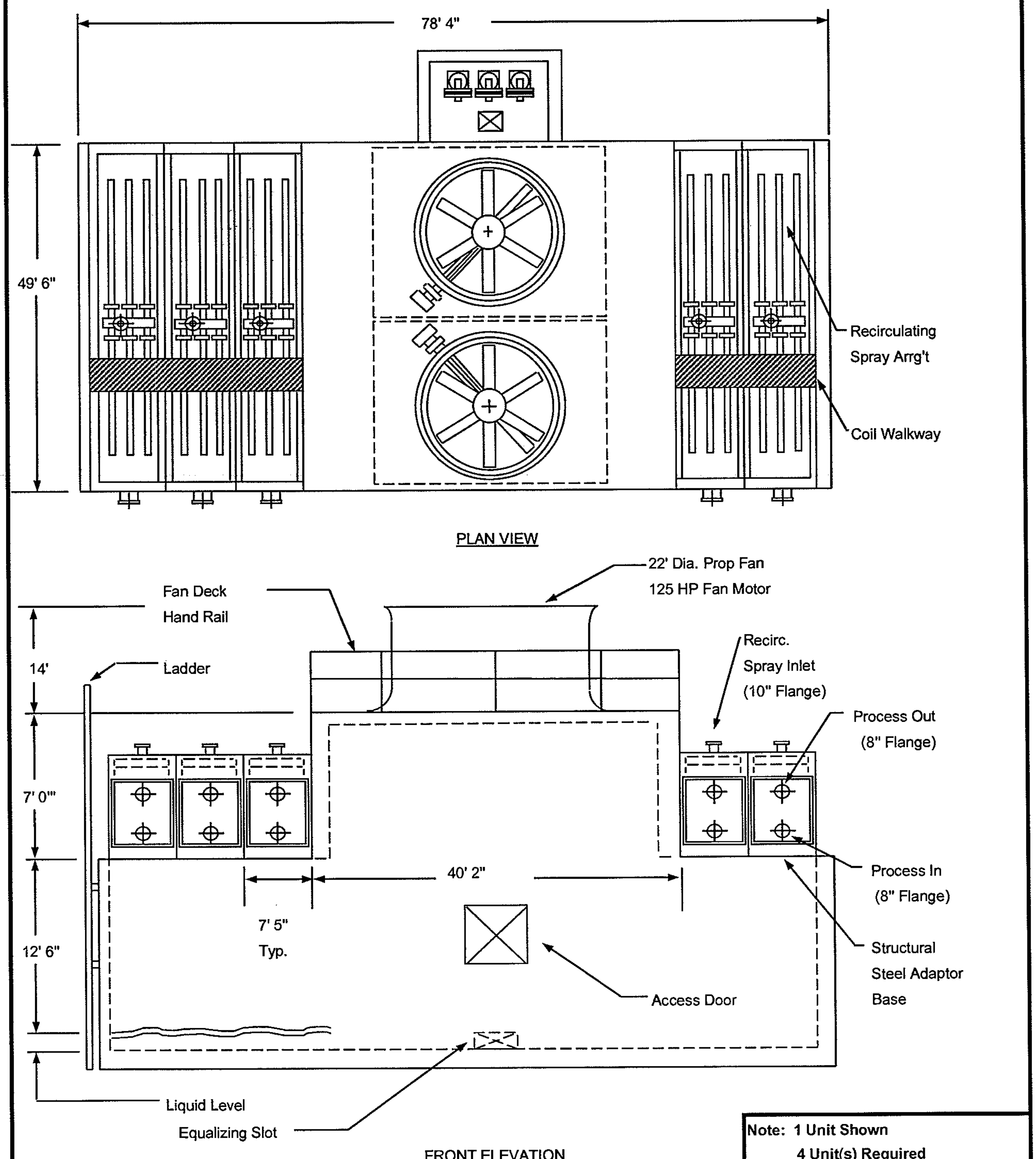
To learn how Niagara can provide
custom-built coils for your requirements,
contact a Niagara Applications Engineer today.

NIAGARA
Niagara Blower Heat Transfer Solutions
673 Ontario St., Buffalo, NY 14207
Phone: (716) 875-2000 ~ Fax: (716) 875-1077
sales@niagarablower.com / www.niagarablower.com

Customer:	Army Corps Engineers	Proposal #:	WS11-147
Engineering Firm	Worley Parsons	Rev:	Original
Domestic Project:	Sea Water Make up (FL)	Engineer:	Chuck Marchetta
Sales Office:	Alberts & Associates	Date:	July 13, 2011

