APPENDIX 10.8

WATER USE PERMIT APPLICATION INFORMATION

10.8 WATER USE PERMIT APPLICATION INFORMATION

This appendix provides information to demonstrate that GREC's proposed groundwater withdrawals from two new process water supply wells comply with all Suwannee River Water Management District applicable requirements for water use approvals. GREC will also require two small wells dedicated for potable use only. Details for these potable wells and potable water system are provided in Appendix 10.12.

GREC's proposed water use of 1.4 million gallons per day (MGD) annual average and 1.5 MGD maximum daily will meet the facility's total process and potable water supply requirements.

SUWANNEE RIVER WATER MANAGEMENT DISTRICT
Route 3, Box 64
Live Oak, Florida 32060
Telephone: (904) 362-6909

APPLICATION FOR AN INDIVIDUAL WATER USE PERMIT

FOR SRWMD USE ONLY

Application File Number ________________ Date Received ________________

I. Applicant's Name **Gainesville Renewable Energy Center**

Address **75 Arlington Street, 5th Floor, Boston, Massachusetts 02116**

Contact **Joshua H. Levine** Title **Director of Project Development**

Phone **617/482-6150** Date ________________

NOTE: The applicant may, at his discretion, choose to submit a more detailed water supply and use plan and simply reference the appropriate sections of the plan in items II through VI of this application. The plan should address the minimum information requirements of this application.

II. Quantity Applied For:

Maximum Daily Rate of Withdrawal (MDR) **1.5 MGD**

Average Daily Rate of Withdrawal (ADR) **1.4 MGD**

Anticipated duration of MDR **60** days/year

III. Water Supply Source/Location of Withdrawal or Diversion:

Attach one supplement information form FOR EACH POINT OF WITHDRAWAL OR DIVERSION.

Total Number of Withdrawals or Points of Diversion **2**

IV. Place of Water Use: Describe the Service Area or Location of Use

Gainesville Renewable Energy Center (GREC): Groundwater production wells Located in the city of Gainesville, Alachua County; Section 27, Township 8 south, Range 19 east

V. Type of Water Use:

Agriculture – Describe the type and acreage of crop(s) to be irrigated and the irrigation system(s) used including manufacturer and model number.

Public/Municipal Supply – Indicate the number of commercial and noncommercial service connections and the population served.

Industrial/Commercial – Describe the use or uses. Flow charts and/or schematics are acceptable.

"Power production use," as defined in Section 40B-2.021(9), F.A.C. Annual average daily and maximum daily water balance diagrams are included as Figures 1 and 2, respectively, in Attachment 1.

VI. Discharges – The applicant shall describe the location, volume, and quality of discharges. If the discharges are covered by a permitting system, a copy of the permits shall be attached to this application.

No industrial wastewater discharge. GREC is a zero liquid discharge (ZLD) facility.

VII. Requested Duration of Permit **Not applicable (site certification with life of project approval instead of actual WUP)**

VIII. Joshua N. Levine **Director of Project Development** 11/19/09

Applicant's Signature Title Date

IX. Identify by name, firm, address, and phone number the person completing this form if other than the applicant.

Name Name of Firm Represented

Address Phone No.

SUWANNEE RIVER WATER MANAGEMENT DISTRICT
Route 3, Box 64
Live Oak, Florida 32060
Telephone: (904) 362-6909

INDIVIDUAL WATER USE PERMIT APPLICATION
SUPPLEMENTAL GROUNDWATER WITHDRAWAL SITE DESCRIPTION

(Complete one form for each well)

Application File No. ____________________

NOTE: If wells are proposed, so indicate under each appropriate section and supply information relative to planned well design.

FOR SRMWD USE ONLY
SRWMD Site Id No. ______________________
SRWMD Water Use Permit No. ______________
SRWMD 40B-3 Permit No. _________________

I. Applicant's Well ID No. **WSW-1**

II. Well Construction Data

A. Provide a complete description of the well including total depth, casing(s) depth(s) and diameter(s), screened or open hole diameter, and date of completion.

Proposed well; design is expected to include 14-inch (or larger) diameter black steel casing to a depth of 210 ft and 12-inch (or larger) diameter open hole depth interval from 210 to 540 ft

B. Indicate the type and location of any logs available including driller's logs, geologist logs, or geophysical logs. (Applicants are encouraged to attached available logs).

Proposed well; See Attachment 1 for local geologic logs.

C. Identify the producing aquifer.

Floridan aquifer.

III. Aquifer Test Data

A. Provide a description of any production testing or aquifer testing conducted including the method of testing (with references), the rate of pumping, duration of testing (with references), results and who performed the test, if other than the applicant. (Applicants are encouraged to supply test or supportive data).

Proposed well; See Attachments 1 and 2 for local aquifer test information and groundwater modeling, respectively.

IV. Pumping Equipment

Describe the pumping equipment installed or anticipated at the time of application including depth setting, intake or drop pipe diameter, horsepower and type of motor, and diameter of discharge line.

Proposed well; pumping equipment to be determined. Design capacity is expected to be approximately 20 percent higher than the MDR of 1.5 MGD.

V. Maximum Daily Rate of Withdrawal

With the pumping equipment identified in Item IV, what is the peak withdrawal rate of this well?

~1,250 gpm x 1440 **~1.8** mgd

VI. Location sketch of the well. Please provide appropriate referencing – property boundaries, roads, section lines, etc.

Proposed well; See location in Figure 3 in Attachment 1.

1 inch _________ feet
(Approximate Scale)

VII. Identify by name, firm, address, and phone number the individual completing this form if other than the applicant.

Name | Name of Firm Represented

Address | Phone No.

SUWANNEE RIVER WATER
MANAGEMENT DISTRICT
Route 3, Box 64
Live Oak, Florida 32060
Telephone: (904) 362-6909

INDIVIDUAL WATER USE PERMIT APPLICATION
SUPPLEMENTAL GROUNDWATER WITHDRAWAL SITE DESCRIPTION

(Complete one form for each well)

Application File No. ____________________

NOTE: If wells are proposed, so indicate under each appropriate section and supply information relative to planned well design.

FOR SRMWD USE ONLY

SRWMD Site Id No. ____________________

SRWMD Water Use Permit No. ______________

SRWMD 40B-3 Permit No. ________________

I. Applicant's Well ID No. **WSW-2**

II. Well Construction Data

A. Provide a complete description of the well including total depth, casing(s) depth(s) and diameter(s), screened or open hole diameter, and date of completion.

Proposed well; design is expected to include 14-inch (or larger) diameter black steel casing to a depth of 210 ft and 12-inch (or larger) diameter open hole depth interval from 210 to 540 ft

B. Indicate the type and location of any logs available including driller's logs, geologist logs, or geophysical logs. (Applicants are encouraged to attached available logs).

Proposed well; See Attachment 1 for local geologic logs.

C. Identify the producing aquifer.

Floridan aquifer.

III. Aquifer Test Data

A. Provide a description of any production testing or aquifer testing conducted including the method of testing (with references), the rate of pumping, duration of testing (with references), results and who performed the test, if other than the applicant. (Applicants are encouraged to supply test or supportive data).

Proposed well; See Attachments 1 and 2 for local aquifer test information and groundwater modeling, respectively.

IV. Pumping Equipment

Describe the pumping equipment installed or anticipated at the time of application including depth setting, intake or drop pipe diameter, horsepower and type of motor, and diameter of discharge line.

Proposed well; pumping equipment to be determined. Design capacity is expected to be approximately 20 percent higher than the MDR of 1.5 MGD.

V. Maximum Daily Rate of Withdrawal

With the pumping equipment identified in Item IV, what is the peak withdrawal rate of this well?

~1,250 gpm x 1440 **~1.8** mgd

VI. Location sketch of the well. Please provide appropriate referencing – property boundaries, roads, section lines, etc.

Proposed well; See location in Figure 3 in Attachment 1.

1 inch _________ feet
(Approximate Scale)

VII. Identify by name, firm, address, and phone number the individual completing this form if other than the applicant.

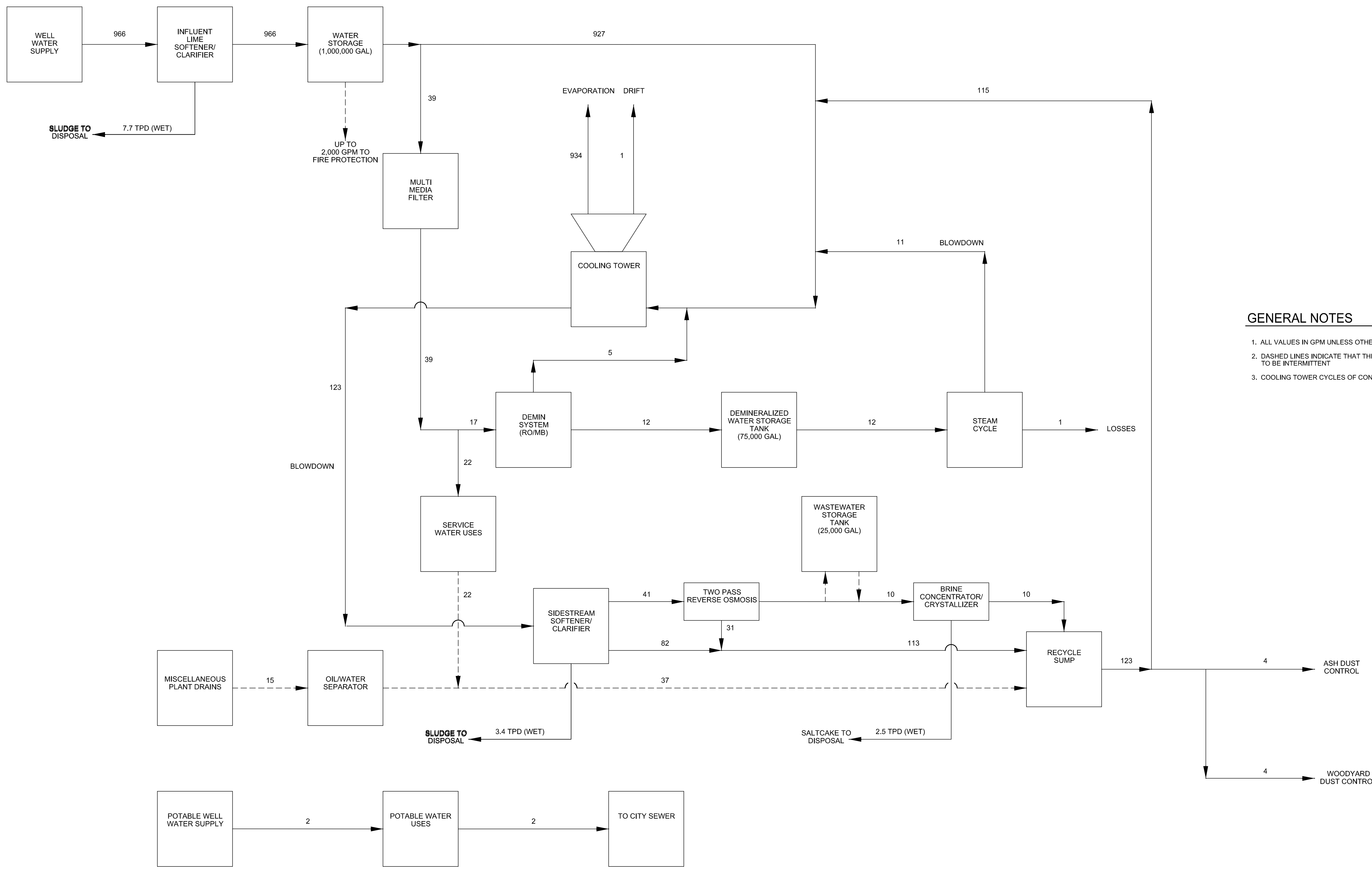
Name | Name of Firm Represented

Address | Phone No.

Y:\GDP-09\AR\GREC\SCA\APP-WUP.DOC—112209

ATTACHMENT 1

Water Balance Figures 1 and 2
Proposed Location of Wells Figure 3
Geologic Logs (Deep) (GRU)
GRU Aquifer Test Information



GENERAL NOTES

1. ALL VALUES IN GPM UNLESS OTHERWISE NOTED
2. DASHED LINES INDICATE THAT THE FLOW IS EXPECTED TO BE INTERMITTENT
3. COOLING TOWER CYCLES OF CONCENTRATION OF 8.6

FIGURE 1.

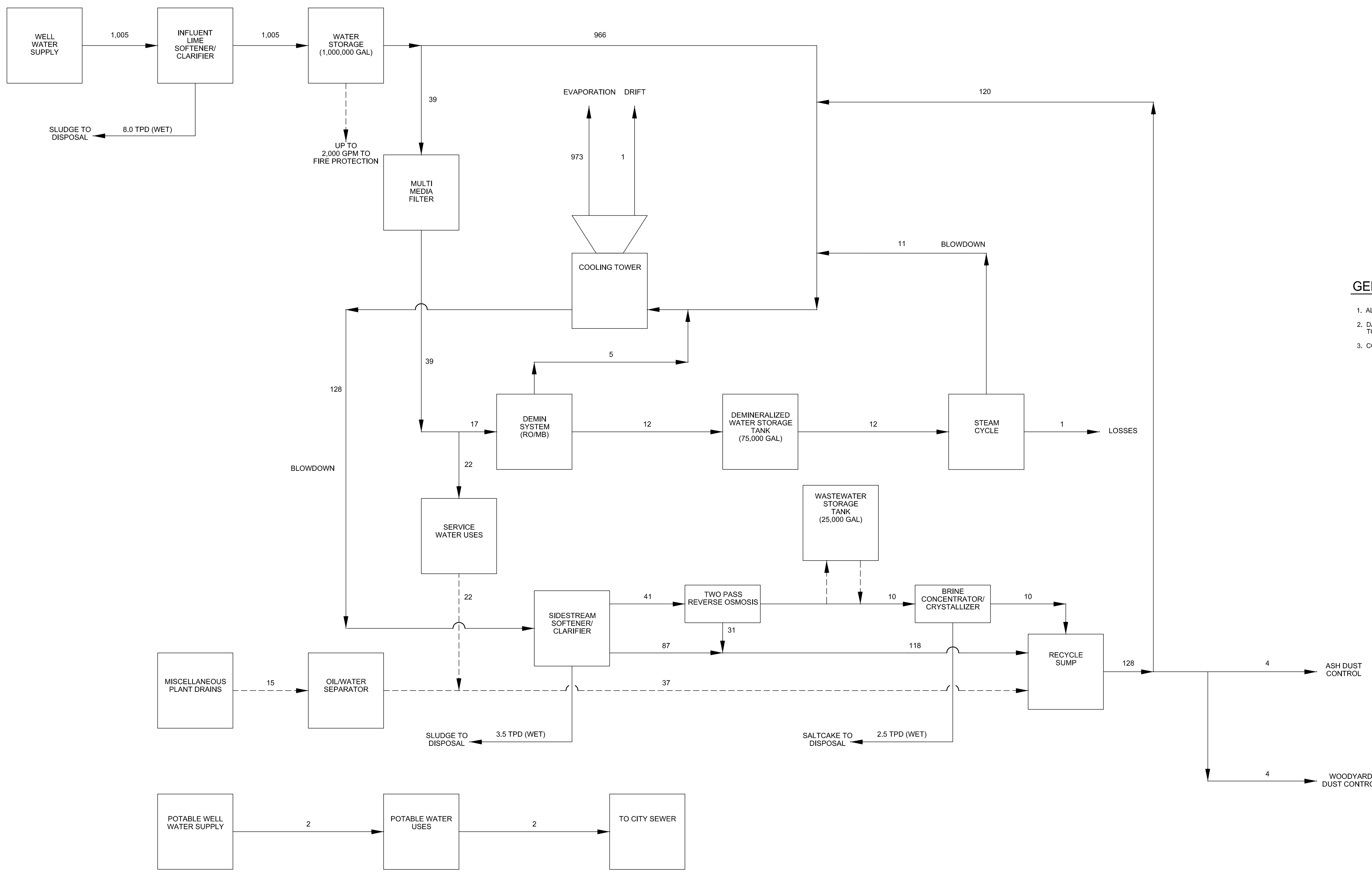
GAINESVILLE RENEWABLE ENERGY CENTER

WATER BALANCE ANNUAL AVERAGE WATER USAGE

Sources: Zachry Engineering, 2009; ECT, 2009.

Gainesville Renewable Energy Center

An American Renewables Company



GENERAL NOTES

1. ALL VALUES IN GPM UNLESS OTHERWISE NOTED
2. DASHED LINES INDICATE THAT THE FLOW IS EXPECTED TO BE INTERMITTENT
3. COOLING TOWER CYCLES OF CONCENTRATION OF 8.6

FIGURE 2.

GAINESVILLE RENEWABLE ENERGY CENTER
WATER BALANCE MAXIMUM DAILY WATER USAGE

Sources: Zachry Engineering, 2009; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

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Nov 11, 2009 - 11:20am by ndenahan

FIGURE 3.

OVERALL LAYOUT OF PROPOSED GREC FACILITIES AND WATER SUPPLY WELLS

Source: FDOT, 2008; Zachary, 2009; EDA, 2009, Genesis, 2009; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

Well No: I

FLORIDA STATE GEOLOGICAL SURVEY
TALLAHASSEE

WELL DATA

Please fill this blank out in so far as is possible and consistent with your policy, and either mail it direct to Florida Geological Survey or send it with the samples. On completion of the well the samples should be sent promptly to Tallahassee by express collect in order to avoid possible loss through moisture damage.

