

APPENDIX “C”

Impact Analysis – Port LaBelle Utility (SFWMD CUP #26-00096-W)

IMPACT ANALYSIS
PORT LABELLE UTILITY
SFWMD CUP #26-00096-W
HENDRY, COUNTY

January 8, 2007

Prepared by



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IMPACT ANALYSIS
PORT LABELLE UTILITY
SFWMD CUP #26-00096-W

INTRODUCTION

The purpose of this report is to provide South Florida Water Management District (SFWMD) Staff with reasonable assurances that the proposed increased groundwater withdrawals by Pt. LaBelle Utility (Figure 1) from the Sandstone Aquifer System will not cause adverse impacts to legal existing users, wetlands, or saline water intrusion. This is accomplished by using the USGS MODFLOW model code. MODFLOW was used as allowed in the new District rules, in that no more than two layers were used to represent the system, the parameters are uniform across the entire domain (including the leakance value), the simulation was run for 90 days without recharge, and surface water features were not included. This report describes the hydrogeology, model input, and resultant projected drawdowns.

Hydrogeology

There are three major water-bearing aquifers in Hendry County: the Surficial Aquifer System, the Intermediate Aquifer System, and Floridan Aquifer Systems. The Surficial Aquifer System contains the water table aquifer and the lower Tamiami aquifer. The Intermediate aquifer contains the Sandstone and mid-Hawthorn aquifers. The withdrawals for this project are from the Intermediate Aquifer System.

Based on information collected by Geraghty & Miller in 1980, the lower Tamiami Aquifer does not exist at the project site and surrounding area. The water table aquifer extends to about 60 feet below land surface (bls), with sandy blue-green clay to between 100 and 190 ft bls. The Sandstone Aquifer starts between 100 and 190 ft bls in the project site area and consists of just over 100 ft of sand. According to the Geraghty & Miller report, it was suspected that the aquifer is bounded on the southwest about 1600 feet away and on the northeast about 2 miles away from the Pt. LaBelle wellfield. Data suggests that the aquifer is a linear feature trending northwest to southeast. Lithologic data collected at that time suggests such boundaries. An Aquifer Performance Test was conducted at the site by Geraghty & Miller. The results of the test and how they were used in the model are discussed below.

MODEL DESCRIPTION

The United States Geological Survey (USGS) modular three-dimensional finite-difference groundwater flow code, commonly known as MODFLOW was used to simulate the groundwater flow within the Intermediate Aquifer System. The code was used as part of a graphical interface called Visual MODFLOW developed by Waterloo Hydrogeologic. The model code is structured with a main program that can retrieve independent subroutines called modules. Each module deals with a specific feature of the hydraulic system to be modeled, such as recharge, evapotranspiration, rivers, drains, wells, and other sources and sinks of water external to the model (boundary conditions). Several iteration solution options are available; for this model, the WHS Solver (a Bi-Conjugate Gradient Stabilized acceleration routine) was used. The solution was achieved by using 10 time steps for the 90-day transient run.

The model is designed with a no-flow boundary that is implicit along the outer edges and bottom layer of a model grid. To simulate what appears to be a bounded aquifer, the grid extends about 3900 feet to the west and 5800 ft to the east, as shown in Figure 2. Even though the aquifer trends northwest to southeast, for modeling purposes it is easier to trend the aquifer north to south. The model grid comprises two layers with 20,000 cells in 200 rows and 50 columns. The cell sizes encompassing the project area are 250 ft by 195 ft. The model is set up with two layers representing the aquifer system.

Boundary Conditions/Model Cell Types

This model is designed as strictly a drawdown model. Because of this, all starting heads for are set at zero. All cells within the model are active cells for the 90-day transient run.