WSAC Design Summary

Specification	Requirement	Niagara Blower Company
Unit		
Model Number		RWC 58948-2F22
Flow Type		Series
Number of Cells Proposed		4
Unit Type	Closed Circuit Fluid Cooler	Wet Surface Air Cooler
Length / Width	/	49.5 ft / 78.3 ft
Performance		
Service		Water Cooler
Flow Rate (gpm)		21,000 GPM
Mass Flow Rate (lb/hr)		10,500,018 lb/hr
Temp In		124.8 F
Temp Out		91.8 F
Inlet Air Wet Bulb Temp		81.0 F
Design Heat Load		346,500,578 BTU/hr
Coils		
Cooling Surface Construction Type	Bolted Removable Covers	Straight Thru - Mechanically Cleanable
Maximum Operating / Test Pressure		150 psig / 195 psig
Total Number of Bundles (Total)		20
Cooling Tube Material		SA-249-304/304L SS
Tube Diameter and Thickness		1.25 in. x 0.049 in.
Pressure Drop		9.6 psi
Process Connection		150# RFSO Flanged
Tubesheet Material		SA-240-304 SS
Bundle Cover Material		Carabon Steel Painted
Casing Panels		FRP
Fan System		
No of Fans (Total)		8
Fan Diameter		22 ft
Fan Motors		125HP 1800RPM TEFC
Fan Type		Axial Propeller / Gear Drive Reduction
Gear Box Fan Speed Reducer		Amarillo or equiv, SS shafts epoxy coated.
Fan Horsepower (Operating)		983.2 Bhp
Air Flow (Total)		5,140,162 CFM
Spray System - Sea Water Makeup		
Spray Pipe Material		PVC
Spray Water Recirculation Rate (Total)		38,400 GPM
Spray Pump Horsepower (Operating)		402.6 Bhp
Estimated Make-Up Water Requirements (based on 3 cycles of concentration)		910 GPM
Structure		
Basin / Plenum Construction		Poured in Place Reinforced Concrete
Basin / Plenum Civil Design		By NBCo / Foundation By Others



Note: 1 Unit Shown
4 Unit(s) Required

Niagara Blower Co. **Process Equipment for Industry**	**Title:** WSAC Model # RWC 58948-2F22		
	Customer: Army Corps Engineers		
	Date: 7/13/2011	**Prop #:** WS11-147	**Rev. Original**

PLYMOUTH TUBE CO USA®

SEA-CURE® (UNS S44660)
Super-ferritic Stainless Steel Condenser and Evaporator Tubing

MANUFACTURING & TECHNICAL STANDARD, 0TS-053 Rev 09 FEBRUARY 16, 2010.

1.0 SCOPE:
This technical standard covers the processing and testing of SEA-CURE® super-ferritic (UNS S44660) stainless steel condenser tubing to meet or exceed the requirements of ASTM A268, ASME SA268 and special customer requirements. Plymouth Tube internal quality procedures are referenced where applicable.

2.0 RAW MATERIAL: RMS-SC-Ti+Cb
Electric furnace melted, AOD refined, and cold rolled strip is procured to a proprietary Plymouth specification and any special customer requirements.

3.0 WELDING: WG-02
The strip is cold formed into a tubular shape and fusion welded by the gas tungsten arc welding (GTA) method without the addition of filler material. To assure weld integrity, proprietary procedures specify that weld test samples are taken during setup and multiple times during each production shift thereafter for destructive testing and acid etching. The destructive tests include flare, flange, flatten and reverse flatten tests according to the methods of A1016. In addition, prior to cutting, continuous, full-body in-line Eddy Current testing is performed to monitor tube quality.

4.0 COLD WORKING:
After welding, the weld area is sufficiently cold worked to promote diffusion and homogenization of the weld on subsequent annealing. The cold working is accomplished utilizing both OD and ID tooling to ensure that the weld is blended into the base metal without the removal of any stock. Plymouth does not bead polish as this process can mask weld defects and create localized dimensional under-tolerances.

5.0 PRE-ANNEAL CLEANING:
The original clean strip finish is maintained on the tube ID no lubricants are used in forming, welding or cold working, therefore, no cleaning is necessary.

6.0 ANNEALING: PCS-011
The tubes are solution annealed in accordance with proprietary procedures at 1500°F (815°C) minimum, followed by water quench from the anneal temperature to prevent the formation of harmful precipitates and to provide ductility to meet the mechanical properties, and manipulation test requirements of the specification.

7.0 STRAIGHTENING: QCS-123
The tubes are straightened to a tolerance of .030" maximum camber in any 3 foot section (1mm/meter). As tubing 1" (25.4mm) OD and smaller is not stiff enough to accurately measure this, straightness will be demonstrated by having the ability to freely roll the tubes down a 5 degree incline.

8.0 AIR TEST: QCS-108
The tubes will be air tested under water at a minimum of 250 psi (1725 KPa) for all tubing produced per this OTS, for not less than 5 seconds and long enough for the operator to inspect the full length of tube.

9.0 CUT AND DEBURR: QCS-142
Each tube end will be abrasive cut and thoroughly de-burred, producing a square, burr free end suitable for expanding and/or flaring.

10.0 PICKLE: **PCS-016**

Each tube will be pickled in a mixture of nitric acid/H_2O/hydrofluoric acid to remove all oxide or scale and produce a smooth, clean, passivated, corrosion resistant surface for the optimum corrosion resistance of this grade.

11.0 RINSING:

Each pickled tube will be thoroughly rinsed by tank immersion, followed by a hose rinse with demineralized water with 1 PPM maximum chloride and a maximum conductivity of 10 micromhos.

12.0 FINAL INSPECTION: **QCS-123**

Tubing will be examined for straightness, length, OD size and wall thickness, and surface appearance to insure specification conformance. An OD go ring gauge is used to check OD size on both ends of each tube. To allow sliding clearance, it will be .002" (.05mm) larger than the maximum diameter allowed by the specification. Tubing will meet ASTM A268/ASME SA268 specification. To examine the inside surface, a light box will be placed on the opposite end of the tubes.