When additional sample bags are needed notify us.

1. Owner: City of Gainesville Address: Gainesville, Florida

2. Location of well (If possible, please get from owner's tax receipt description):
New Generator Plant - Well No. 1.

County: Alachua Nearest post office:
Direction from post office: Distance from post office:
Section: Township: Range:

3. Driller: Address:

4. Exact Surface Elevation: 184 feet above sea level
(If the exact elevation is unknown please DO NOT give an estimate)

5. Date well started: March 9, 1970 Date completed: March 1970

6. Depth of well: 434 feet Total depth cased: 182 feet

Sizes and lengths of casings: 182 feet of 14 inch
feet of inch
feet of inch
feet of inch

7. Does water flow at surface without pumping? No
If so, how high above surface will it rise?
If not flowing, how far below surface does it stand? 136 ft. 6 inches

8. Natural yield, if flowing: gals. per min. Yield by pumping: 1500 gals. per min. Drawdown: 12' 7"

9. For what purpose is water used? Domestic Quality:
(Domestic, irrigation, manufacturing, etc.) (Fresh, salty, soft, etc.)

10. On back of this sheet give driller's log, record of activities, analysis of water and other facts not provided for above.

DATE: April 1970

(Name of Person filling out data blank)

Floyd
(Address)

(over)

Well No: I — Character of Material New Generator Plant - Gainesville	From	To
Sand	0'	12'
White Clay	12'	20'
Red Clay	20'	40'
Rock	40'	45'
Clay	45'	50'
Rock (Soft)	50'	81'
Rock (Very Hard)	81'	89'
Soft Rock	89'	100'
Hard Rock	100'	102'
Soft Rock	102'	182'
Very Hard Rock	182'	184'
Brittle Lime Rock	184'	255'
Very Hard Rock - brown	255'	257'
Brittle Brown Rock	257'	300
Very (extra) Hard Rock	300'	316'
(Hole or very soft)	316'	318'
Dark Hard Rock	318'	360'
Hard Brown Lime Rock	360'	395'
Soft Lime - water bearing Rock	395'	433'

WELL NO: I - CITY OF GAINESVILLE NEW GENERATOR PLANT
Gainesville, Florida

MARCH 19, 1970

TIME	G. P. M.	10"Pipe-8"Office Inches in Tube	Drawdown Water Level -136' 6"
8:30 A. M.	0000	0	136 ft. 6 inches
8:45 A. M.	1525	24 inches	12 ft. 6 inches
9:00 A. M.	1525	24 inches	12 ft. 7 inches
9:30 A. M.	1525	24 inches	12 ft. 7 inches
10:00 A. M.	1525	24 inches	12 ft. 7 inches
10:30 A. M.	1525	24 inches	12 ft. 7 inches
11:00 A. M.	1525	24 inches	12 ft. 7 inches
11:30 A. M.	1525	24 inches	12 ft. 7 inches
12:00 Noon	1525	24 inches	12 ft. 7 inches
12:30 P. M.	1525	24 inches	12 ft. 7 inches
1:00 P. M.	1525	24 inches	12 ft. 7 inches
1:30 P. M.	1525	24 inches	12 ft. 7 inches
2:00 P. M.	1525	24 inches	12 ft. 7 inches
2:30 P. M.	1525	24 inches	12 ft. 7 inches
3:00 P. M.	1525	24 inches	12 ft. 7 inches
3:30 P. M.	1525	24 inches	12 ft. 7 inches
4:00 P. M.	1525	24 inches	12 ft. 7 inches
4:30 P. M.	1525	24 inches	12 ft. 7 inches
4:45 P. M.	1525	24 inches	12 ft. 7 inches
5:00 P. M.	1000	9 1/2inches	9 ft. 6 inches

xc: C. Heidt
D. Richardson
(for AL. County)
file: WLOG 1.0

SUWANNEE RIVER WATER MANAGEMENT DISTRICT

May 25, 1994

Ms. Yolanta Jonynas
Gainesville Regional Utilities
Post Office Box 147117
Station A136
Gainesville, Florida 32614-7117

Subject: Lithologs - GRU Well DEERHAVEN (PRODUCTION WELL)

Dear Ms. Jonynas:

Enclosed are available logs for the 24-inch well. (PRODUCTION WELL)

Call me at 1-800-226-1066 with any questions or if you need additional information.

Sincerely,

Ron Ceryak

Ron Ceryak
Hydrogeologist

RC/sp
Enclosure

ROUTE 3, BOX 64 • LIVE OAK, FLORIDA 32060 • TELEPHONE 904/362-1001 • 800/226-1066 • FAX 904/362-1056

PRODUCTION WELL.

MWI (MONITORING WELL INVENTORY) DATA INPUT FORM

1.	TRCODE:	A	45.	SRDRIL:	
2.	CO:	001	46.	COST:	
3.	SACODE:	8027	47.	SAMPER:	
4.	SITEID:	-081926002	48.	SAMPBY:	W
5.	LATLON:	294539822320	49.	PUMP:	T
6.	GMSID:		50.	GWLREC:	
7.	OWNER:	CITYOFGAINESVILLE-DEERHAVEN			
8.	ADDRES:	P O BOX 490	51.	FSPX:	2669837.62
9.	CITY:	GAINESVILLE	52.	FSPY:	282885.28
10.	STATE:	FL	53.	TOPROK:	+79
11.	ZIP:	32602	54.	ROKPIC:	G
12.	PHONE:	9043742910	55.	DPERMIT:	8411
13.	USGSID:		56.	MPID:	C
14.	DATCOMP:	12/27/79	57.	ACC:	N
15.	GSCODE:	03110206	58.	GWCOND:	N
16.	AMCODE:	A	59.	LOGGER:	C
17.	STATUS:	K	60.	LOGSRUN:	CEG
18.	WTYPE:	IS	61.	INSTID:	
19.	WATUSE:		62.	WPERMIT:	
20.	CONTYP:	R	63.	PMDR:	
21.	FAUC:		64.	LITHOLOG:	Y
22.	TOTDEP:	500	65.	WNUM:	14556
23.	CASDEP:	184	66.	CORE:	
24.	FINISH:	X	67.	PERM:	
25.	OPHOLE:	184- 500	68.	SIEVE:	
26.	SCRTYP:		69.	PURGE:	
27.	SCRDIA:		70.	MLUSE:	
28.	CASTYP:	L	71.	UPDATE:	/ /
29.	CASDIA:	24.00			
30.	LSD:	185			
31.	MPELEV:	187.00			
32.	AQCODE:	FU			
33.	SUBCOD:	124OCAL			
34.	AQTOP:	+50			
35.	AQBOT:				
36.	GEOLOG:	Y			
37.	DRILOG:	Y			
38.	HYDATA:				
39.	CASMSL:	+3			
40.	TDMSL:	-313			
41.	MAXWL:	45			
42.	MINWL:	35			
43.	FNLADR:				
44.	COMMENT1:				

GROUND-WATER STATION DATA SHEET

Transaction	SRWMD Site No.	Bureau of Geology No.	USGS No.
A D M	1: ±0819260b2 (+=North, -=South)	11:	17:

32 QW Frequency: Z

33 Level Frequency: Z

34 Hydrogeologic Unit: F

35 Ground-Water Condition: A

R = Random
A = Annual
S = Semiannual
B = Bimonthly
M = Monthly

Q = Quarterly
W = Weekly
D = Daily
C = Continuous
Z = Other

L = Leaky Floridan
S = Surficial
D = Secondary
H = Hawthorn
F = Floridan
U = Unknown
M = Mixed Floridan along rivers

N = Nonartesian
A = Artesian
U = Unknown
B = Varies betwe[en] artesian & n[on]artesian (ar[te]sian-nonarte[sian] boundary)

36 Site Type: W

37 Site Use: W

38 Water Use: T

W = Well
H = Sinkhole
S = Spring
B = Boring
Z = Other

O = Observation
T = Test
R = Drainage
E = Dewater
I = Injection
W = Withdrawal
U = Unused
D = Destroyed
Z = Other

U = Urban Domestic
R = Rural Domestic
I = Irrigation
L = Livestock
M = Municipal
P = Public Supply

N = Industrial
C = Commercial
S = Institution
T = Thermoelectric
A = Air Condition
Z = Other
X = Unused

LOCATION

Topo Map No. (39): C99C

¼ ¼ ¼ AB CD (43): DAC

Basin No. (46): 0206

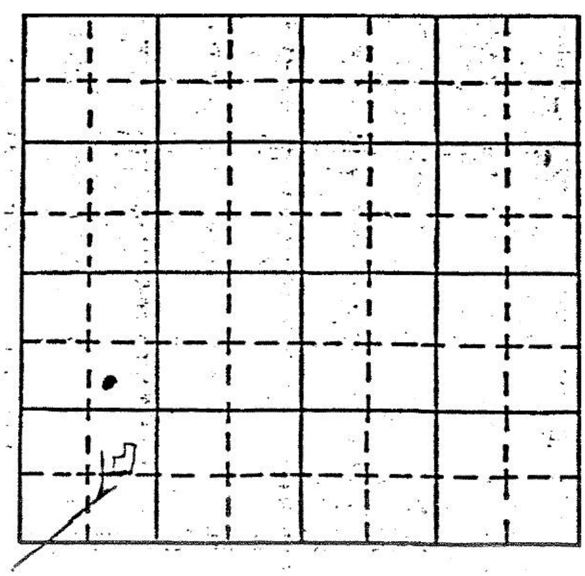
County No. (50): 39

Latitude - Longitude (52): 294539827370

Florida State Plane Coord. (64–77):

UTM Coord. (1–14):

Well located by (Initials) (15): DBK



Remarks (18–57): WEll is NoRthERM most oNE of the 4

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

WELL COMPLETION REPORT

OWNER: City of Gainesville
Last Name / First Name / Initial

PO Box 490
Number / Street

Gainesville FLORIDA
City / State

904 374 2831 — 32602
Area Code / Phone Number / Zip Code

WELL LOCATION:
¼ ¼ ¼ of Section 26
Township 8 S (N-S) Range 19 E (E-W)
Latitude Deg. Min. Sec. N
Longitude Deg. Min. Sec. W
Locate in Section

Number / Street/Road

Lot No. / Subdivision

GAINSVILLE — ALACHUA
City / County

OWNER WELL NUMBER OR NAME:

DRILL METHOD: [✓] Rotary [ ] Cable Tool [ ] Jet [ ] Auger
[ ] Other:

SURFACE CASING, CASING, AND LINER MATERIAL:

Steel Dia. (24) Black	Galv.	S. Steel	Steel Wt. (lb./ft.)	Dia. (In.) PVC	Other†	From (Ft.)	To (Ft.)	Schedule No.	Joints*
✓			94			0	186	20	W

† Describe Material:
* TC = Threaded and Coupled, TCW = Threaded, Coupled, and Welded, W = Welded, B = Bonded (PVC), O = Other:

GROUT: [ ] None [✓] Neat Cement [ ] Other:

Type and Percent of Additives and Grout Volume or Number of 94 lb. Sacks

	From (Ft.)	To (Ft.)
300 SAX	0	186

TYPE OF WORK: [✓] New Construction [ ] Repair
[ ] Deepening [ ] Plugging
[ ] Other:

PERMIT NUMBER: 8411

WELL NUMBER

TYPE OF WELL: [ ] Water Well [✓] Test Well [ ] Recharge [ ] Drainage
[ ] Waste Disposal [ ] Observation [ ] Other

USE: [ ] Domestic [ ] Irrigation [ ] Industrial [ ] Livestock [✓] Public Supply
[ ] Other:

SKETCH LOCATION OF WELL in relation to local landmarks, giving distance and direction from nearest town, road, or other reference point.

↑ North

East side of 441, about 4 - 5 miles North of the City of Gainesville.

GEOPHYSICAL LOGS: Type: CALIPER, GAMMA RAY, RESISTIVITY By CH2M HILL

WELL LOG

Bore Hole (In.)	Casing Size (In.)	Depth (Ft.) From	To	Examine cuttings at 20 ft. or smaller intervals and at changes. Give color, grain-size and type of material. Note any cavities. Indicate producing zones. Attach additional sheets if necessary.
24"		0	10	Sand
		10	15	White clay
		15	20	brown clay
		20	40	yellow or tan clay
		40	44	lime w/fine rock
		44	80	lime clay w/fine sand & rock

Deerhaven Generating Plant
Engineers: Burns & McDonnell - Kansas City

Driller: J.D. Twist
Casing: 186' - 24"

Location: Section 26
Township 8 S
Range 19 E

Started: 11-27-79
Completed: 12-27-79

W.L. : 147'6"

FORMATION	FROM	TO
broken fractured	255	257
soft loose lime with hard streaks	257	269
cavity	269	271
hard lime rock	271	275
medium hard rock with soft streaks	275	300
hard lime rock	300	302
medium hard brown lime rock	302	305
medium hard grey lime rock with shell	305	308
hard brown lime rock	308	328
loose soft lime with water	328	333
hard brown fractured lime rock	333	335
hard brown lime rock	335	355
loose soft lime rock with water	355	365
soft limerock with hard streaks	365	375
soft lime rock with soft loose streaks	375	420
soft lime rock, loose and fine	420	425
soft lime rock loose and finewith hard streaks	425	435
soft lime rock loose and fine	435	438
soft lime rock white	438	455
soft loose lime white	455	495

LOG OF WATER-WELL CUTTINGS

Client: Gainesville-Alachua County Regional Utilities Board

Job Name: GAINESFL   Project Numer: 76-077-1

Well Number 4   Drilled: December, 1979   Observer: Eileen Chase

Depth From	Depth To	Description
0	10	Sandy clay, tan mottled by dark brown. Friable, abundant roots. Sand is fine to medium grained, perhaps 30%.* Not calcareous.
10	23	Gray clay and tan sand. Sand is fine to medium grained. Sand approximately 40%. (May have been interlayered sand and clay.) Not calcareous.
23	25	Silty clay with some sand. Light golden-brown color. Mottled by gray clay. Very slight reaction to HCl. Occasional ¼" chert pebbles.
25	35	Bright golden-brown clay with some sand and silt. Non-calcareous.
35	40	Same as 25-35', but 1/8" grains of calcium carbonate occur.
40	45	Gray or yellow-gray clay with up to 20% fine to medium sand.
45	55	Gray calcareous clay and small (1/8-1/4") fragments of limestone and chert. Some clasts are angular, as if broken in drilling. Others are well-rounded. Two percent sand-size grains of calcium carbonate. Medium plastic, friable.
55	70	Gray or yellow-gray clay as at 45-50' except that small clasts are more abundant, ≈40%. Highly angular fragments of light-gray dolomitic limestone occur. Matrix is highly calcareous.

* All percentages are approximations based on visual examination.

Client: Gainesville-Alachua County Regional Utilities Board

Log of Water-Well Cuttings, December, 1979

Depth From	Depth To	Description
70	100	Mixture of 1/8-1/4" fragments of two types of rock: 1) White, silty limestone, moderately calcareous, 2) Dark-gray dolostone or mudstone, not calcareous.
100	105	Same as 70-100, but mixed with soft grayish-tan clay.
105	110	Same as 70-100.
110	140	80% coquina fragments 1/8" in diameter. 20% white limestone fragments. Occasional woody debris.
140	210	Circulation low or completely lost. No cuttings.
210	235	Small fragments (≈1/8") of calcareous coquina shells and 1/8-1/2" angular fragments of light gray concrete from cleaning bottom of well after cementing.
235	270	Same as 210-235 but small clasts of porous, cream colored limestone occur. Limestone can be broken with fingers. Also contains shell fragments up to ½".
270	305	No cuttings.
305	310	60% hard dark-tan dolomitic limestone, moderately calcareous. 40% cream-colored, chalky limestone containing well-rounded quartz sand and silt. Cream-colored limestone is highly porous and calcareous. Occasional fragments of concrete. Particles are 1/16-1/4".
310	315	≈60% cream-colored chalky limestone as above, and 40% dark tan limestone. Occasional concrete and fossils, 1/16-1/2".

Client: Gainesville-Alachua County Regional Utilities Board

Log of Water-Well Cuttings, December, 1979.

Depth From	To	Description
315	320	50% rough clasts of porous, chalky white limestone (up to 1/2") and 50% hard, platey, dark tan dolomitic limestone. Small fossils.
320	325	90% small platey fragments of dark tan dolomitic limestone. 10% chalky, cream-colored limestone as above. Fragments are 1/4-1/2", some 3/4".
325	330	95% gray-brown dolomitic limestone. Pinhole vugs. Mixture of small (6 1/8") platey fragments and angular pebbles up to 1". 5% chalky white limestone.
330	335	80% tan dolomitic limestone. 20% chalky white limestone.
335	340	50% dolomitic limestone. 50% chalky white limestone as above. Occasional concrete.
340	345	90% porous brown dolomitic limestone. Slightly calcareous. 10% chalky white limestone. Cuttings up to 1/2" in size.
345	350	80% porous, dark-tan dolomitic limestone 10% chalky, cream-colored limestone 10% concrete
350	355	90% porous dark-tan dolomitic limestone 10% chalky, cream-colored limestone.
360	365	65% porous tan dolomitic limestone in ¼" fragments. 25% gray concrete 10% chalky, cream-colored limestone.

Client: Gainesville-Alachua County Regional Utilities Board

Log of Water-Well Cuttings, December, 1979.