Hydraulic Characteristics

An Aquifer Performance Test was conducted on the production zone (Sandstone Aquifer) at the site by Geraghty & Miller in January 1982. The parameters from the test are averaged as follows:

Transmissivity	240,000 gpd/ft (32,100 ft ² /d)
Storage	0.0004

Murray Consultants Inc re-evaluated the raw data with the following results:

Transmissivity	163,000 gpd/ft (21,750 ft ² /d)
Storage	0.0002
Leakance	0.002 gpd/ft ² (0.00026/d)

The model was initially set up using the re-calculated numbers and then adjusted to get an acceptable match to the APT data results. Layer 1 of the model represents the water table and the thickness of the aquifer is set up to include the aquifer and the confining zone, a total thickness of 135 ft. Based on SFWMD Technical Publication 90-04, the hydraulic conductivity is about 100 ft/d with a thickness of 20 ft. Because this model has been set up with a thickness of well over 20 ft, a hydraulic conductivity of 20 ft/d was used, resulting in an equivalent transmissivity. To test the sensitivity of the Layer 1 hydraulic conductivity value on the results of Layer 2, each value was input into the model. The drawdown results were the same for each value. The best match to the APT data resulted in the aquifer parameters listed below, which were used in the predictive model run:

Sandstone Aquifer Parameters

Transmissivity	185,500 gpd/ft (24,800 ft ² /d)
Storage	0.000138
Leakance	0.002 gpd/ft ² (0.00026/d)
Bottom of aquifer	-300 ft

Water Table Aquifer Parameters

Hydraulic Conductivity	20 ft/d
Bottom of Aquifer	-135 ft

MODEL DISCUSSION AND RESULTS

The model is set-up such that 1.2 MGD is withdrawn from one model cell located at the plant site. The model is a transient model and set to run for 90 days with no recharge. The results are shown in Figure 3. The maximum drawdown projected within the production zone near the project is 6 ft. The 1.0 ft projected drawdown contour line is about 2 miles away from the project site. The off-site drawdowns are minimal and the potential for adverse impacts to legal existing users and the water resources are minimal.

Based on District modeling criteria, any permitted users within the 1.0 ft drawdown cone - of-depression must be included in a cumulative model. Two permitted users of the Sandstone Aquifer are located within the 1.0 ft cone -of-depression: #26-00818-W CHL Home Builders Construction Office and #26-00142-W Mira Verde LP. Each of these projects is a small general permit with the following maximum day withdrawals:

#26-00818-W	5,300 gpd
#26-00142-W	14,700 gpd

A cumulative model was set up that included the above projects and the Pt. LaBelle Utility projected demands. The results are shown in Figure 4. The cumulative projected drawdowns are only slightly greater than just Pt. LaBelle because the additional withdrawals are so small.

Model files for each run are included on a CD included in the Appendix. Additionally, included on the CD are copies of most of the Geraghty & Miller Reports (some parts of the report I do not have) and the re-evaluated data analysis.