13.0 NON-DESTRUCTIVE ELECTRIC TEST: **QCS-109**

Each tube will be given a non-destructive electric test to the requirements of ASTM A1016/ASME SA1016 and additional Plymouth Tube requirements.

14.0 IDENTIFICATION AND PACKAGING: **QCS-158**

After final inspection and eddy current test on straight tubes, each tube will be stenciled in non-detrimental ink with the following: manufacturer, welded, alloy designation, OD and wall (IP and/or SI units), specification, annealed, heat number, coil number, mill bundle number, date and shift of final inspection, and mill order number. All accepted tubes are packed in wooden boxes lined with polyethylene. The box covers will not be attached by nailing. Each box will be identified with customer order number, Plymouth mill order number, tube size and length, heat number, number of pieces, and box number.

15.0 CUSTOMER INSPECTION: **QCS-145**

Plymouth Tube – East Troy will allow entry and provide reasonable facilities for the customer's representative during testing or final inspection of the customer's order. Notification by Plymouth will be in accordance with the customer's purchase order requirements.

16.0 LABORATORY TESTS:

The following tests will be made according to ASTM A268/ASME SA268

16.1 Tensile Test
16.2 Rockwell Hardness Test
16.3 Flange Test
16.4 Reverse Flatten
16.5 Additional Tests per Customer Specification

17.0 CORROSION (Pitting Resistance) TESTING:

Samples from each heat of SEA-CURE will be corrosion tested according to ASTM G-48 Method "C" at a temperature of 65°C for 72 hours. No visible pitting in excess of 0.001" will be allowed. Testing shall be performed on samples in the as-shipped condition. Except for localized mechanical cleaning to remove superficial marks from the cutting operation, no chemical or mechanical surface preparation of the samples prior to testing is allowed. If attack is found to have been caused by the creation of a crevice during the test, retests are permitted.

18.0 TEST REPORTS:

Certified reports showing test results verifying specification conformance will be furnished.

NOTE: We are willing to forward current revisions of referenced documents after order placement. However, several of these are considered proprietary and may only be reviewed on Plymouth premises.

PLYMOUTH TUBE CO USA
2061 Young Street • East Troy, WI 53120 USA
Visit us online at http://www.plymouth.com
Phone: **1-262-642-8201**
Fax: 262-642-8486
Email: sales@plymouth.com

Appendix 6 - Seawater Desalination

From: Kertell, Charles R. (Reading)
Sent: Wednesday, August 10, 2011 1:23 PM
To: 'Louis Sloan'
Cc: Archer, John C. (Reading); Toll, Edward B. (Reading)
Subject: Progress Energy LNP Service Water Desalination
Attachments: Salt Water Quality.pdf; Crystal River Proposal.pdf

As we discussed, Levy Nuclear Plant (LNP) is a proposed Progress Energy facility located in Levy County, Florida, approximately 10 miles north of the Crystal River Energy Complex. Circulating water cooling will be by salt water cooling tower with makeup from the Cross Florida Barge Canal. Service water is currently proposed to be provided by groundwater wells on the plant site, drawing from a fresh water aquifer, with multi-media filtration. Environmental concerns require consideration of alternate sources of service water, including desalination of salt water from the Cross Florida Barge Canal.

Conceptual recommendations and budgetary costs for a desalination system are the subject of this email. We would like recommendations and budgetary costs at a similar level of detail to the attached 2007 Anderson proposal for Crystal River.

Preliminary design considerations are as follows:

- Plant design – two (2) units, Westinghouse AP1000 standard plant
- Service water uses –
  - makeup to service water cooling tower
  - feed to demineralized water treatment system
  - potable water
  - filling of fire water storage tanks
- Design flow rate for service water
  - Normal flow – 500 gpm per unit
  - Maximum flow – 1200 gpm per unit
  - Simultaneous maximum flow (two units) – 2050 gpm
- Required water quality
  - Maximum influent temperature - 113 °F
  - Maximum turbidity - < 1.0 NTU
  - Silt Density Index (SDI) - < 4.0
  - LSI (scaling potential limit) - < +1.5
- Salt water quality – current barge canal water is brackish, but is assumed will change after circulating water makeup flow is established; use attached analysis from Crystal River Units 4 & 5 intake
- Sizing basis – provide two (2) separate systems, one for each plant unit; each unit to have three (3) 50% trains sized at 600 gpm each; one (1) train for normal flow, two (2) trains for maximum flow, one (1) train standby (discuss if you suggest some alternate sizing basis)
- Redundancy – system to be "highly reliable"; provide significant degree of redundancy for all equipment

Please call if you have any questions.

Charles R. Kertell

ANDERSON – WPT
160 King Street West, 2nd Fl.
Dundas, Ontario, L9H 1V4, Canada
Tel. (905) 627-9233
Fax. (905) 627-2381

1455 S. 5500 W., Suite C
Salt Lake City, Utah, 84104, USA
Tel. (800) 494-2525
Fax. (801) 973-9733

August 26, 2011

Worley Parsons
2675 Morgantown Road,
Reading,
PA
19607

Attn: Mr. Charles Kertell

Re: Progress Energy - LNP
Desalination Systems – Your Email August 10.2011
Our Proposal # 2574-2011

Dear Mr. Kertell,

Further to your inquiry, we are pleased to submit our budget proposal no. 2574-2011 for your consideration.