Depth From	Depth To	Description
365	370	90% porous, light-tan dolomitic limestone 10% concrete
370	375	90% light-tan dolomitic limestone. No longer porous. 10% chalky, cream-colored limestone.
375	380	90% light-tan dolomitic limestone, porous. 10% chalky, cream-colored limestone.
380	385	Light-tan dolomitic limestone, as from 370-375. Fragments are 1/16" thick, hard and brittle.
385	405	90% light tan dolomitic limestone. Highly porous. Occasional gray chert. 10% brittle, platey dolomitic limestone. Subangular fragments 1/8" to 1/2".
405	415	50% chalky, porous, white limestone. 50% vuggy, light gray dolomitic limestone. Fragments are 1/8-1/4" in upper 5'; up to 1" in sample from 410-415.
415	430	Porous, chalky white limetsone. Most fragments 1/8". Abundant marine fossils.
430	445	50% porous white limestone, 50% hard dense angular white limestone. Most fragments are 1/4".
445	450	Porous, chalky white limestone. Fragments 1/8 to 1/2"
450	455	90% light-gray, vuggy dolomitic limestone. Hard, dense angular fragments up to 1/2". 10% porous chalky white limestone.
455	460	90% porous, chalky white limestone. Rounded fragments 1/8-1/2". 10% light-gray dolomitic limestone, as from 450-455.

Client: Gainesville-Alachua County Regional Utilities Board

Log of Water-Well Cuttings, December, 1979.

Depth From	Depth To	Description
460	465	Light-tan dolomitic limestone. Hard, platey fragments up to 1/2".
465	485	Porous, chalky white limestone. Rounded fragments 1/8-1/2".

W-14556
W-Aa-T8S-R19E-26

PERMIT #	:
OWNER	: Deerhaven Generating Plant
LOCATION	: Sec. 26, T8S, R19E
COUNTY	: Alachua
ELEVATION	:
DRILLER	: J. D. Twist
STARTED	: 11-27-79
COMPLETED	: 12-27-79
DEPTH	:
CASING	: 186' of 24"
HEAD	:
YIELD	:
QUALITY	:
USE	:
REMARKS	: 83 samples

CHARACTER OF MATERIAL

FT.		FT.	
0	-	10	Sand
10	-	15	White clay
15	-	20	Brown clay
20	-	40	Yellow or tan clay
40	-	44	Lime with fine rock
44	-	80	Lime clay with fine sand rock
80	-	100	Limerock with soft streaks
100	-	110	Limerock, medium hard
110	-	140	Fine loose lime with shell
140	-	153	No return
153	-	170	Medium hard lime
170	-	178	Soft limerock
178	-	180	Medium hard limerock
180	-	190	Hard limerock
190	-	219	Medium hard limerock with hard streaks
219	-	220	Cavity
220	-	232	Medium hard white lime with soft streaks
232	-	235	Broken with shell
235	-	255	Soft, loose lime with hard streaks
255	-	257	Broken fractured
257	-	269	Soft loose lime with hard streaks
269	-	271	Cavity
271	-	275	Hard limerock
275	-	300	Medium hard rock with soft streaks
300	-	302	Hard limerock
302	-	305	Medium hard brown limerock
305	-	308	Medium hard grey limerock with shell
308	-	328	Hard brown limerock

W-14556 Cont'd.

328	-	333	Loose soft lime with water
333	-	335	Hard brown fractured limerock
335	-	355	Hard brown limerock
355	-	365	Loose soft limerock with water
365	-	375	Soft limerock with hard streaks
375	-	420	Soft limerock with soft loose streaks
420	-	425	Soft limerock, loose and fine
425	-	435	Soft limerock loose and fine with hard streaks
435	-	438	Soft limerock, loose and fine
438	-	455	Soft limerock, white
455	-	495	Soft loose lime, white

FEASIBILITY OF DEEP-WELL INJECTION AT THE DEERHAVEN POWER STATION, ALACHUA COUNTY, FLORIDA

prepared for

BURNS & MCDONNELL

March 1978

GERAGHTY & MILLER, INC.
Consulting Ground-Water Hydrologists and Geologists
13902 N. Dale Mabry Highway, Suite 150
Tampa, Florida 33682

SUMMARY

A test-injection well was drilled and tested at the Alachua County Regional Utilities Board (R.U.B.) property at the Deerhaven Power Station near Gainesville, Florida, during the period from August 26, 1977, to January 10, 1978. The purposes of the project were: 1) to locate and test potential injection zones, 2) to determine their suitability for injecting 200,000 gpd (gallons per day) of cooling-tower blowdown, and 3) to determine the presence and adequacy of overlying confining units. The proposed fluid to be injected, largely cooling-tower blowdown, would contain from 2,000 mg/l (milligrams per liter) to as much as 6,000 mg/l of total dissolved solids. The well was drilled through marine deposits composed chiefly of limestone and dolostone, and clastic sediments composed chiefly of sandstone and shale to a final depth of 3,400 ft below land surface.

The original procedure, as proposed, consisted of drilling through the base of fresh water, anticipated at approximately 1,000 ft in the Floridan Aquifer, and setting a 10-in-diameter casing in the first underlying confining unit to protect the fresh water zone. Drilling was to proceed to crystalline basement rock or 3,400 ft, whichever came first, and a 4-in-diameter liner casing was to be set at approximately 2,000 ft in confining zones containing salt water or brine. Confining units of gypsum and anhydrite

APPENDIX A

Geologic Log of Test-Injection Well

Description	Depth (ft)	Thickness (ft)
Sand, clayey, medium to coarse, subangular, poorly sorted, soft and crumbly, light-gray; white, plastic clay; trace of sandy iron oxide.....	0 - 11	11
Sand, clayey, medium to coarse, subangular, poorly sorted, soft and crumbly, white to orange, individual quartz grains clear; white, plastic clay; interbedded with white and orange clay.......	11 - 29	18
Limestone, microcrystalline, porous, friable, poorly indurated, calcite cement; interbedded with white chert lens.................................	29.0 - 29.5	0.5
Cavity: lost circulation of drilling fluid; no cuttings were returned to surface...............	29.5 - 40	10.5
Sandstone, argillaceous, fine to coarse, subangular, poorly sorted, moderately indurated, white, micrite cement............................	40 - 70	30
Siltstone, microcrystalline, irregular, well sorted, soft to moderately hard, white to light olive; micrite cement.............................	70 - 92	22
Calcilutite, microcrystalline, well sorted, vugular, soft to moderately hard, white to tan.....	92 - 110	18
Limestone, very fine, porous, friable, moderate induration, fossiliferous, white to tan...........	110 - 174	64
Cavernous zone: lost circulation of drilling fluid, no cuttings were returned to surface, drilling tools dropped sporadically throughout this interval......	174 - 318	144
Limestone, microcrystalline, irregular, porous, moldic, fossiliferous, micrite cement, white to light-gray......................................	318 - 330	12
Limestone, cryptocrystalline, porous, vugular, moldic, micrite cement, fractured, white to gray; dark-brown, vugular, filled with crystalline calcite, very fine dolostone............................	330 - 340	10
Limestone, dolomitic, very fine, subhedral, porous, pinpoint vugs, calcitic cement, well indurated, tan to brown; interbedded with white, chalky, echinoid limestone..............................	340 - 370	30

Description	Depth (ft)	Thickness (ft)
Limestone, dolomitic, very fine, euhedral to subhedral, porous, interconnecting pinpoint vugs, vug filling with crystalline calcite, well indurated, tan to light-brown; white to light-gray, friable, pisolitic limestone...........................	370 - 380	10
Limestone, dolomitic, microcrystalline to very fine, subhedral, porous, pinpoint vugs, partially filled with micrite, well indurated, light-brown to brown.	380 - 390	10
Limestone, dolomitic, microcrystalline to very fine, subhedral, porous, pinpoint vugs, vugs partially filled with micrite.............................	390 - 410	20
Dolostone, calcitic, microcrystalline to very fine, subhedral, high porosity, vugular, moderately indurated, buff to tan; trace of clear, subrounded quartz sand and white, echinoid limestone.........	410 - 440	30
Dolostone, calcitic, microcrystalline to very fine, subhedral, porous, vugular, moderately indurated, cream to tan; interbedded with blue-gray, vugular, microcrystalline dolostone.......................	440 - 450	10
Limestone, cryptocrystalline, allochemical, porous, vugular, well indurated, buff to cream............	450 - 470	20
Limestone, dolomitic, microcrystalline, porous, moldic, vugular, moderately indurated, white to buff....................................	470 - 480	10
Dolostone, calcitic, microcrystalline to fine, euhedral, porous, pinpoint vugs, partially filled with crystalline calcite, well indurated, buff to white...................................	480 - 486	6
Limestone, dolomitic, microcrystalline, euhedral, porous, moldic, pinpoint vugs, micrite in interstices, moderately indurated, white to buff.......	486 - 493	7
Limestone, dolomitic, microcrystalline, euhedral, high porosity, moldic, pinpoint vugs, moderately indurated, white to buff; interbedded with tan, porous, well indurated, microcrystalline dolostone....................................	493 - 500	7

Description	Depth (ft)	Thickness (ft)
Limestone, cryptocrystalline, allochemical, high porosity, pinpoint vugs, partially filled with crystalline calcite, chalky, moderately indurated, white to light-tan..............................	500 - 513	13
Clay, soft and plastic, light-green; impacted, light-tan dolomitic limestone.....................	513 - 515	2
Limestone, microcrystalline to very fine, subhedral, high porosity, pinpoint vugs, vugular, well indurated, chalky, white to light-gray; interbedded with light-tan, blocky, porous, well indurated dolostone.........................	515 - 530	15
Limestone, microcrystalline to very fine, subhedral, porous, moldic, pinpoint vugs, moderately indurated, white to light-tan; interbedded with milk-white, chalcedony............................	530 - 540	10
Limestone, microcrystalline to very fine, subhedral, porous, pinpoint vugs, moderately indurated, white to light-tan; interbedded with tan, well indurated, porous, euhedral, microcrystalline dolostone.........................	540 - 560	20
Limestone, cryptocrystalline, allochemical, fragmental, porous, moldic, moderately indurated, fossiliferous, echinoid, matrix is micrite, white to tan....................................	560 - 640	80
Limestone, cryptocrystalline, allochemical, porous, moldic, moderately indurated, fossiliferous, echinoid, white to buff; interbedded with tan, low porosity, pinpoint vugular, microcrystalline dolostone..	640 - 650	10
Lignite, argillaceous, porous, fractured, poorly indurated, dull brown-black; interbedded with white, allochemical limestone....................	650 - 663	13
Limestone, coquinoid, microcrystalline to very fine, irregular, porous, moldic, poorly indurated with echinoids, gastropods, mollusks, white to light-tan.....................	663 - 670	7

Carrollwood Village Executive Center
13902 North Dale Mabry Highway
Suite 150

Post Office Box 271173
TAMPA, FLORIDA 33688
Telephone: (813) 961-1921

Geraghty & Miller, Inc.

GROUND-WATER CONSULTANTS

June 14, 1984

Mr. Robert L. Guyer
Environmental Coordinator
Electric Systems
Gainesville Regional Utilities
Post Office Box 490
Gainesville, Florida 32602

Dear Mr. Guyer:

Enclosed are lithologic logs and well-construction diagrams of monitor wells installed at the Deerhaven Generating Station. The wells were installed during the week of April 23, 1984, at locations shown in Figure A-1 (Appendix A). Soil-sample collection and monitor-well installation were performed under the direction of a hydrogeologist from Geraghty & Miller, Inc. Lithologic logs of each monitor well were prepared from descriptions of geologic samples and are presented in Appendix B.

Surficial Aquifer Wells

Before the surficial aquifer monitor wells were installed, continuous split-spoon samples were collected in order to determine the depth of clayey sediments underlying the surficial aquifer. A 6-inch-diameter borehole was then drilled to the bottom of the surficial aquifer, after which a 2-inch-diameter PVC pipe with a 5-foot-long PVC well screen attached was installed in the borehole. A uniformly graded sand was then emplaced by tremie method around the screen and for some distance above it to ensure contact with the surrounding material. A very fine-grained sand was placed over the sand pack to act as a cap, and the remainder of the annulus was grouted by tremie method with Class A Portland cement from the top of the cap to land surface. The wells were developed by swabbing and pumping until the discharge was clear and free of suspended sediment. Specific well depths, screened intervals, and sand pack intervals are indicated on well-construction diagrams in Appendix C.

Floridan Aquifer Well

A Floridan aquifer monitor well was installed at the location depicted in Figure A-1. A 4-inch-diameter pilot hole was drilled in order to collect geologic samples and determine the depth at which to set the well casing. An 8-inch-diameter borehole was then drilled to a depth of 140 feet, after which a 4-inch-diameter PVC pipe was installed into the borehole and grouted with Class A Portland cement. After the cement had been given time to harden, a 4-inch-diameter hole was drilled below the casing to a depth of 164 feet. Geologic samples were collected on 5-foot intervals or at changes in lithology for the entire depth of the well and were used to prepare the lithologic log listed in Appendix B. A submersible pump was installed in the well and pumped until the discharge was clear and free of suspended sediment. Details of the well and pump are shown on the well-construction diagram in Appendix C.

The monitor wells installed during this field program were constructed in accordance with technical specifications. Changes or deviations from the specifications, such as well depths, depth to the top of sand pack or sand cap, were approved in the field by a hydrogeologist of Geraghty & Miller, Inc.

Geraghty & Miller, Inc., appreciates the opportunity to provide hydrogeologic consulting services to Gainesville Regional Utilities. If you have any questions or if we can be of further assistance, please contact us.

Sincerely,

GERAGHTY & MILLER, INC.

Daniel W. Rothenberger

Daniel W. Rothenberger
Staff Scientist

JEKubal

Jerry E. Kubal
Senior Scientist

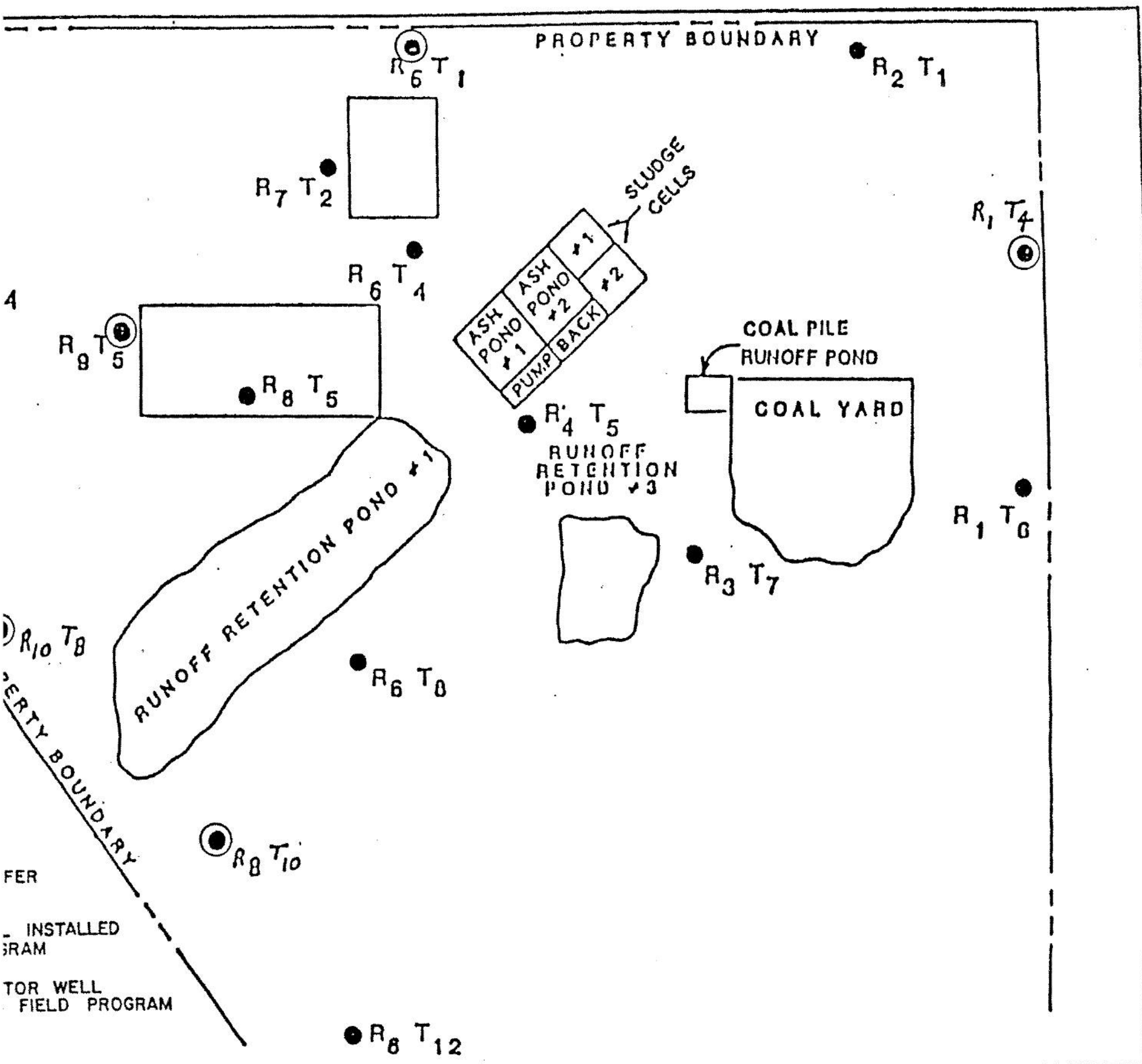


Figure A-1. Well Site Locations.