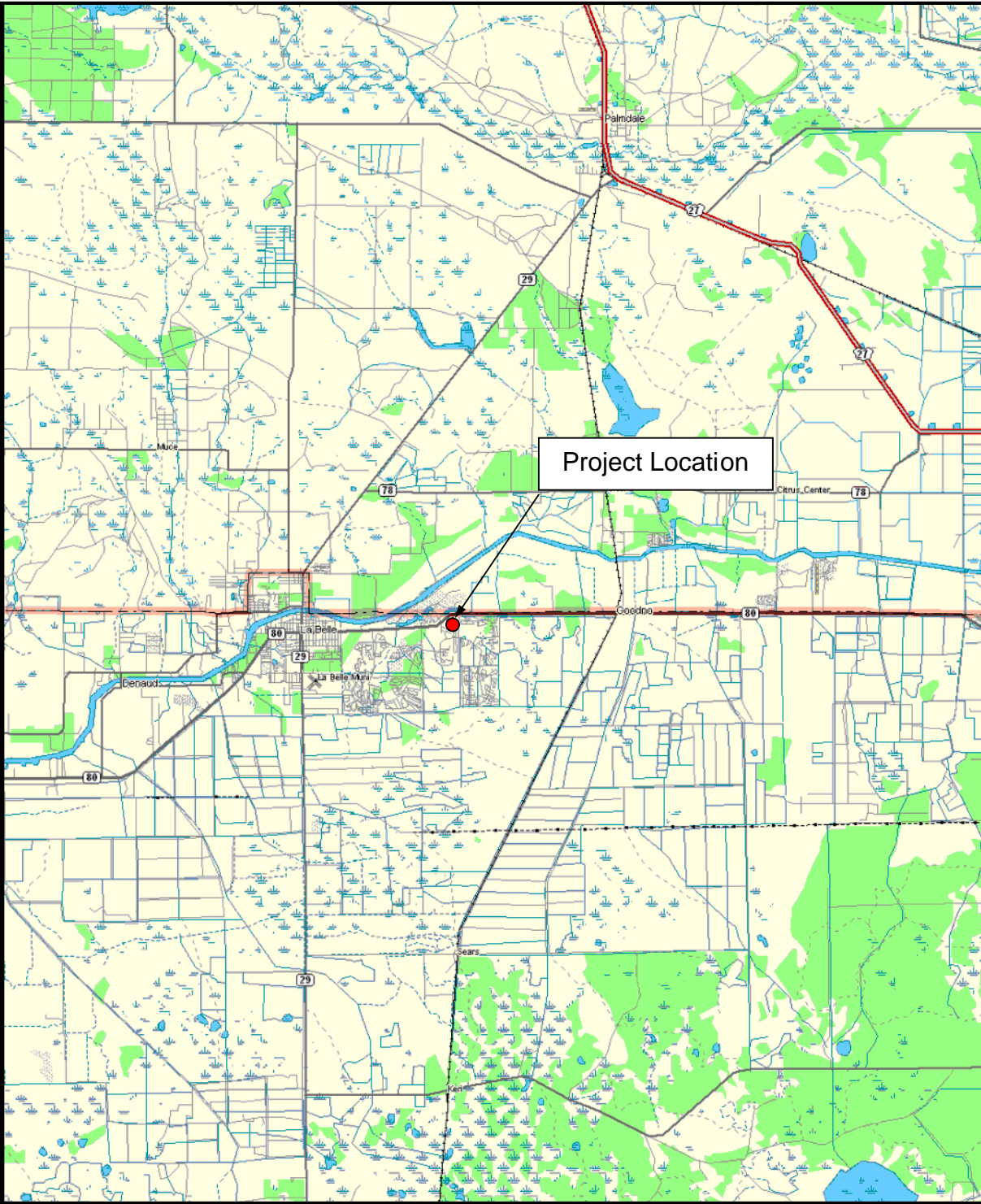
A licensed Professional Geologist has prepared this report for use in acquiring a SFWMD Consumptive Use Permit.

Murray Consultants, Inc.

Gail Murray Doyle, P.G. #459
Hydrogeologist

Date:

FIGURES



Murray Consultants, Inc.
Water Resources Consultants

18963 SE Fernwood Dr.
Tequesta, FL 33469
561/747-9917

Location Map

Pt LaBelle Utility
PO Box 1760
LaBelle, FL 33935

Pt. LaBelle Utility

SCALE:
1 in = 20,000 ft

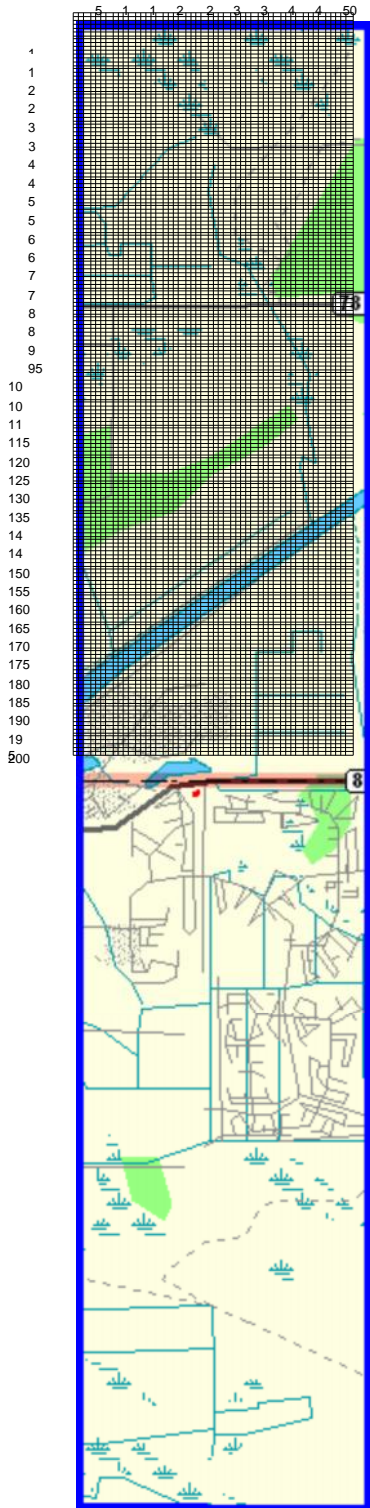
DRAWN BY:
gmd

DATE:
1/8/07

FIGURE NUMBER:

1

26-00096-W



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MODFLOW Grid

Pt LaBelle Utility
PO Box 1760
LaBelle, FL 33935

Pt. LaBelle Utility

FIGURE NUMBER:

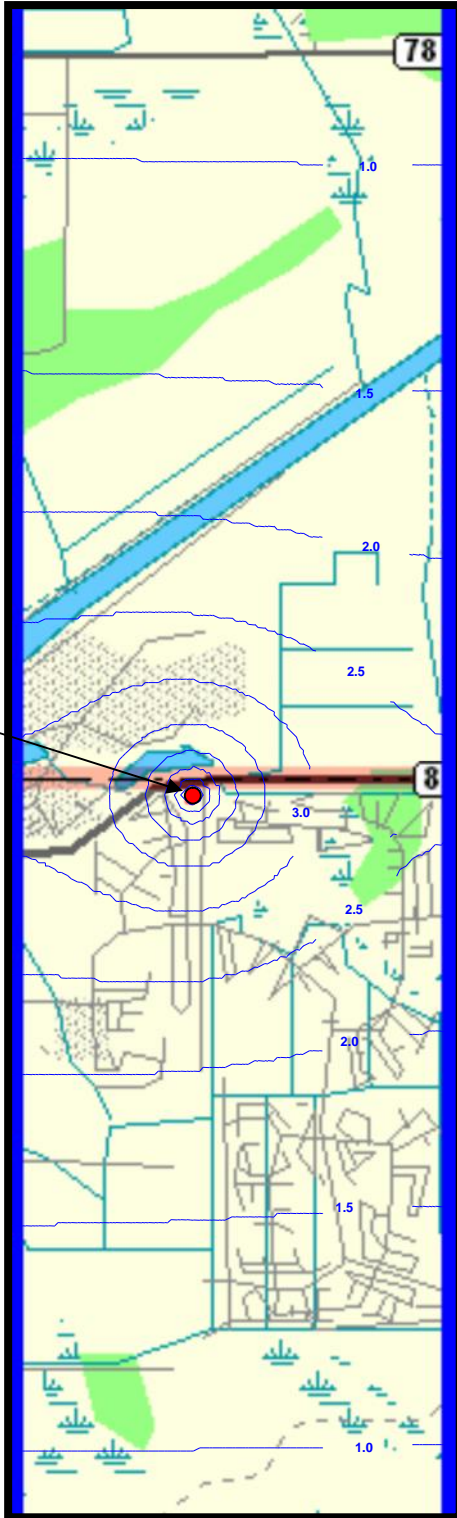
2

SCALE:
NTS

DRAWN BY:
gmd

DATE:
1/8/07

26-00096-W



Pt LaBelle Utility
#26-0096-W

LEGEND

- Well location
- Projected drawdown contour line, ft



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Projected Drawdown Pt. LaBelle Only

Pt LaBelle Utility
PO Box 1760
LaBelle, FL 33935

Pt. LaBelle Utility

FIGURE NUMBER:

3

SCALE:
1 in = 4200 ft

DRAWN BY:
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DATE:
1/8/07

26-00096-W



Pt LaBelle Utility
#26-00096-W

#26-00142-W

#26-00142-W

LEGEND

● Well location

— Projected drawdown
contour line, ft



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Cumulative Projected Drawdown

Pt LaBelle Utility
PO Box 1760
LaBelle, FL 33935

Pt. LaBelle Utility

FIGURE NUMBER:

4

SCALE:
1 in = 4200 ft

DRAWN BY:
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DATE:
1/8/07

26-00096-W

APPENDIX

CD with MODFLOW files, Geraghty & Miller Report, and Murray Consultants Inc APT Data
Analysis