Anderson-WPT is part of Degremont Technologies North America group of companies, along with our sister companies: Infilco, Ozonia, and Degremont Ltee. We have formed integrated Technology Competence Centers to design, manufacture, and deliver the best Water Treatment Systems for our clients under our new group of companies.

Thank you for the opportunity to quote you our equipment. We look forward to work with you on this project. In the meantime, please do not hesitate to contact us should you have any questions, or should you require further clarification on any component of our proposal.

Yours truly,
ANDERSON-WPT

Peter Midgley
Regional Business Manager

William Tuck
Head of Applications

CC: - Jonathan Lister / Sales Director
- Mario Castineira / VP – Engineering
- Lou Sloan (SES)

ANDERSON – WPT
160 King Street West, 2nd Fl.
Dundas, Ontario, L9H 1V4, Canada
Tel. (905) 627-9233
Fax. (905) 627-2381

1455 S. 5500 W., Suite C
Salt Lake City, Utah, 84104, USA
Tel. (800) 494-2525
Fax. (801) 973-9733

Proposal No. 2574-2011
DESALINATION SYSTEMS

For:
PROGRESS ENERGY – LNP
LEVY COUNTY, FL

Prepared for:

WORLEY PARSONS

Prepared by:

William Tuck

Date:

August 25, 2011

INTRODUCTION

With the combined experience of over 100 years Anderson-WPT has provided proven expertise in the design, engineering, manufacturing and commissioning of industrial and municipal process water treatment systems. With more than 3000 installations in 40 countries, Anderson-WPT systems are applied in some of the world's finest power plants, refineries, chemical production facilities, pulp and paper mills, food and beverage production, pharmaceutical and a variety of manufacturing facilities.

Key capabilities include custom engineered solutions, pre-engineered equipment, process optimization, packaged water treatment systems, start-up and commissioning, remote monitoring, and long-term service and customer support programs.

Anderson-WPT applies technologies such as reverse osmosis, UPCORE® packed bed, EDI, ion exchange, degasification, clarification, and filtration.

Partnering with its customers, Anderson-WPT develops and delivers the best solutions for process water, industrial wastewater, and water recycling. Anderson-WPT has a proven record of customer satisfaction providing technically-superior total water treatment solutions.

SECTION 2: PROCESS / DESIGN NOTES

DESIGN CAPACITY,EACH SYSTEM

Filters:	867 gpm each normal, 889 gpm each maximum.
	2667 gpm total.
	4100 gpm backwash flowrate, each filter.
Cartridge Filters:	1334 gpm each.
RO Pumps:	667 gpm @ 800 psig, each.
RO Units:	600 gpm each.
	1200 gpm total.
Recovery:	45%.

Estimated RO Pump KW consumed to produce 1200 gpm: 960 KW.

The above KW is net after energy recovery and at 100°F influent temperature.

Preliminary Building size required is 100'-0" x 125'-0"

DESIGN CONDITIONS AND REQUIREMENTS

System Feedwater Analysis – Major Ions:

Parameter	mg/L as ion	mg/L as $CaCO_3$	Parameter	mg/L as ion	mg/L as $CaCO_3$
Calcium	280	700	M Alk	13	11
Magnesium	860	3543	SO_4	2000	2080
Sodium	8400	18228	Cl	15000	21150
Sodium (for adjustment)	355	770			0.5
			SiO_2	1.4	
Total Cations	**9895**	**23241**	**Total Anions**	**17014**	**23241**

Other Data

Parameter	mg/L or unit
pH	8.24
Barium	0.0094
Strontium	5.1
Boron	3.1
Aluminum	0.79
Temperature(assumed)	60-100 deg F

PROCESS GUARANTEES

For process guarantees to be valid in this project, it is required that the equipment is operated as per instructions issued by Anderson-WPT and the influent analysis is as specified, then the average effluent quality will not exceed the limits as outlined below:

Desalinated Water Quality

Parameter	
Total Dissolved Solids	< 400 ppm
Maximum Turbidity	<1.0 NTU
SDI	< 4.0 ppm
LSI	< + 1.5

SCOPE OF SUPPLY

The proposed system is designed to produce potable water from high TDS water. Each of the two systems will consist of the following:

2 - Chemical feed system, to feed sodium hypochlorite to inject chlorine and sulphuric acid in filter feed.

1 - Filter ferric chloride feed system.

1 - Filter polymer feed system.

4 - Primary multi-media filters, horizontal.

2 - Filter air scour blowers, each 100% capacity.

2 - Chemical feed systems, 1 – to feed sodium bisulphite and 1 – to feed antiscalant.

3 - Cartridge filters.

6 - Seawater RO (SWRO) feed pumps with ERT.

3 - SWRO membrane skids, to process high chloride, high TDS water.

1 - CIP system.

1 - Control panel with PLC and HMI.

Not included:

Interconnecting piping and wiring.

Motor starters. SWRO pumps require soft starters.

VFDs, if required.