Geraghty & Miller, Inc.

TABLE B-7. LITHOLOGIC LOG OF FLORIDAN AQUIFER MONITOR WELL

Description	Depth (ft)	Thickness (ft)
Sand, fine-grained, silty, gray and black.	0 - 2	2
Sand, fine-grained, brown.................	2 - 4	2
Sand, fine-grained, tan...................	4 - 6	2
Sand, fine-grained, gray..................	6 - 11	5
Clay, sandy, stiff, gray and blue-green...	11 - 20	9
Clay, slightly sandy, stiff, yellow.......	20 - 25	5
Clay, sandy, yellow.......................	25 - 30	5
Clay, sandy, white and yellow.............	30 - 35	5
Clay, sandy, gray and yellow..............	35 - 40	5
Clay, sandy, gray, yellow and blue-green..	40 - 43	3
Clay, sandy, blue-green...................	43 - 48	5
Clay, sandy, blue-green, yellow...........	48 - 53	5
Clay, sandy, blue-green, gray and yellow..	53 - 57	4
Clay, sandy, gray; white limestone fragments................................	57 - 62	5
Clay, slightly sandy, gray to tan; limestone fragments......................	62 - 67	5
Clay, slightly sandy, tan; limestone fragments................................	67 - 72	5
Sand, fine-grained, clayey, tan; lime-stone fragments.........................	72 - 75	3

TABLE A-7 (Continued)

Dolostone, hard, brown....................	100	- 104	4
Limestone, granular, white; brown, hard, dolostone................................	104	- 110	6
Limestone, clayey, granular, white........	110	- 115	5
Limestone, slightly clayey, granular, white..................................	115	- 120	5
Limestone, granular, moderately hard, white; blue-green and olive-green clay....	120	- 125	5
Limestone, granular, moderately hard, white..................................	125	- 130	5
Limestone, granular, moderately hard, white..................................	130	- 135	5
Limestone, granular, moderately hard, white; olive-green waxy, clay.............	135	- 145	10
Limestone, granular, moderately hard, white..................................	145	- 164	19

Water Supply Well Withdrawal

As discussed in Chapter 2, all well pumping tests in the area, for which information is available, have been conducted in wells which apparently penetrate the Floridan Aquifer under artesian conditions. Tests performed originally at the Deerhaven water supply wells did not provide an estimate of the aquifer storage coefficient so that groundwater withdrawal effects could be reliably predicted. As discussed in Chapter 2 and shown in Figure 2.5-7, some authors have proposed that the Floridan Aquifer in the Deerhaven vicinity experiences groundwater table conditions. Such suggestions are based on the assumption that the Ocala group, which constitutes the top of the Floridan Aquifer in this area, performs as a hydrologic unit throughout its depth and that, since the aquifer's potentiometric surface lies below the top of the Ocala group, the aquifer therefore experiences water table (i.e. unconfined aquifer) conditions. However, field experience indicates that this formation and others which comprise the Floridan Aquifer may contain zones of both low and high permeability. The implication of this observation for the Deerhaven site is that, even though the potentiometric surface in the Floridan Aquifer is known to be 28 feet below the top of the Ocala group (in September, 1977), this is not necessarily positive proof that the Floridan Aquifer beneath the site is under water table conditions. Furthermore, if the assumption that the aquifer is under water table conditions is correct, the only data which have been available for drawdown prediction have been obtained from wells under artesian conditions, and their application to the Deerhaven water supply wells may provide invalid results.

In order to obtain site-specific data, a test of one of the existing water supply wells was performed from September 9, 1977, to September 13, 1977. As Figure 5.1-1 indicates, three water supply wells presently exist to meet the present needs of the station. These wells are aligned approximately on a north-south axis and are 150 feet apart. The three supply wells range in depth from 360 to 440 feet. An observation well, 281 feet deep, lies 485 feet south of the central water supply well.

During the week preceding the aquifer test, the central water supply well was the only well pumped for the station's needs. This well was pumped continuously to establish quasi-equilibrium in the groundwater system at a rate equal to the average withdrawal rate for the preceding months. This continuous pumping terminated at 5:00 a.m. September 9, 1977. Pre-test water levels were measured in the south water supply well and in the observation well. These were used as monitoring wells during the aquifer test and the central water supply well was used as the pumping well. It was not possible to insert water level measuring devices in the north and central water supply wells due to the small annular clearance in the well casing. Pre-test water level observations indicated that the aquifer had not fully recovered from the previous pumping; however, only a limited shut-down time could be tolerated due to water supply needs at the station. Therefore, the aquifer test was begun at 3:02 p.m. September 9, 1977, and proceeded for 94 hours, 16 minutes until 1:19 p.m. September 13, 1977. During this test period the central water supply well was pumped at a rate of 881 gallons per minute.

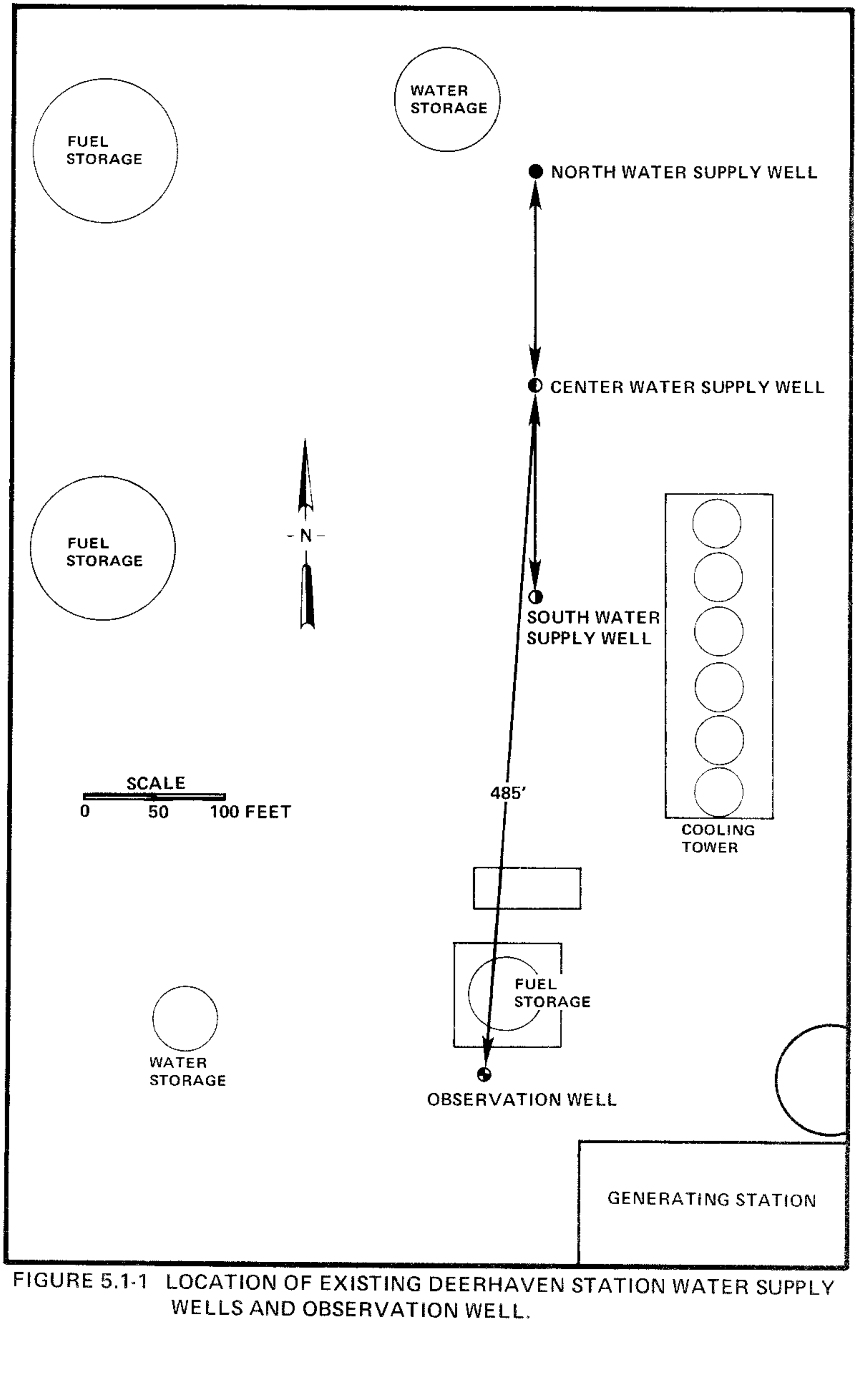


FIGURE 5.1-1 LOCATION OF EXISTING DEERHAVEN STATION WATER SUPPLY WELLS AND OBSERVATION WELL.

The collected data were analyzed using two models to determine transmissivity and storage coefficient values. These were the Hantush-Jacob model, a non-steady state, leaky artesian aquifer model which assumes fully penetrating wells, no release of water from storage in the aquitard and constant discharge conditions; and Boulton's delayed drainage model for a water table aquifer with fully penetrating wells and constant discharge conditions.

Time-drawdown response during the first few hundred minutes of the test indicated that the aquifer system may be responding as a water table aquifer. Using Boulton's technique, time-drawdown data for both monitoring wells was plotted on log-log paper and the plots were matched to the Boulton model type curves. A match for early and late times was obtained for the south water supply well and only a match for early time was obtained for the observation well. A summary of the results of this analysis is shown in Table 5.1-1.

The log-log plots of the time-drawdown data for both monitoring wells were also matched for the Hantush-Jacob leaky artesian model type curves. A summary of the results of this analysis is presented in Table 5.1-2.

As indicated, values of transmissivity determined from both methods of analysis range from a high of 300,000 gpd/ft. to a low of 250,000 gpd/ft. The values of storage coefficients range from 1.8×10^{-4} to 5.2×10^{-5}

Table 5.1-1 Aquifer Parameters Obtained Using the Delayed Drainage Model

Well	Transmissivity (gpd/ft) Early	Transmissivity (gpd/ft) Late	Storage Coefficient (dimensionless) Early	Storage Coefficient (dimensionless) Late
South	250,000	250,000	1.6×10^{-4}	0.15
Observation	300,000		5.2×10^{-5}	

Table 5.1-2 Aquifer Parameters Obtained Using the Leaky Artesian Model

Well	Transmissivity (gpd/ft)	Storage Coefficient (dimensionless)
South	280,000	1.8×10^{-4}
Observation	290,000	5.2×10^{-5}

for the artesian aquifer analysis. A specific yield of 0.15 was calculated from the late-type curve match using the Boulton delayed drainage model and test data monitored at the south water supply well.

There is still a degree of uncertainty regarding the nature of the aquifer system beneath the Deerhaven site. As mentioned above, the time-drawdown response for the first few hundred minutes of the test indicated a water table system; however, the geologic condition of the site (that is, the sequence of shallow water table aquifer, clay and siltstone, and deeper limestone aquifer), could indicate a leaky artesian system, provided the confining beds are saturated. Since the purpose of the test program was to provide data to project regional water table impacts due to proposed groundwater withdrawal at the Deerhaven site, it was determined that impacts should be predicted using both models. This, it was felt, would provide both an optimistic and pessimistic prediction of such impacts. Using each aquifer model the net drawdown of the Floridan Aquifer's potentiometric surface was predicted based on an average withdrawal rate of 3,289 gpm (4.7 mgd) from on-site wells.

For the modeling assumption of a leaky artesian type system, an equilibrium type mathematical model was used. This model assumed that the Floridan Aquifer is recharged by the leakage of water through the confining layer, or aquitard, (i.e. the Hawthorn formation) from the shallow water table, and that equilibrium (i.e. no further drawdown) occurs when the cone of depression from Deerhaven water supply wells intercepts enough leakage to offset the water supply well withdrawal. For the leaky artesian aquifer assumption, the following parameters were used: transmissivity = 290,000 gpd./ft.; storage coefficient = 5.0 x 10^{-5}; leakage = 0.197 gpd./ft.^{3}. Table 5.1-3 presents the predicted net drawdown upon reaching equilibrium. As indicated, this model predicts that detectable net drawdown will be confined almost entirely to the Deerhaven site and that no measurable offsite impacts to the shallow water table, shallow wells, lakes, or marshes would result.

For the modeling assumption of a water table type system, net drawdown was computed for several withdrawal periods. The net cone of depression predicted by Boulton's delayed drainage model for each withdrawal period was superimposed on a theoretical potentiometric surface.

It was assumed that equilibrium would be established, and no further drawdown would occur, when the annual volume of vertical infiltration into the Floridan Aquifer (i.e., recharge) intercepted by the resulting net cone of depression equaled the annual Deerhaven water supply well withdrawal. Clark et al (1964) developed an estimated value, which they described as conservative, of 1.8 inches of recharge per year for a 525 square mile area whose center is approximately 20 miles east of the site in similar terrain. Using this value, it was determined that equilibrium would be established after a cone of depression with a radius of approximately 22,000 feet had developed.

Table 5.1-3 Net Equilibrium Drawdown at 3,289 Gallons/Minute Withdrawal Assuming a Leaky Artesian Aquifer

Radius from Deerhaven Wells (ft)	Drawdown (ft)
500	2.93
1,000	1.43
2,000	0.46
3,000	0.16
5,000	0.02

The following parameters were used: transmissivity = 250,000 gpd/ft.; specific yield = 0.15; delay index = 1.11 days. This analysis predicted that equilibrium drawdown would be reached after approximately one year of withdrawal. Table 5.1-4 presents the predicted net drawdown at the end of the one-year period and Figure 5.1-2 shows net drawdown contours within 5 miles of the Deerhaven wells at the end of the one-year period as predicted by the water table aquifer model. As seen, the total drawdown due to all Deerhaven water supply well withdrawal declines from 3.1 feet one mile away from the wells to 0.2 feet four miles away from the wells. Table 2.5-9 presents the known wells within five miles of the Deerhaven site. Wells which are deep enough to penetrate into the Floridan Aquifer would be expected to be influenced by this drawdown. Because this model assumes no influence on the shallow water table by the drawdown in the Floridan Aquifer, there would be no impacts to the shallow water table or to lakes, marshes, or shallow wells.

Effects of Offstream Cooling - Fogging Potential

Offstream cooling can increase the occurrence of fog in limited areas around the plant site. It has been reported that the potential for artificially created fog occurs when moisture is discharged into air that has a deficit between the actual and saturation moisture content of less than 0.1 gram per cubic meter (GPA Report, 1972). This deficit is related to air temperature and relative humidity in Table 2.6-4.

Table 5.1-4 Net Drawdown at Equilibrium (after five years withdrawal) at 3,289 Gallons/Minute Assuming a Water Table Aquifer

Radius from Deerhaven Wells (ft)	(miles)	Drawdown (ft)
1,000	0.2	6.8
2,000	0.4	5.3
4,000	0.8	3.8
6,000	1.1	2.7
10,000	1.9	1.2
14,000	2.7	0.53
18,000	3.4	0.38
20,000	3.8	0.24
22,000	4.2	0.12

ATTACHMENT 2

GROUNDWATER FLOW MODELING AND IMPACT ASSESSMENT

GROUNDWATER FLOW MODELING AND IMPACTS ASSESSMENT

Prepared for:

Gainesville Renewable Energy Center
An American Renewables Company

Prepared by:

ECT
Environmental Consulting & Technology, Inc.
3701 Northwest 98th Street
Gainesville, Florida 32606

ECT No. 090408-0100

July 2009

PROFESSIONAL GEOLOGIST CERTIFICATION

PROJECT NAME: Gainesville Renewable Energy Facility, Gainesville, Alachua County, Florida

ECT PROJECT NUMBER: 090408

I hereby certify that geologic interpretations in this water use permit application have been performed by me or under my direct supervision in accordance with sound geological principals and practices. The findings and results of this report are for the sole use and benefit of the Suwannee River Water Management District, the Florida Department of Environmental Protection, and Gainesville Renewable Energy Center, LLC. Utilization of this report by other parties is at their risk and neither Environmental Consulting & Technology, Inc., nor I am liable for consequences or damage extending therefrom. I do not attest to the accuracy of items outside of my area of expertise, including, but not limited to, laboratory analysis procedures.

SIGNED:

Richard J. Stebnisky

Richard J. Stebnisky, P.G. PG 1177

11-18-09

Date

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LIST OF FIGURES

1.0 INTRODUCTION AND OBJECTIVES

This groundwater modeling and impacts assessment document was developed by Environmental Consulting & Technology, Inc. (ECT), in conjunction with the site certification application (SCA) for the proposed Gainesville Renewable Energy Center (GREC). The GREC Site is located in northern Alachua County, Florida, within the Suwannee River Water Management District (SRWMD) boundary (see Figure 1). SRWMD regulates the use of water in this region. Groundwater use is proposed at an average withdrawal rate of 1.4 million gallons per day (MGD) at the GREC facility.

The overall objective of this study is to assess potential impacts from the requested groundwater withdrawals at the GREC facility in accordance with the SCA, the water use permit (WUP) requirements of SRWMD, and other agency requirements.

In the context of a WUP application, SRWMD would require that the applicant's proposed withdrawal satisfies conditions for issuance of permits per Section 40B-2.301 of the Florida Administrative Code (F.A.C.), which are specified at Section 373.223, Florida Statues (F.S.). To obtain a WUP (under the current rule), the applicant must establish that the proposed use of water:

- Is a reasonable-beneficial use as defined in Section 373.019, F.S.
- Will not interfere with any presently existing legal use of water.
- Is consistent with the public interest.

On August 21, 2009, SRWMD formally proposed significant amendments to Chapter 40B-2, F.A.C. The exact text from the proposed Section 40B-2.301, F.A.C. is reprinted in the following:

> "40B-2.301 Conditions for Issuance of Permits.
>
> (1) To obtain a water use permit, renewal, or modification pursuant to the provisions of this chapter, the applicant must provide reasonable assurances that the proposed use of water:
>
> (a) Is a reasonable-beneficial use;

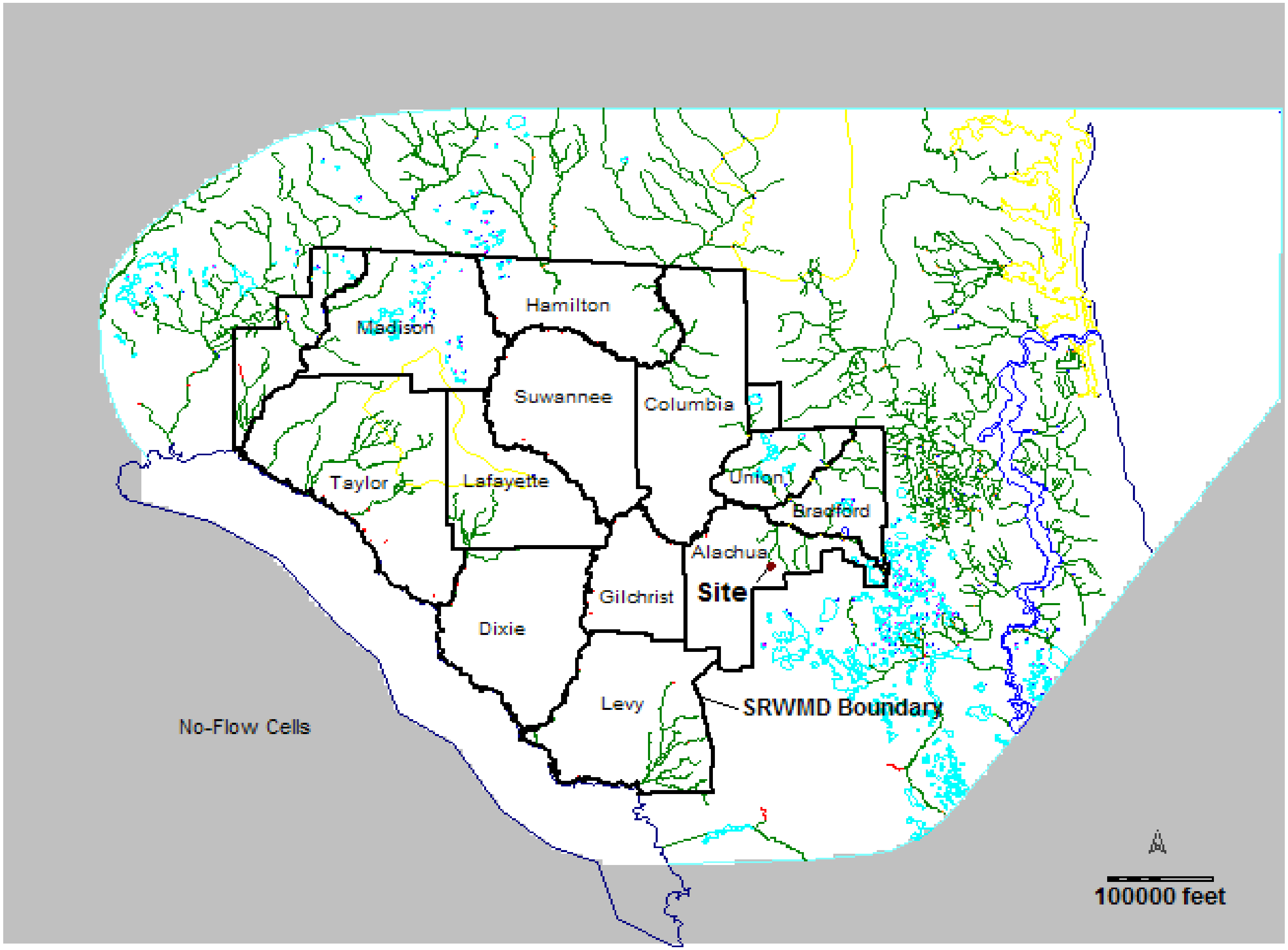

FIGURE 1.

SRWMD MODEL AREA SHOWING THE SRWMD BOUNDARY

Sources: Schneider *et al*., 2008. ECT, 2009.

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(b) Will not interfere with any presently existing legal use of water; and
(c) Is consistent with the public interest.

(2) Reasonable assurances must be provided that the following criteria are met in order for a use to be considered reasonable-beneficial:

(a) The use must be in such quantity and quality as is necessary for economic and efficient use.
(b) The use must be for a purpose that is both reasonable and consistent with the public interest.
(c) The source of the water must be capable of producing the requested amounts and appropriate quality of water.
(d) The use will not degrade the source from which it is withdrawn.
(e) The use will not cause or contribute to flooding.
(f) The use will not harm offsite land uses.
(g) The use will not cause harm to wetlands or other surface waters. Harm to wetlands or other surface waters must be mitigated after completion of reduction or elimination of harm in accordance with sections 3.1.8. through 3.1.10. of the Water Use Permitting Guide.
(h) The use will not cause or contribute to a violation of either minimum flows or levels.
(i) The use will not cause or contribute to a violation of state water quality standards in waters of the state as set forth in Chapters 62-301, 62-302, 62-520, and 62-550, F.A.C.
(j) The use is otherwise a reasonable-beneficial use as defined in Section 373.019(2), F.S., with consideration given to the factors set forth in subsection 62-40.410(2), F.A.C.
(k) A permit applicant's proposed reasonable-beneficial use of an alternative water supply is presumed to be in the public interest.

(3) The standards and criteria set forth in the Water Use Permitting Guide, hereby published by reference and incorporated into this chapter, must be used to provide the reasonable assurances required in this section. A current version of this document is available on the District's website and at its headquarters.

Rulemaking ~~Specific~~ Authority 373.044, 373.113, 373.171 FS. Law Implemented 373.042, 373.0421, 373.219, 373.223, 373.236, 373.227, 373.229, 373.232, 373.236, 373.239, 373.250 FS. History– New 10-1-82, Amended 5-1-83,_________."

This groundwater flow modeling and impacts assessment document addresses the SRWMD conditions for issuance of permits in accordance with the current Section 40B-2.301, F.A.C., and consideration is also given to the intent of the proposed rule and other regulatory agency requirements.

Section 2.0 of this assessment provides information regarding the hydrogeologic setting. Section 3.0 describes the methods used for various groundwater modeling applications and presents the results of the groundwater models. Section 4.0 provides discussion and interpretation of the various groundwater modeling results and provides conclusions regarding the assessment of potential impacts from the proposed groundwater withdrawals. Section 4.0 provides discussion and conclusions regarding other conditions for issuance of permits that are not directly related to groundwater modeling.

2.0 HYDROGEOLOGIC SETTING

The GREC Site area geology and hydrology, subsurface hydrology, and site water budget and area users are described in the SCA, Sections 3.3.1, 3.3.2, and 3.3.3, respectively. Please refer to those SCA sections for a complete description of the hydrogeologic setting. Additional descriptions of the hydrogeologic setting are included in Sections 3.0 and 4.0 of this assessment.

3.0 METHODS AND RESULTS OF GROUNDWATER MODELS FOR IMPACTS ASSESSMENT

Two groundwater models were applied for this assessment of potential impacts. As described in the following subsections, these include the SRWMD regional groundwater flow model for evaluation of most types of potential impacts (see Section 3.1) and the Nonsteady or Steady State Coupled (NSSCOU) aquifer analytical model for evaluation of potential impacts to localized features such as onsite wetlands (see Section 3.2).

3.1 SRWMD REGIONAL GROUNDWATER FLOW MODEL

ECT completed a regional groundwater modeling analysis for the proposed GREC withdrawals of 1.4 MGD average. Cooling and process water for the proposed generation facility will be obtained from one of the two groundwater supply wells proposed to be completed in the Upper Floridan aquifer (UFA) for the GREC Project.

To evaluate the potential impact from this groundwater withdrawal, ECT obtained the electronic model files for the north florida model that was created by SRWMD as a permitting and groundwater resource assessment tool (Schneider *et. al.*, 2008) (SRWMD Model). The SRWMD Model is a calibrated, steady-state simulation using the Modular Three-Dimensional Finite Difference Groundwater Flow Model (MODFLOW) developed at U.S. Geological Survey (USGS) by McDonald and Harbaugh (1988, 1996, and 2000) and the Groundwater Modeling System (GMS) Version 6.0 interface software. The GMS version of the SRWMD Model was subsequently converted by SRWMD into Groundwater Vistas compatible files. ECT acquired the Groundwater Vistas version of the SRWMD Model, as revised August 2008, from the SRWMD Web site (http://www.srwmd.state.fl.us/index.aspx?NID=125) for use in this impact analysis.

3.1.1 MODEL AREA AND DESIGN

The SRWMD Model was created using a uniformly spaced grid consisting of 190 rows (R) by 245 columns (C) with each cell measuring 5,000 by 5,000 feet (ft). The model grid covers approximately a 25,000-square-mile (ft^2) area (see Figure 1). The southwest corner or origin of the model grid is located at -95,500 ft Northing and 1,901,250 ft Easting in the Florida State Plane North (NAD83) coordinate system. The proposed 1.4-MGD groundwater supply well is located in model cell R114, C147. Detailed documentation and design information for the north florida model is provided in Schneider *et al.* (2008).

The conceptual model (Schneider *et al.*, 2008) consists of five active layers generally representing the surficial aquifer system (SAS) as Layer 1, the intermediate aquifer system and confining unit (IAS) as Layer 2, the UFA as Layer 3, the Middle Floridian confining unit (MCU) as Layer 4, and the Lower Floridan aquifer (LFA) as Layer 5. The SRWMD model and other published literature (Sepulveda, 2002) represents that the MCU (Layer 4) is absent beneath the Site. Therefore, the UFA (Layer 3) beneath the proposed Site is in contact with the LFA (Layer 5) as described by Schneider *et al.* (2008). Together, the UFA and the LFA comprise the Floridan aquifer system (FAS). Table 1 presents a summary of the model layer elevations, thicknesses, hydraulic conductivities, and transmissivities in the model cell representing the GREC Site location.

The proposed Site is also located in an area SRWMD describes as Class III Confined, meaning that it is characterized by deeper, highly confined portions of the UFA (Layer 3). Lakes in this confined area of the UFA (Layer 3) were simulated as being in direct connection with either the IAS (Layer 2) or the SAS (Layer 1), depending on the specified lake elevation relative to the elevation of the base of the SAS (Layer 1) or the top of the IAS (Layer 2).

The lateral boundary for the SAS (Layer 1) and the IAS (Layer 2) in the SRWMD Model is simulated using a general head boundary, where surface water bodies outside the active modeled area were expected to affect groundwater flow within the modeled area. Figures 2 through 6 illustrate the boundary condition definition for each of the five model layers. No-flow boundaries were used elsewhere. The lateral boundaries for the UFA (Layer 3) are specified head, general head, or no-flow, depending on location. The Gulf of Mexico is simulated with a specified head within the SAS (Layer 1) to allow offshore flow in the UFA (Layer 3).

Table 1. Aquifer Parameters Defined in the SRWMD Model at the GREC Site Location

Model Layer	Top Elevation (ft-NGVD)	Bottom Elevation (ft-NGVD)	Hydrogeologic Unit	Unit Thickness (ft)	Kx (ft/day)	Ky (ft/day)	Kz (ft/day)	Aquifer Transmissivity (ft^2/day)
Layer 1	173	84.5	SAS	88.5	21.56	21.56	7.19	1,908
Layer 2	84.5	0.0	IAS	84.5	0.00805	0.00805	0.0027	0.68
Layer 3	0.0	-925	FAS	925.0	4377	4377	1459	4,048,725
Layer 4	-925	-935	FAS	10.0	4377	4377	1459	43,770
Layer 5	-935	-1455	FAS	520.0	4377	4377	1459	2,276,040

Note: GREC pumping well located in model cell R114, C147.
The MCU is missing in the vicinity of the proposed site; therefore, the UFA and LFA together comprise the FAS.
K = hydraulic conductivity.
Kz = set to a constant ratio of Kx divided by 3.
LPF package used, model using Kz and thickness to calculate vertical conductance.

Source: Scheider *et al.* , 2008.

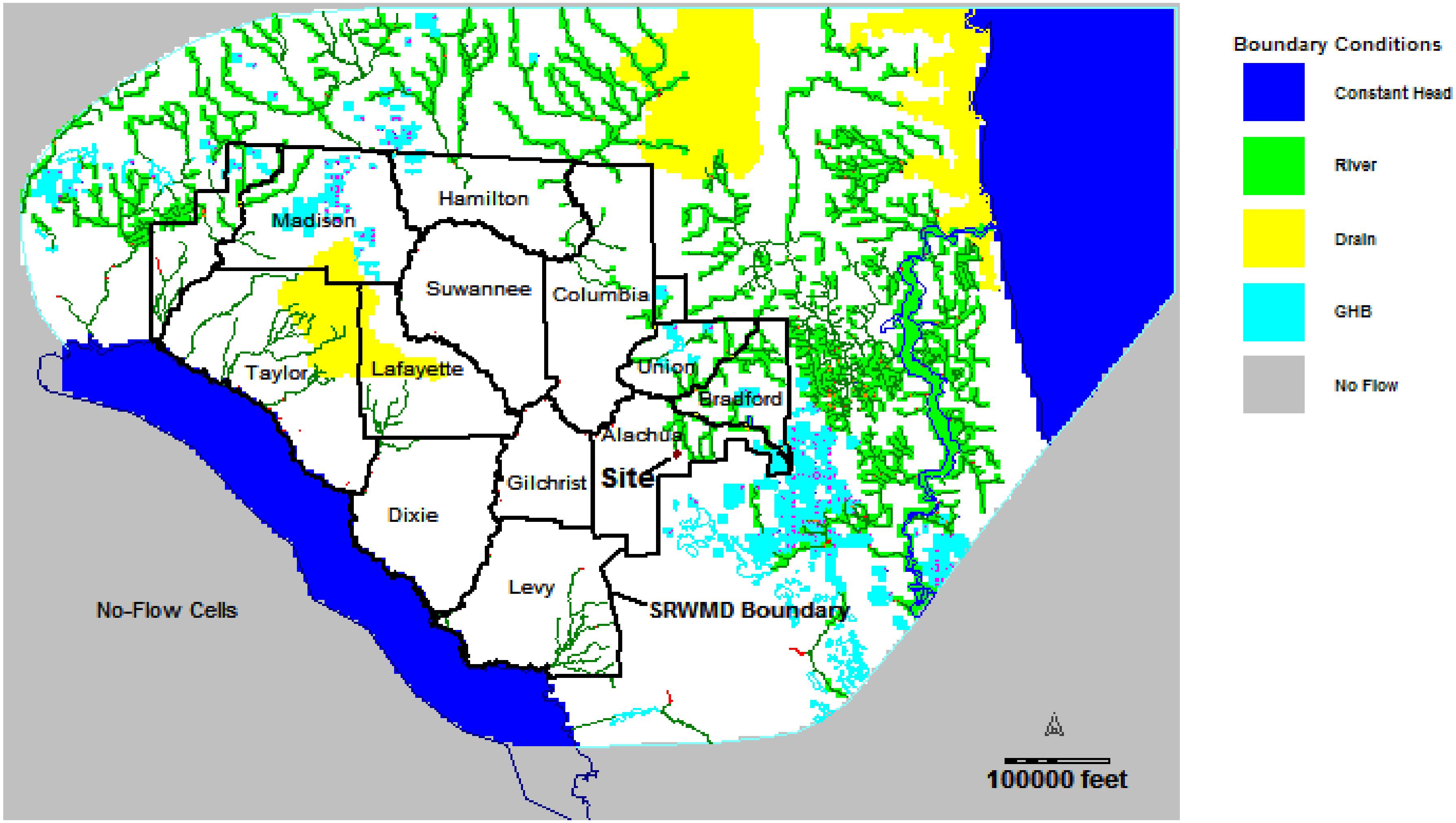

FIGURE 2.

SRWMD MODEL BOUNDARY CONDITIONS FOR THE SAS (LAYER 1)

Sources: Schneider *et al*., 2008. ECT, 2009.