DESIGN BASIS

1) Feed water to the filters will be as stated herein.
2) Filters are designed to use the influent as the backwash source.
3) It was assumed that the required flowrate is available for filter backwash and service flows.
4) Filter feed pressure required is 60 psig minimum.
5) Treated water (permeate) will be available at 15 psig.

DESIGN HILITES

The equipment is designed for a long life. The materials of construction are suitable for high chloride application as indicated below:

- Filters Rubber lined with FRP / CPVC internals.
- Cartridge Filters ....Rubber lined housings.
- Pumps Duplex wetted parts.
- Energy Recovery Device..........Duplex wetted parts.
- High Chloride Piping ....Duplex / FRP / CPVC.
- Membrane...............................Low energy Filmtec membranes have been used. Relatively low flux rate and recovery used will provide longer membrane life.
- Flexibility ....Each of the 3 SWRO membrane skids have 2 x 50% units. This will minimize the loss of capacity during cleaning since 900 gpm of treated water will still be available.
- One of the cartridge filters and one of the RO trains are standby.

OPTIONAL EQUIPMENT

For a poorer feed water quality, the following equipment may be required:

Two (2) stage filtration, with polishing filters in series with the primary filters.

Backwash tank / pumps to backwash filters with filtered water.

BRIEF DESCRIPTION OF THE MAJOR COMPONENTS

Filters:

Four (4) – 9'-0" diameter Horizontal Filters, rubber lined, with FRP / CPVC internals, FRP/ PVC face piping, anthracite, sand, and garnet media.

Cartridge Filters:

Three (3) – Cartridge Filters with rubber lined housing and polypropylene cartridges, FRP face piping. One unit is standby

RO Pumps:

Six (6) – Pumps with duplex wetted parts, with energy recovery devices, also with duplex wetted parts, and 400 HP, 480/3/60 motors. Two of the pumps of the operating trains are standby

RO Skids:

Three (3) – RO Skids, each having 36 housings with 256 Filmtec membranes (7 membranes per housing), with duplex high pressure and CPVC low pressure piping.

CIP System:

One (1) – CIP Unit, with a FRP tank, a cartridge filter and a forwarding pump. CIP system will be used for RO flushing also.

Control Panel:

A dedicated control panel with a PLC and an HMI.

SECTION 7: COMMERCIALS

BUDGET PRICE

To design, procure, assemble, test and prepare for shipment of the Systems as described herein:

LOT Budget Price for your feasibility study .... $ 13,000,000.00

COMMERCIAL NOTES

1. **Quoted Currencies:** The above price is in US Dollars. We reserve the right to adjust our prices if the exchange rate utilized in this Proposal ($ 1.00 CAD = $ 1.02 USD) changes by more than 1.0 cent in either direction.

2. **Taxes:** All Federal, State, or Local taxes are not included.

3. **Terms and Conditions:** This proposal is based on Anderson-WPT's Standard Terms and Conditions of Sale.

4. **Payment Terms:** Net 30 days. We propose progress payments:

   - 10% upon submittal of P&ID's.
   - 40% upon order placement of major materials.
   - 40% upon receipt of major materials at our shop.
   - 10% upon notification of readiness to ship NTE 60 days from notification of readiness to ship.

5. **Major Drawing Schedule:**

P and I Drawings	6 Weeks After Receipt of Order
Mechanical Arrangements	4 Weeks After Return of Approved P&I Dwgs
Wiring and Instrumentation Drawings	10 Weeks After Return of Approved P&I Dwgs

6. **Delivery:**

   a. Schedule: 44 Weeks. To be confirmed at time of order.
   b. Turnaround for Approval: 2 weeks maximum turnaround for approval submission and only one approval submission. Any additional time will result in review and possible adjustment in schedule at the discretion of Anderson-WPT.
   c. Incoterms 2000: All prices are FCA Seller's shop.

7. **Validity:** This proposal is valid for 60 days. Beyond this date, we reserve the right to adjust our price according to the material escalation formula outlined below.

8. **Spare Parts:** Spare parts lists are typically developed during the detailed engineering phase of the project where bill of materials are available. Therefore, the prices for spare parts for start-up / commissioning and for two years operation will be provided at that time.

9. **Special Tools:** Special tools are not required for the proposed system.

10. **Technical Service Advisor:** Technical assistance to audit installations, commission the systems, supervise, and train customer's personnel in the operation, care and maintenance of the Anderson-WPT's Equipment are not included in the lot price. These services are available on per diem basis. Please refer to our standard "Schedule of Charges for Technical Service Advisors (TSA)".

11. **Cancellation Schedule:**

Subsequent to the cancellation clause as outlined in WPT Conditions of Sale, the following formula shall apply.

C = Total Contract Price
S = Supplier's/Sub-Contractors Cancellation and Restocking Charges
A = WPT's Material and Labour Costs to Date
0 – 1 Week............................5% C
1 – 2 Weeks..........................10% C
2 – 4 Weeks..........................S + 15% C
4 – Scheduled Delivery ....A + S + 20% C

Note: Subsequent to cancellation the ownership rights to all the purchased material, documents, etc. are conveyed to the client.