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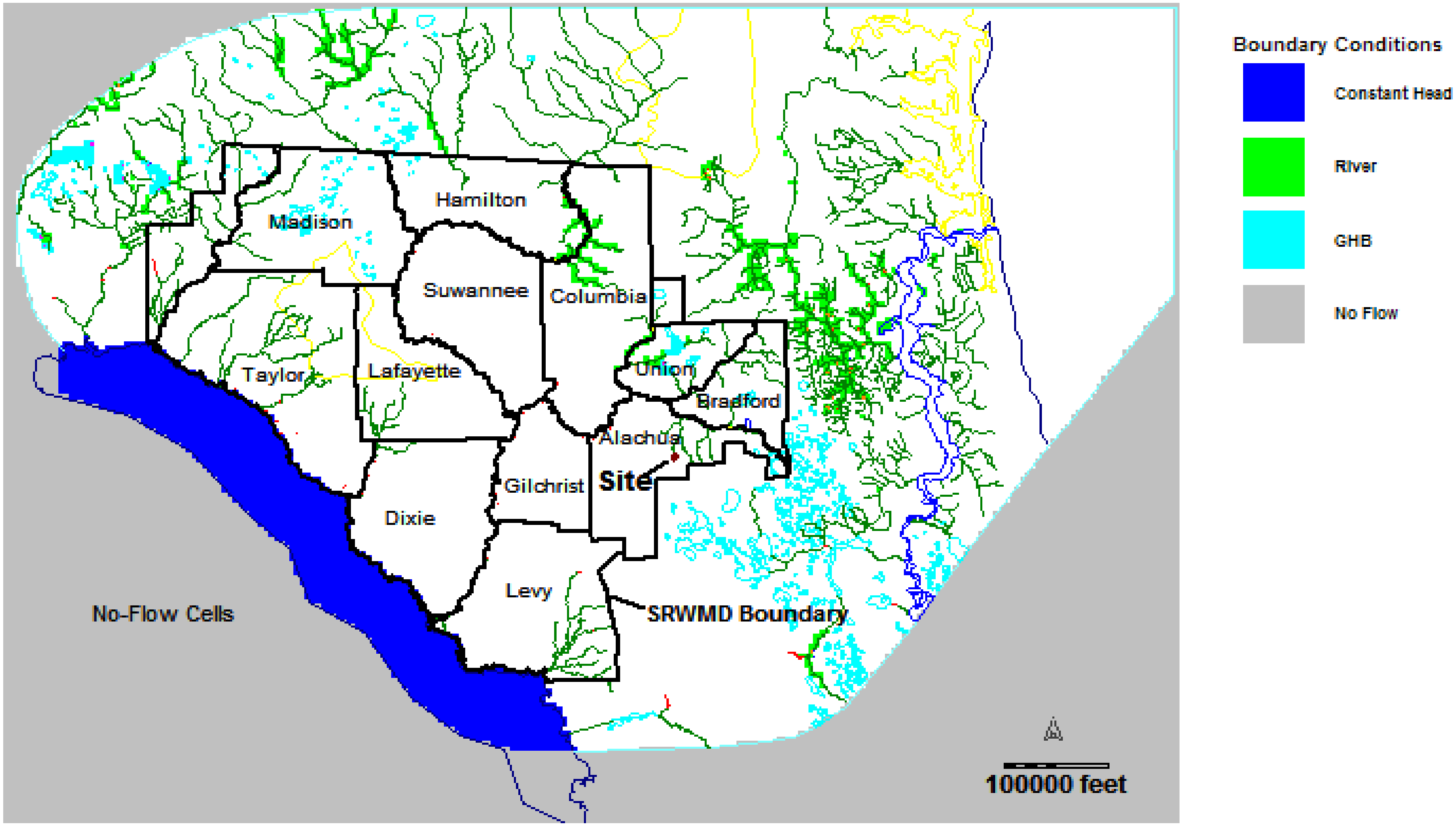

FIGURE 3.

SRWMD MODEL BOUNDARY CONDITIONS FOR THE IAS (LAYER 2)

Sources: Schneider *et al*., 2008. ECT, 2009.

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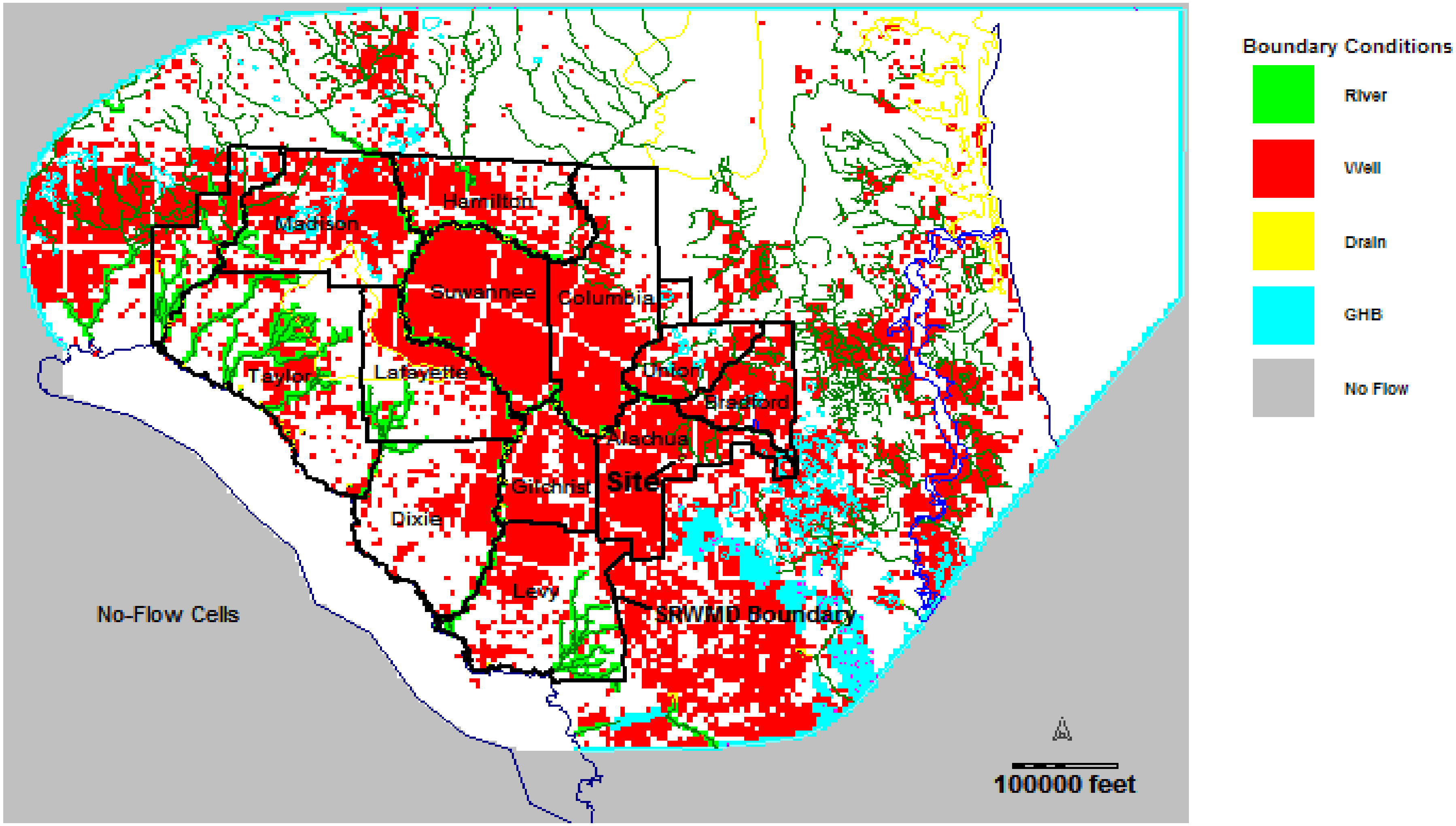

FIGURE 4.

SRWMD MODEL BOUNDARY CONDITIONS FOR THE UFA (LAYER 3)

Sources: Schneider *et al*., 2008. ECT, 2009.

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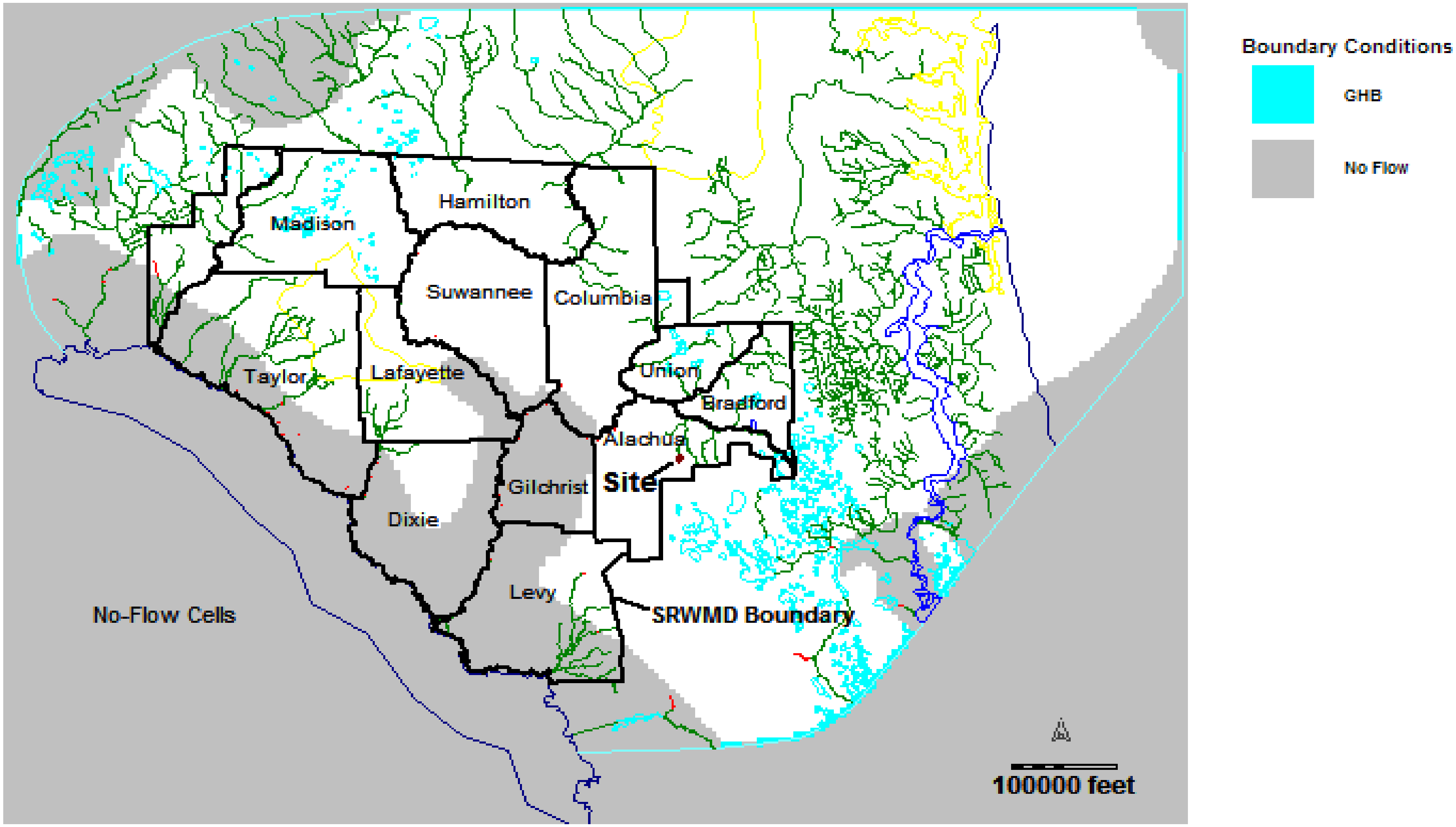

FIGURE 5.

SRWMD MODEL BOUNDARY CONDITIONS FOR THE MCU (LAYER 4)

Sources: Schneider *et al*., 2008. ECT, 2009.

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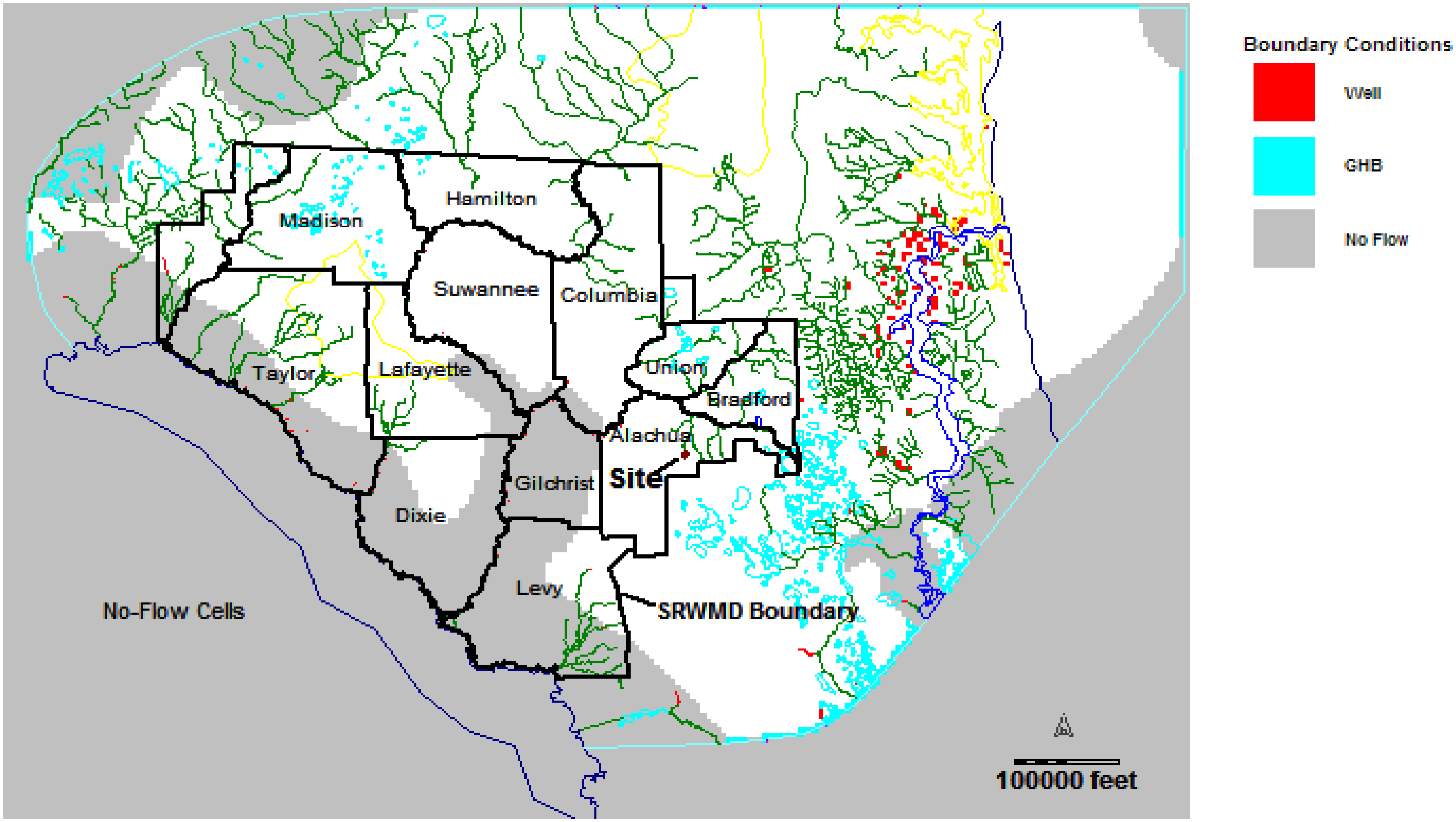

FIGURE 6.

SRWMD MODEL BOUNDARY CONDITIONS FOR THE LFA (LAYER 5)

Sources: Schneider *et al*., 2008. ECT, 2009.

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Recharge is applied to the uppermost layer representing the SAS (Layer 1) over the entire model area using the MODFLOW recharge and evapotranspiration packages. However, recharge is limited to less than 12 inches per year in areas defined as Class III Confined such as the proposed Site.

The river package was used to simulate direct discharge from the SAS (Layer 1) and UFA (Layer 3) to the surface water system. The drain package was used to simulate discharge from the UFA (Layer 3) for approximately 135 springs located within the modeled area. Springs are simulated as being in direct connection with the UFA (Layer 3). Lakes throughout the model are simulated using the MODFLOW general head boundary (GHB) package. The well package is used to simulate the estimated water use within the model area. Groundwater withdrawals in the vicinity of the proposed Site, located in Alachua County, are from the UFA (Layer 3). Withdrawals are observed from the LFA in the model to the east of the proposed Site beginning at approximately 22 miles to the east of the Site or immediately beyond the eastern SRWMD boundary.

The SRWMD Model is a steady-state model that was calibrated by SRWMD to average groundwater heads and flows for the period of June 1, 2001, through May 31, 2002.

3.1.2 MODEL LAYERS AND AQUIFER CHARACTERISTICS

The MODFLOW layer property flow (LPF), which uses hydraulic conductivity and layer thickness to calculate the transmissivity for each model cell, was used in the SRWMD Model. The distribution of hydraulic conductivity was controlled by values assigned to pilot points that are spatially distributed within a layer or regional area and is based on calibration targets for water levels and discharges to constrain the results (Schneider *et al.*, 2008). Table 1 presents a summary of the model layer elevations, thicknesses, hydraulic conductivities, and transmissivities in the model cell representing the site location.

3.1.2.1 Surficial Aquifer System (SAS)—Layer 1

The final calibrated hydraulic conductivity of the uppermost aquifer, defined as Layer 1, ranged from 20 to 125 feet per day (ft/day) with an average of 32 ft/day. Beneath the Site, horizontal hydraulic conductivity was 21.58 ft/day. The ratio between vertical and horizontal hydraulic conductivity is specified as a constant value of 3 for all layers in the model (i.e., vertical hydraulic conductivity is equal to the horizontal hydraulic conductivity divided by 3). Therefore, beneath the Site, the vertical hydraulic conductivity was calculated to be 7.19 ft/day. Beneath the Site, the transmissivity value used in the model is 1,908 square feet per day (ft^2/day).

3.1.2.2 Intermediate Aquifer Systems and Confining Unit (IAS)—Layer 2

Layer 2 represents the IAS in areas of the model where the IAS is present and represents a portion of the SAS in areas where the IAS is not present. In the vicinity of the Site, Layer 2 represents the IAS. The calibrated horizontal hydraulic conductivity of the IAS was 0.005 to 0.1 ft/day with an average value of 0.03 ft/day in the model. Beneath the Site, the horizontal hydraulic conductivity is 0.00805 ft/day with a corresponding vertical hydraulic conductivity of 0.0027 ft/day. Layer 2 is approximately 80 ft thick with a model transmissivity of approximately 0.7 ft^2/day, representative of a confining unit.

3.1.2.3 Upper Floridan Aquifer (UFA)—Layer 3

The final calibrated hydraulic conductivity of the UFA (Layer 3) ranged from 5 to 10,000 ft/day, with an average value of approximately 3,700 ft/day. Beneath the Site, the horizontal hydraulic conductivity is approximately 4,377 ft/day with a corresponding vertical hydraulic conductivity of 1,459 ft/day. The transmissivity of the UFA (Layer 3) defined in the model at the site location is 4,048,725 ft^2/day.

3.1.2.4 Middle Floridan Confining Unit (MCU)—Layer 4

Layer 4 represents the MCU in the model in areas where the MCU is present. In the SRWMD Model, the MCU is reportedly absent in the vicinity of the GREC Site. To represent this, the value of the horizontal hydraulic conductivity of the MCU (Layer 4) is set to the same value as that defined in the UFA (Layer 3) with a typical thickness set to approximately 10 ft. Therefore, beneath the Site, the vertical and horizontal hydraulic conductivity of the Layer 4 is the same as Layer 3. The resulting transmissivity value calculated for Layer 4 in the model at the site location is 43,770 ft^2/day

3.1.2.5 Lower Floridan Aquifer (LFA)—Layer 5

Layer 5 represents the LFA in the areas of the model where the MCU is present. Where the MCU is absent, such as in the GREC Site area, the hydraulic conductivity of Layer 5 was set equal to the values used in Layer 3. Therefore, in the vicinity of the Site, the horizontal and vertical hydraulic conductivity of Layer 5 has been set equal to the values for Layer 3. The transmissivity is 2,276,040 ft^2/day for Layer 5 beneath the Site based on the thickness defined in the model for this layer.

3.1.3 RESULTS OF SRWMD MODEL SIMULATION OF DRAWDOWNS

To estimate the potential water level drawdowns, ECT first ran the SRWMD Model without the addition of the proposed groundwater withdrawal. The GREC supply well was then added to the model in cell R114, C147, and the model was rerun with the proposed groundwater withdrawal rate of 1.4 MGD. The steady-state head files from those two simulations were then subtracted. The resulting head data, which represents the water level drawdown due to the proposed groundwater withdrawal, was then imported into Groundwater Vistas and contoured.

Figure 7 depicts the steady-state potentiometric surface drawdown estimated by the SRWMD Model in the UFA (Layer 3) based on a constant pumping rate of 1.4 MGD. The calculated transmissivity of the UFA (Layer 3) is relatively high in this area, resulting in estimated drawdowns that are less than 0.05 ft everywhere. Because the MCU is absent in the site area, the aquifer characteristics of the MCU (Layer 4) and the LFA (Layer 5) are equal, and the aquifers are in contact. Therefore, the drawdown predicted by the steady-state model in Layers 4 and 5, the MCU and LFA respectively, are the same as observed in the UFA (Layer 3) and are less than 0.05 ft everywhere (see Figures 8 and 9, respectively).

Similarly small drawdowns are predicted to occur in the overlying aquifers. The groundwater model estimates drawdowns of less than 0.044 ft everywhere in both the IAS (Layer 2) are presented in Figure 10, and the SAS (Layer 1) are shown on Figure 11.

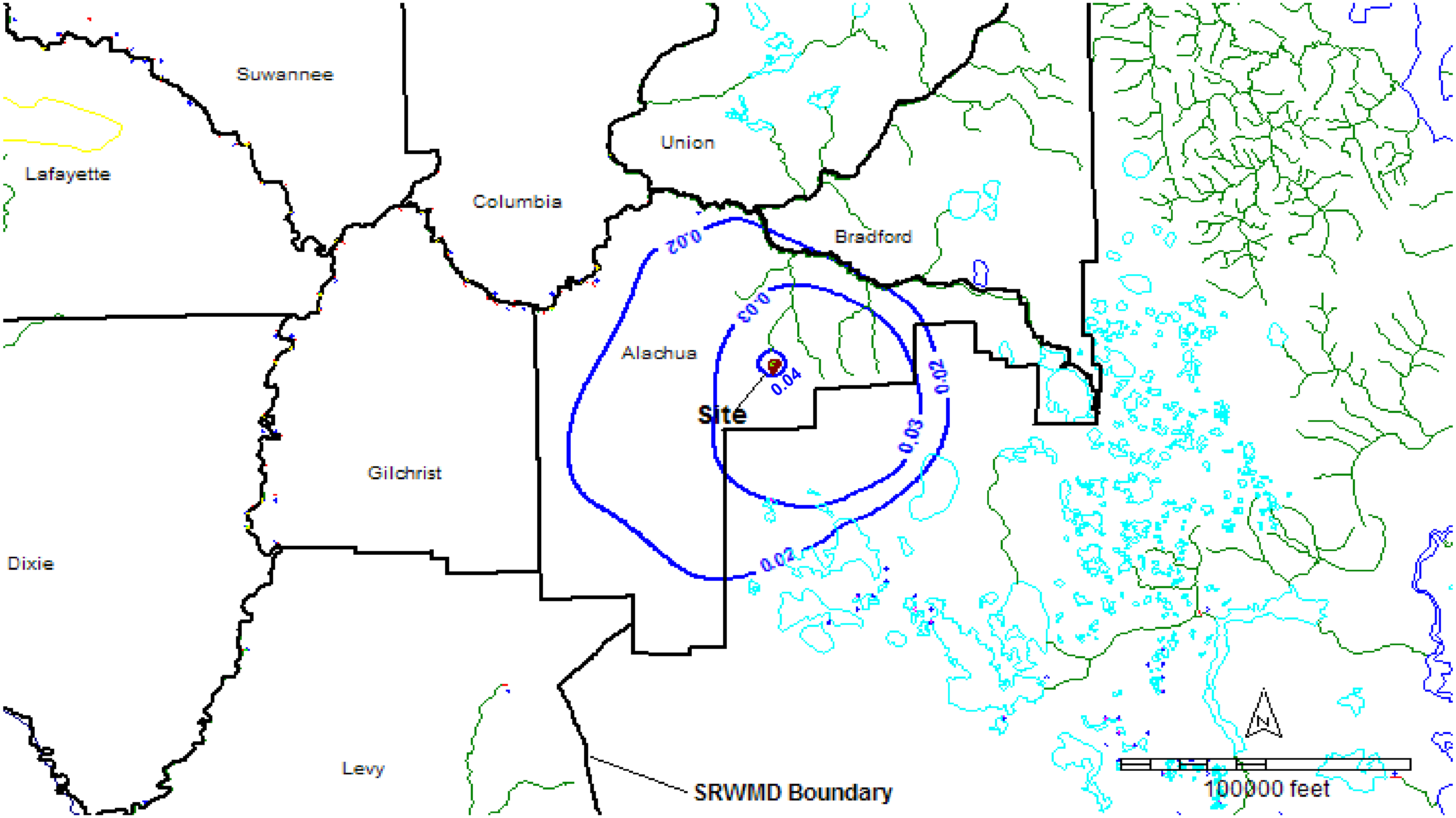

FIGURE 7.

STEADY-STATE DRAWDOWN (FT) IN UFA (LAYER 3) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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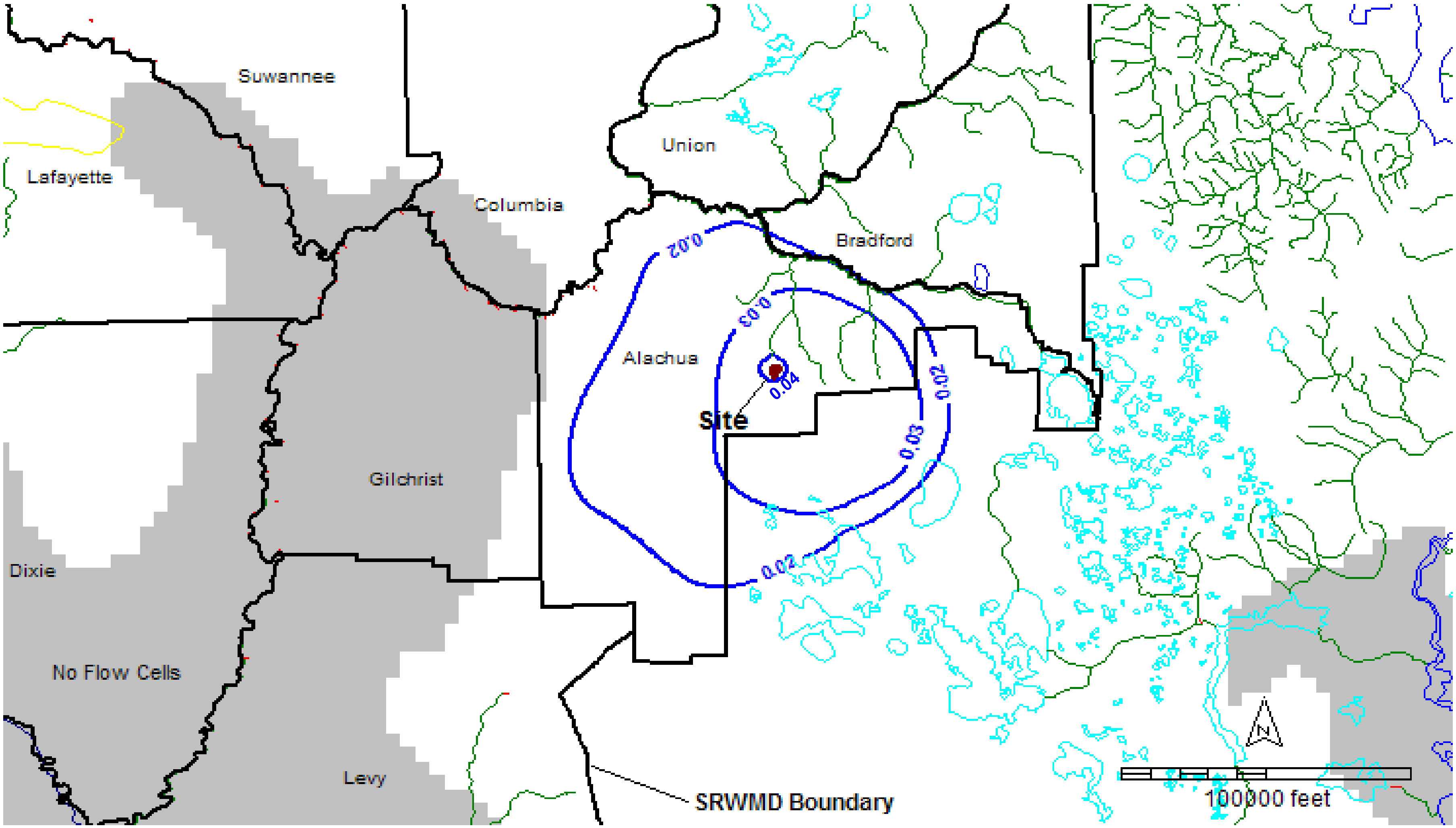

FIGURE 8.

STEADY-STATE DRAWDOWN (FT) IN MCU (LAYER 4) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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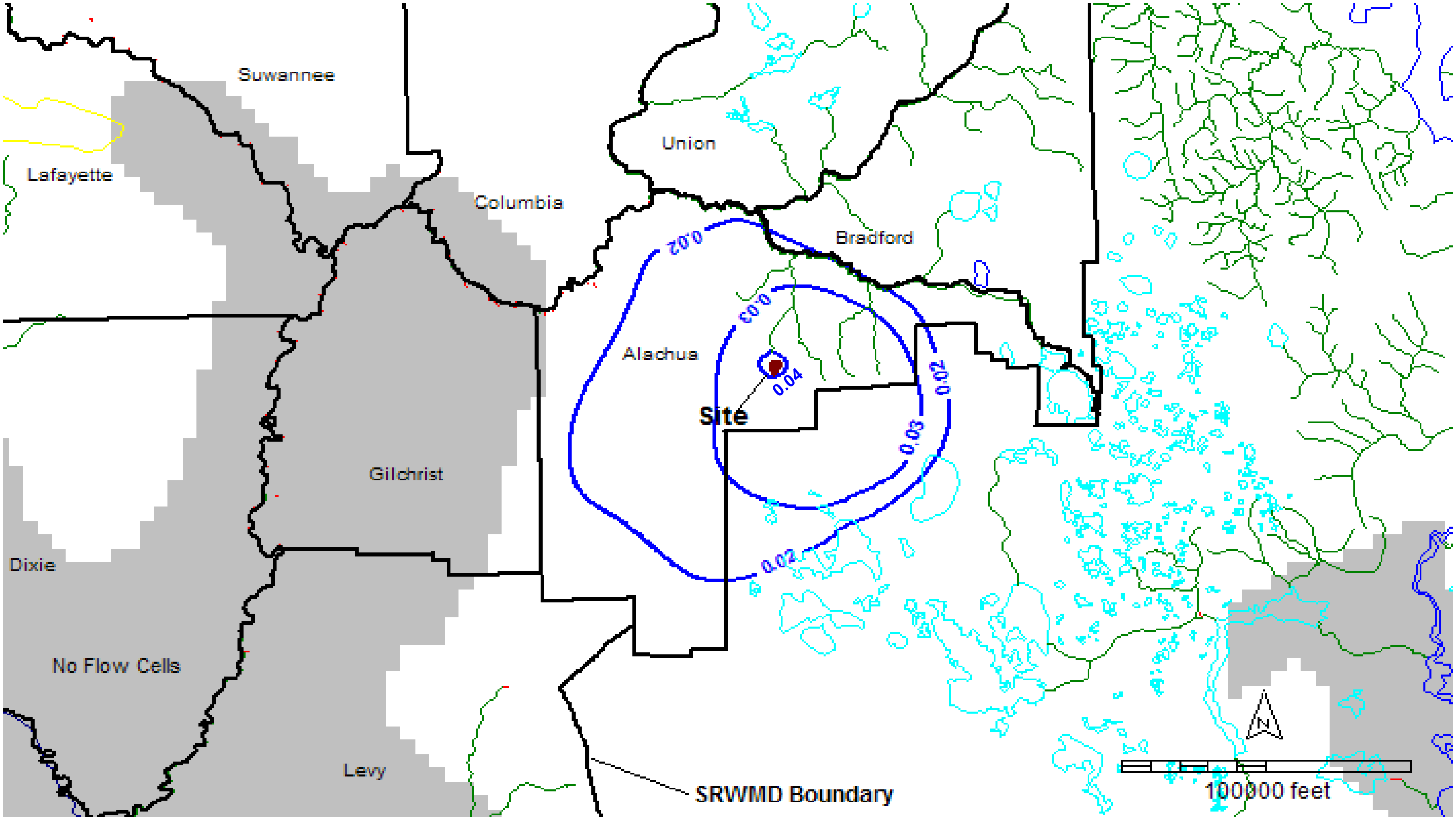

FIGURE 9.