12. **Engineering and Equipment Supply Index Formula:**

Index Formula = PPIn/PPIo x Bid Price

Where:

PPI = Producer Price Index.
PPIo= Base Indices as published for the month of February 2006.
PPIn = Final Indices as published for the month in which the Notice-To-Proceed is issued.
PPIo = 0.6 x [WPU10]o + 0.4 x [PCU3399]o
PPIn = 0.6 x [WPU10]n + 0.4 x [PCU3399]n

Where further:

WPU10 = ppi component series id for "metals and metal products".
PCU3399 = ppi component series id for 'other misc. manufacturing.

All as published monthly by the U.S. Department of Labor, Bureau of Labor Statistics.

SCHEDULE OF CHARGES FOR TECHNICAL SERVICE ADVISORS (TSA)

Technical Service Advisors (TSA's) are available on request to audit installations, commission systems and to supervise your personnel in the operation, care and maintenance of the Anderson Water Systems Equipment.

SERVICE CHARGES

	TIME OF SERVICE	RATE
1.	Monday to Friday (8 hours maximum per day)	$ 125.00 /hour
2.	Monday to Friday (in excess of 8 hours per day) Saturday (all day)	$ 187.50 /hour
3.	Sundays, Anderson Holidays	$ 250.00 /hour
4.	Standby Days (not working but available to the site)	$ 1,000.00 /day

TRAVEL CHARGES

TRAVEL TIME From Anderson office to the job site	$ 125.00 /hour
TRAVEL EXPENSES Personal vehicle usage: **or** Airfare, ground transportation and car rental	$ 0.50 /km Actual cost
HOTEL & MEAL EXPENSES Meals allowance (per diem) Lodging	$ 50.00 /day Actual cost

NOTES

1. Receipts are available on request for airfare, car rental and hotel accommodation. Meal expense receipts will not be provided.
2. The maximum workweek per TSA is sixty hours per week. Time in excess of sixty hours will require the assignment of additional TSA's at standard rates.
3. The complexity of the requested service may require the presence of more than one TSA.
4. Although our TSA's are normally readily available, we would request two (2) weeks advance notice be provided for non-emergency situations.
5. All prior contract invoices due must be paid in full prior to the TSA being dispatched.
6. A deposit may be required prior to the TSA being dispatched.
7. The maximum continuous on-site period for a TSA is three (3) weeks. If additional time is required, the TSA will return to Dundas for a total off-site period of five (5) days.
8. Service invoice payment terms are net seven (7) days from date of invoice. Listed charges are in **USD** funds. Taxes extra where applicable. Invoices will be issued every two (2) weeks at our discretion.
9. Rates are subject to change without prior notice.

ANDERSON-WPT'S STANDARD TERMS & CONDITIONS OF SALE

1. **ENTIRE AGREEMENT**: The Terms and Conditions of Sale set forth herein, and any supplements which may be attached hereto, constitute the full and final expression of the contract (the "Contract") for the sale of equipment or services (hereinafter referred to as "Equipment") to Purchaser, and supersedes the terms and conditions of any request for proposal or request for quotations, specifications, quotations, purchase orders, correspondence or communications whether written or oral between the Purchaser and AWS. No amendment or modification hereto nor any statement, representation or warranty not contained herein shall be binding on AWS unless made in writing and signed by an authorized representative of AWS. Prior dealings, usage of the trade or a course of performance shall not be relevant to determine the meaning of this Contract.

2. **TAXES**: The Purchase Price does not include any state or local sales or use taxes.

3. **PAYMENT**: Payment shall be net thirty (30) days in accordance with the milestone payment schedule set forth in AWS' proposal.

4. **RISK OF LOSS**: Risk of loss or damage to the Equipment, or any part thereof, shall pass to Purchaser upon delivery of the Equipment or part to Purchaser at the delivery point stated in AWS' proposal.

5. **EXCUSABLE DELAY**: AWS shall not be liable for any delay in performance or failure to perform due to any cause beyond AWS' reasonable control including, fire, flood, or any other act of God, strike or other labor difficulty, any act, instructions, directions or omission to act of any civil or military authority or of the Purchaser, Owner, or Engineer, change in laws, acts of war, any insurrection, riot, embargo, unavailability or delays in transportation or car shortages. In the event AWS' performance is delayed by any of the foregoing causes, AWS' schedule for performance shall be extended accordingly without penalty. If Purchaser's, Owner's, or Engineer's actions delay AWS' performance, Purchaser shall pay AWS any additional costs incurred by AWS resulting from such delay and shall also pay AWS' invoice for any stored Equipment, or any part thereof, as if they had been delivered in accordance with the milestone schedule.

6. **PROPRIETARY INFORMATION**: All information, plans, drawings, tracings, specifications, programs, reports, models, mock-ups, designs, calculations, schedules, technical information, data, manuals, proposals, CADD documents and other materials, including those in electronic form (collectively the "Instruments of Service"), have been prepared and furnished by AWS for use solely with respect to this Project. AWS shall be deemed the author and owner of these Instruments of Service and shall retain all common law, statutory and other reserved rights, including copyrights. The Purchaser, Engineer, or Owner shall not use these Instruments of Service for future additions or alterations to this Project or for other projects, without the prior written agreement by AWS. The Instruments of Service furnished by AWS are proprietary to AWS, submitted in strict confidence and shall not be reproduced, transmitted, disclosed or used in any other manner without AWS' written authorization.

7. **INSPECTION BY PURCHASER**: Purchaser may inspect the Equipment at the point of manufacture, provided that such inspection is arranged and conducted so as not to unreasonably interfere with AWS' or the manufacturer's operations.

8. **WARRANTY OF TITLE**: AWS warrants and guarantees that upon payment title to all Equipment covered by any invoice submitted to Purchaser will pass to Purchaser free and clear of all liens.

9. **WARRANTY**: AWS warrants that its Equipment shall conform to the description contained in AWS' proposal and be free from defects in material and workmanship for a period of one (1) year from date its Equipment is ready for or initially placed in operation or eighteen (18) months from date its Equipment is shipped, whichever occurs first. Upon AWS' receipt of written notice within thirty (30) days of discovery of any defect, and a determination by AWS that such defect is covered under the foregoing warranty, AWS shall, at its option, repair or replace the defective part or parts, f.o.b. factory. This warranty does not cover failure or damage due to storage, installation, operation or maintenance not in conformance with AWS' written instructions and requirements or due to accident, misuse, abuse, neglect or corrosion. This warranty does not cover reimbursement for labor, gaining access, removal, installation, temporary power or any other expenses that may be incurred with repair or replacement. AWS shall have no responsibility for the condition of primed or finish painted surfaces after the Equipment leaves its point of manufacture. Unless otherwise specifically provided for herein, AWS provides no other warranty of product performance or process results. Correction of non-conformities in the manner and for the period of time provided above shall constitute AWS' sole liability and purchaser's exclusive remedy for failure of AWS to meet its warranty obligations, whether claims of purchaser are based in contract, tort (including negligence or strict liability), or otherwise. THE FOREGOING WARRANTIES ARE EXCLUSIVE, AND IN LIEU OF ALL OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

10. **BACKCHARGES**: AWS shall not be liable for any charges incurred by Purchaser for work, repairs, replacements or alterations to the Equipment, without AWS' prior written authorization, and any adverse consequences resulting from such unauthorized work shall be Purchaser's full responsibility.

11. **LIQUIDATED DAMAGES**: Any liquidated damages clauses for failure to meet shipping or job completion promises are not acceptable or binding upon AWS, unless such clauses are specifically accepted in writing by an authorized representative of AWS at its headquarters office.

12. **LIMITATION OF LIABILITY**: Neither party shall be liable to the other party for any special, indirect, incidental, consequential or punitive damages arising from their obligations under this Contract, whether such damages are based upon breach of contract, breach of warranty, tort, strict liability or otherwise. In no event shall AWS' liability exceed the purchase price of the Equipment or parts of the Equipment on which such liability is based.

13. **CANCELLATION BY PURCHASER**: If Purchaser cancels this Contract or refuses to accept delivery of the Equipment, Purchaser shall be liable to AWS for reasonable costs incurred by AWS including, cancellation charges, administrative costs, and commissions to sales representatives for all work performed or in process up to the time of cancellation or refusal to accept delivery.

14. **DEFAULT BY PURCHASER**: In the event Purchaser should breach its obligations under this Contract or if the Project is suspended or delayed for more than 120 cumulative days, then AWS may, without prejudice to any other right or remedy it may have at law or equity, terminate this Contract or suspend performance if Purchaser fails to cure such breach within thirty (30) days of written notice. In such event, AWS shall be paid for all work performed prior to termination/suspension, including all costs related to the termination/suspension. If payments are not made in accordance with the terms contained herein, AWS shall be entitled to interest at the highest legal rate on the unpaid balance. Purchaser shall reimburse AWS for all attorney's fees and costs related to collection of past due amounts.

15. **DEFAULT BY SELLER**: In the event of any default by AWS and prior to Purchaser terminating the work for default, Purchaser shall give written notice of default to AWS. AWS shall remedy the default to the reasonable satisfaction of the Purchaser within thirty (30) days of receipt of such written notice or, if such default cannot reasonable be remedied within such thirty (30) day period, AWS shall promptly begin to remedy the default within the thirty (30) day period and thereafter diligently prosecute to conclusion all acts necessary to remedy the default, in which event such default shall be deemed to be remedied.

16. **PATENT AND COPYRIGHT INFRINGEMENT**: AWS shall defend any action or proceeding brought against Purchaser based on any claim that the Equipment infringes any United States patent or copyright, provided the Equipment is used in the manner specified and is not modified, altered, or combined with any other equipment without AWS' prior written permission. Purchaser shall give prompt written notice to AWS of any such action or proceeding and will reasonably provide authority, information and assistance (at Purchaser's expense) in the defense of same. If Purchaser is enjoined from the operation or use of the Equipment, AWS shall take reasonable steps to procure the right to operate or use the Equipment. If AWS cannot so procure such right within a reasonable time, AWS shall promptly, at AWS' option and expense, (i) modify the Equipment so as to avoid infringement of any such patent or copyright, (ii) replace said Equipment with equipment that does not infringe or violate any such patent or copyright, or (iii) as a last resort, remove the Equipment and refund the purchase price.

17. **INDEMNITY**: To the extent and proportion of its negligence, AWS will indemnify and hold Purchaser harmless for any claims, damages, suits, or losses by third parties for death or bodily injury or damage to tangible property (other than to the Equipment itself) directly caused by AWS' performance under this Contract.

18. **GOVERNING LAW/JURISDICTION:** This Contract shall be governed by, interpreted and enforced in accordance with the laws applicable in the state where the jobsite is located, without regard to any conflicts of law principles thereof. Any dispute that cannot be resolved amicably by the Parties shall be referred to the federal or state courts having jurisdiction over the jobsite. The Parties irrevocably waive the right to request trial by jury.

19. **NOTICES**: Unless otherwise provided, any notices to be given hereunder shall be given in writing at the address and to the representatives mentioned in the Contract Documents and shall be deemed effectively given (i) upon personal delivery to the party to be notified, (ii) on confirmation of receipt by fax by the party to be notified, (iii) one business day after deposit with a reputable overnight courier, prepaid for overnight delivery and addressed as set forth herein, or (iv) three days after deposit with the U.S Post Office, postage prepaid, registered or certified, with return receipt requested.

20. **ASSIGNMENT/SUCCESSORSHIP**: Neither AWS nor Purchaser may assign this Contract without the prior written consent of the other party, which consent shall not be unreasonably withheld or delayed, except that AWS may assign this Contract to an affiliate without consent. Any prohibited assignment shall be null and void. AWS and Purchaser intend that the provisions of this Contract are binding upon the parties, their employees, agents, heirs, successors and assigns.

21. **SEVERABILITY**: If any term, condition or provision of this Contract or the application thereof to any party or circumstance shall at any time or to any extent be invalid or unenforceable, then the remainder of this Contract, or the application of such term, condition or provision to parties or circumstances other than those which it is held invalid or unenforceable, shall not be affected thereby, and each term, condition and provision of this Contract shall be valid and enforceable to the fullest extent permitted by law.

22. **NO WAIVER**: The failure of either party to insist upon or enforce strict performance by the other party of any provision of this Contract or to exercise any right under this Contract shall not be construed as a waiver or relinquishment to any extent of such party's right to assert or rely upon any such provision or right in that or any other instance; rather, the same shall be and remain in full force and effect.

From: Peter.MIDGLEY@degremont.com
Sent: Thursday, September 22, 2011 9:06 AM
To: Kertell, Charles R. (Reading)
Cc: sesco1147@gmail.com; wtuck@awsl.com; jonathan.lister@a-wpt.com; sasrani@cogeco.ca
Subject: Re: Levy Nuclear Plant
Attachments: pic00875.jpg

Charles, with respect to taking a SW RO train off line:

1. Routine cleaning - takes approx. 1 day
Cleaning frequency varies dependent on feed water source (open intake or beach well) and with good pretreatment can be 1 - 4 times/ year
The Perth 1 desalination plant (built by Degremont) has a cleaning frequency of 2x/year. First pass consists of 12 trains each producing 550 m3/hr at 45% recovery.

2. Planned maintenance
Maintaining pumps/energy recovery devices etc. Some sites plan a scheduled maintenance shutdown of 1x/year. Duration depends on the size of the plant: it can take from a few days to 3-4 weeks. The 3-4 weeks is needed in case of major maintenance activities (like replacing/repairing corroded piping, replacing/repairing energy recovery devices/pumps).
Perth 1 desalination plant did not have a scheduled plant maintenance shutdown in 2010 as the client needed the water. Therefore, they are scheduling this year a shutdown of approx. 3 weeks

3. Short shutdowns: less than 1 day
This is done when high salt passage is measured on individual pressure vessels and these high salt passages are affecting the required permeate quality. In that case, a train is shutdown and O-rings/interconnectors and sometimes some of the membrane elements are replaced. Worse case scenario would be: 1 shutdown per month (of max. 8 hours) Dependent on the number of pressure vessels that need to be inspected and the capacity of the rack:
in some cases it is not necessarily to shutdown the rack instead the pressure vessel is isolated and opened. (isolation valves will need to be present, which we have not included).

--

Peter MIDGLEY

Industrial Regional Business
Manager

ANDERSON WATER SYSTEMS, INC.

160 King Street West, 2nd Floor
DUNDAS - ONTARIO - L9H 1V4 - CANADA

From: Peter.MIDGLEY@degremont.com
Sent: Sunday, September 25, 2011 9:28 AM
To: Kertell, Charles R. (Reading)
Cc: Archer, John C. (Reading); Louis Sloan (sesco1147@gmail.com); sasrani@cogeco.ca; wtuck@awsl.com; jonathan.lister@a-wpt.com
Subject: RE: FW: Levy station
Attachments: pic15573.jpg

Charlie:

1. The space requirement could be reduced to 80' x 100' for each plant still with adequate operating room. The original was a generous estimate for feasability study and included a lab and room for motor control center.

2. One (1) train system for the 2 plants, budget price...US$ 7,000,000.

3. Space requirements for one train system...Each plant.........45' x 90'

--

Peter MIDGLEY

Industrial Regional Business
Manager

ANDERSON WATER SYSTEMS, INC.

160 King Street West, 2nd Floor
DUNDAS - ONTARIO - L9H 1V4 - CANADA

DL : +1 905-627-6503
FAX : +1 905-627-2381
MOB : +1 289-244-7600

www.degremont-technologies.com