STEADY-STATE DRAWDOWN (FT) IN LFA (LAYER 5) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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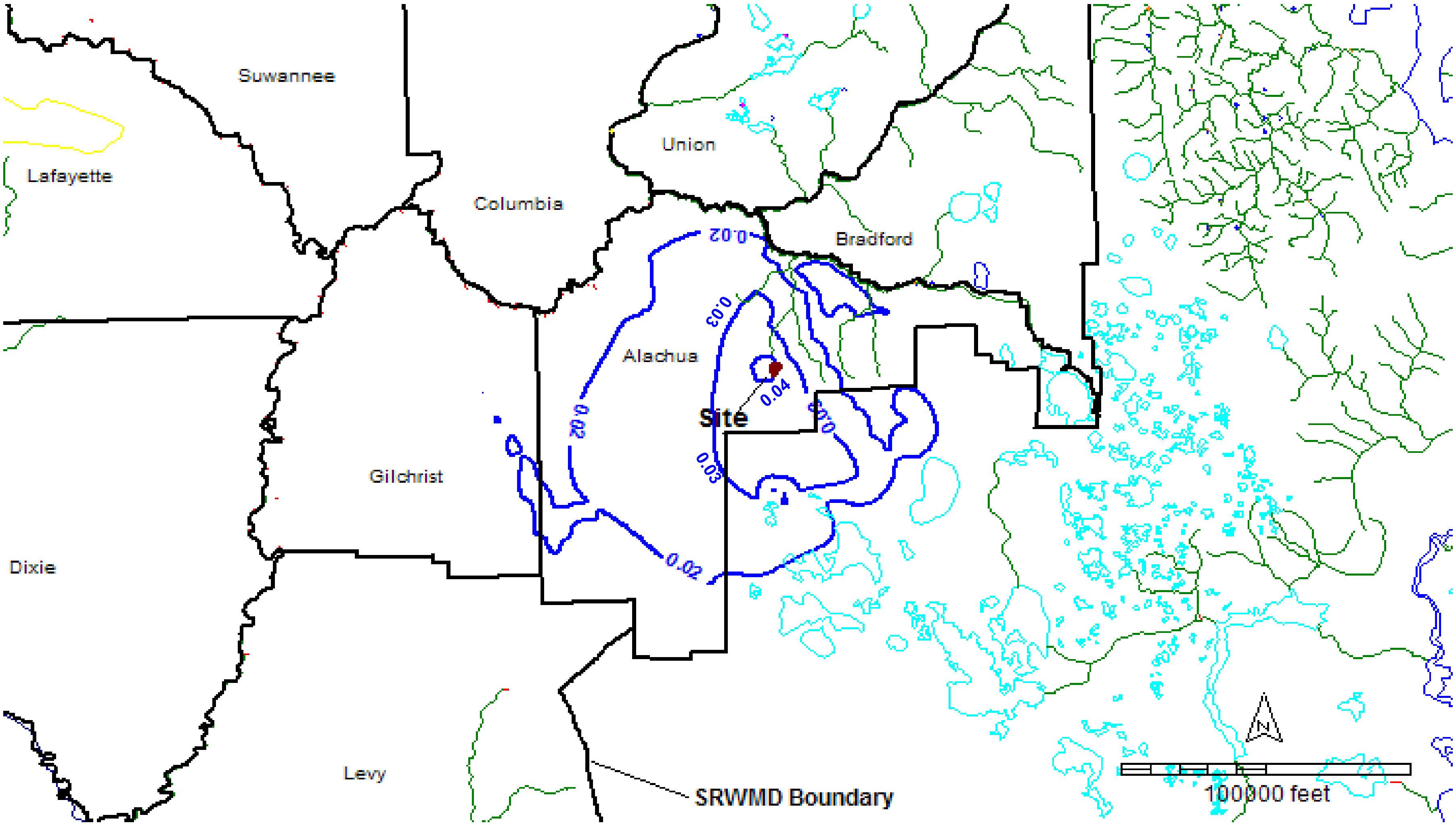

FIGURE 10.

STEADY-STATE DRAWDOWN (FT) IN IAS (LAYER 2) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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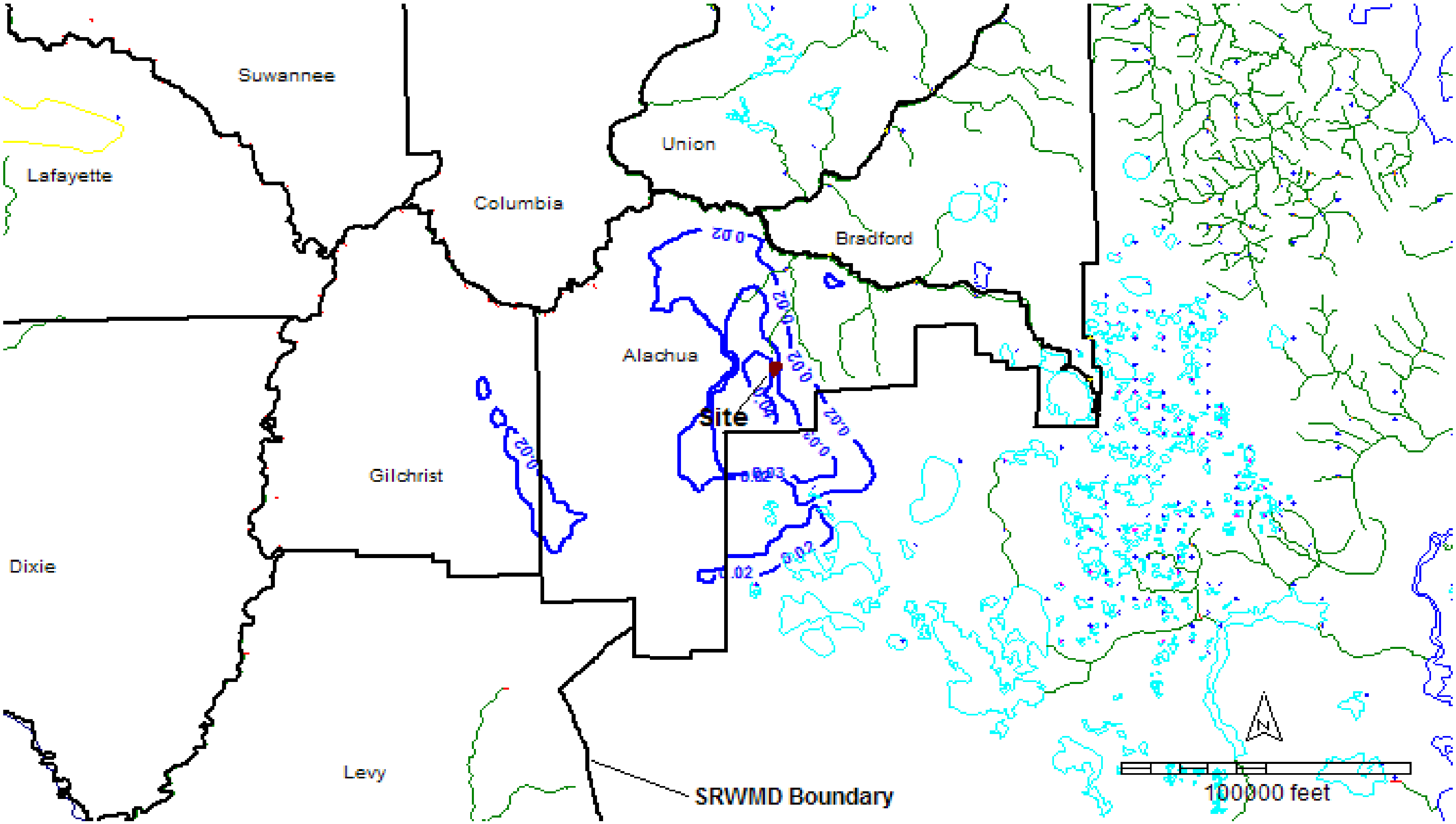

FIGURE 11.

STEADY-STATE DRAWDOWN (FT) IN SAS (LAYER 1) BASED ON 1.4-MGD WITHDRAWAL

Sources: Schneider *et al*., 2008. ECT, 2009.

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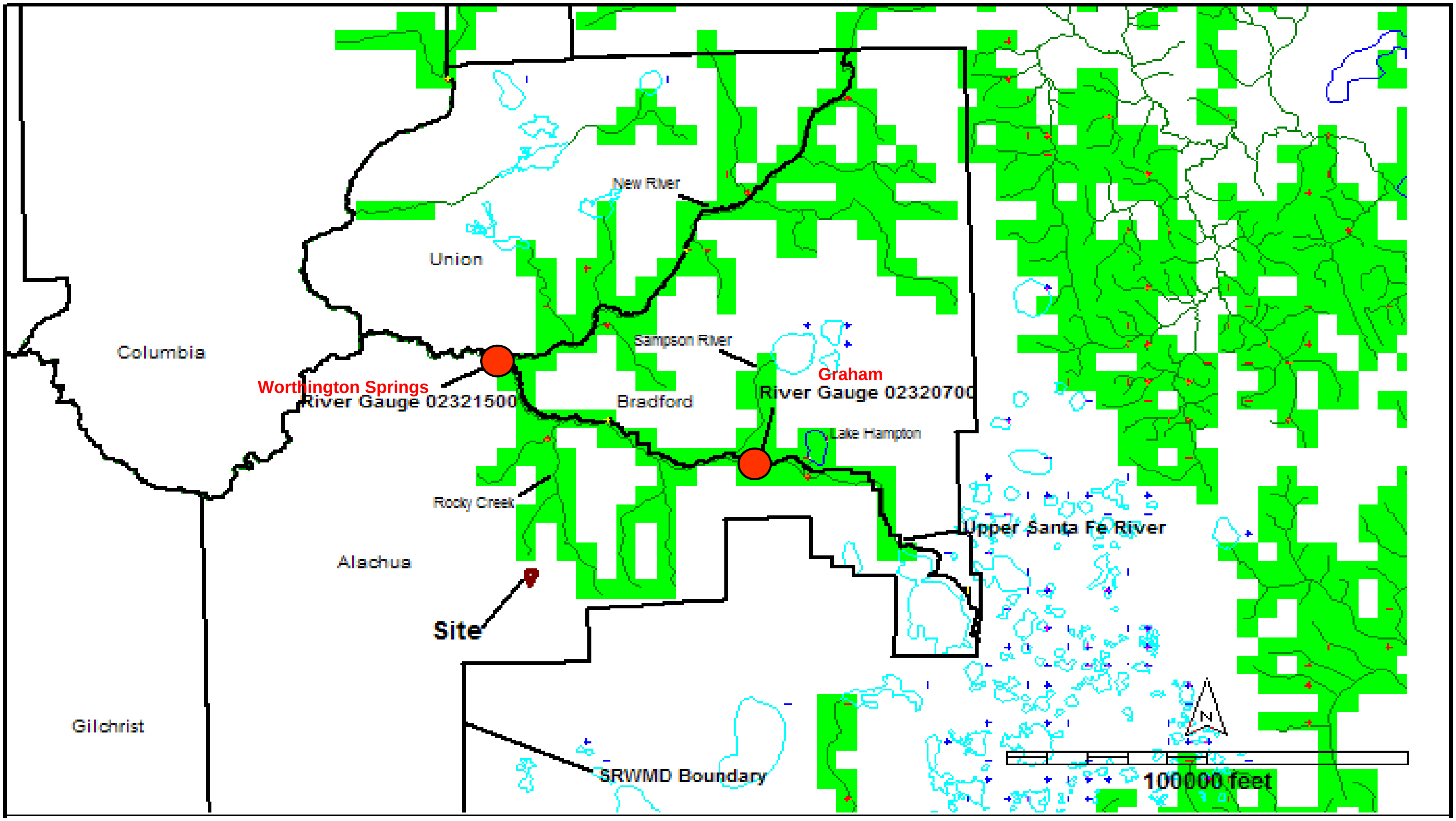
3.1.4 MINIMUM FLOWS AND LEVELS—MODELING METHODS AND RESULTS

The SRWMD Model (Groundwater Vistas version) was also used to evaluate the impact of the proposed 1.4-MGD groundwater withdrawal on minimum flows and levels (MFLs) set for the Upper Santa Fe River, specifically, the MFLs established for the gauges near Graham and at Worthington Springs regarding flows. Figure 12 illustrates the location of the river gauges 02320700 near Graham and 02321500 at Worthington Springs. At its nearest location, the Upper Santa Fe River is approximately 8 miles northeast of the GREC Site.

Changes in the Upper Santa Fe River flow based on the modeling results were calculated between the headwaters and gauge 02320700 near Graham and between gauge 02320700 near Graham and gauge 02321500 at Worthington Springs. The changes in flow were also calculated for Lake Hampton, a northern tributary (Sampson River), two southern tributaries (including Rocky Creek), and the New River and associated tributaries. All of these surface waters are upstream of gauge 02321500 at Worthington Springs. Lake Hampton is also upstream of the gauge near Graham.

The river segments and tributary flows were then summed to estimate the grand total change in flow from the Upper Santa Fe River headwaters to the gauge at Worthington Spring predicted by the SRWMD Model due to the additional 1.4-MGD withdrawal from the UFA (Layer 3).

The change in flow was calculated by first identifying the individual model cell flux (or flow) in each model cell defined as a river boundary cell (river boundary cells are coded in green in the model and in Figure 12) along the Upper Santa Fe River target area. These model cells or sets of cells along the target area of the Upper Santa Fe River were assigned a unique river reach number. Reach numbers are a feature of the Groundwater Vistas program that allows the cell-by-cell flux to be calculated by the model for a particular river reach and to be output and summed. The flux across a given river boundary cell corresponds with the interchange between groundwater and surface water. That is, a given river boundary cell with a negative flux indicates a net discharge of groundwater



GREEN = DEFINED RIVER BOUNDARY CELL

FIGURE 12.

LOCATION OF SANTA FE RIVER GAUGES 02320700 NEAR GRAHAM AND GAUGE 02321500 AT WORTHINGTON SPRINGS

Sources: Schneider *et al*., 2008. ECT, 2009.

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into surface water at that cell, and a positive flux indicates a net recharge of groundwater from surface water at that cell.

Once the river reaches were defined, the baseline flux was calculated (i.e., the flux between groundwater and surface water). Baseline flux is based on the cell-by-cell output for the defined river reaches from the MODFLOW model run without the proposed 1.4-MGD groundwater withdrawal. The model then was rerun with the 1.4-MGD Upper Floridan aquifer groundwater withdrawal included to generate the predicted flux in the defined river reach cells. The river cell flux calculated in the additional 1.4-MGD model scenario was then subtracted from the baseline river cell flux to generate the change in river flow in the target area of the Upper Santa Fe River as a result of the 1.4-MGD withdrawal.

Table 2 presents a summary of the calculated change in river flow for the target portion of the Upper Santa Fe River. The grand total change in surface water flow predicted by the SRWMD Model from the headwaters of the Upper Santa Fe River to the gauge near Graham (02320700), including the upstream Lake Hampton and tributary, was a net reduction of 0.00016 cubic feet per second (cfs). The grand total change in surface water flow predicted by the SRWMD Model from the headwaters of the Upper Santa Fe River to the gauge at Worthington Springs (02321500), including all upstream tributaries, was a net reduction of 0.00341 cfs.

These calculated changes in flows are considered extremely small and are probably immeasurable in the actual river flow. For comparison purposes, the net reductions of 0.00016 cfs at the gauge near Graham and 0.00341 cfs at the Worthington Springs gauge represent flow rates of 0.07 and 1.5 gallons per minute (gpm), respectively. Whereas the average garden hose flows at 10 to 16 gpm and a bathroom faucet flows at 3 gpm, thus, the 1.5-gpm flow reduction at Worthington Springs is approximately one-tenth of the flow from an average garden hose or one-half of the flow from a bathroom faucet.

Table 2. Change in Upper Santa Fe River Flow Based on 1.4-MGD Upper Floridan Withdrawal

Location	Baseline Cell Flux* (cfs)	Cell Flux Based on 1.4 MGD Pumping (cfs)	Change in River Flow (Baseline - Pumping) (cfs)
Total flow from the headwaters of the Santa Fe River to Gauge 02320700 near Graham	-0.31732	-0.31727	-0.00005
Total Lake Hampton and tributary flow to the Santa Fe River	-0.02229	-0.02218	-0.00011
Grand Total from Santa Fe River headwaters to Gauge 02320700 near Graham	**-0.33961**	**-0.33945**	**-0.00016**
Total Santa Fe River flow from Gauge 02320700 near Graham to Gauge 02321500 at Worthington Springs	4.06398	4.06497	-0.00099
Total Santa Fe River North Tributary (Sampson River) flow	-0.43662	-0.43659	-0.00003
Total Santa Fe River South tributaries (includes Rocky Creek) flow	-1.46415	-1.46317	-0.00098
Total New River and tributaries flow to the Worthington Springs Gauge 02321500	-9.30128	-9.30002	-0.00125
Grand total flow from the Santa Fe River headwaters to Gauge 02321500 at Worthington Springs	**-7.47768**	**-7.47427**	**-0.00341**

*Negative cell flux = flow from aquifer to river.
Positive cell flux = flow to aquifer from river.

Source: ECT, 2009.

3.2 NSSCOU ANALYTICAL MODEL

The SRWMD Model is used to assess a variety of potential impacts resulting from the proposed 1.4-MGD withdrawal. However, that model scale is not appropriate for evaluating impacts to immediately local features due to the model cell size of 5,000 by 5,000 ft. Therefore, an analytical model was used as part of this modeling analysis to assess potential drawdown impacts to local wetland areas.

ECT used the analytical NSSCOU aquifer model, which is based on the coupled semiconfined aquifer conditions using a series of equations programmed by Motz (1978 and 1996). At the July 7, 2009, meeting with SRWMD staff, it was agreed that the NSSCOU model is most appropriate for evaluation of drawdowns in relation to local wetland locations.

The published analytical methods of Motz (1978 and 1996) and Denis and Motz (1998) were developed into a FORTRAN program and used to predict the drawdowns for various groundwater pumping scenarios, as described herein. The top layer can be under water table conditions or semiconfined. If the top layer is a water table aquifer, as in this application, the model simulates a reduction in the evapotranspiration rate caused by the resulting drawdown.

The basic assumptions and conditions for the NSSCOU analytical model include:

- The aquifers act under water table or leaky confined conditions, respectively.
- The aquifer has a seemingly infinite areal extent.
- The aquifer is relatively homogeneous, isotropic, and of uniform thickness.
- The aquifer potentiometric surface is initially nearly horizontal.
- The pumping rate is constant.
- The water from storage is released instantaneously with decline in head.
- The pumping well diameter is small enough to neglect storage in the well.

3.2.1 NSSCOU MODEL SIMULATIONS

Two NSSCOU simulations were completed for this analysis. The Case 1 NSSCOU simulation uses aquifer parameter values as defined in the SRWMD Model for the GREC location. The Case 2 NSSCOU simulation, however, uses site-specific transmissivity values of 15 ft^2/day for the surficial aquifer and 40,000 ft^2/day for the Upper Floridan aquifer (this value probably is significantly lower than the actual UFA transmissivity, since it is based on testing that included only a small fraction [approximately 20 percent] of the total aquifer thickness, as described in SCA Section 3.3.2.1). These transmissivites are much lower than those in Case 1. The much lower transmissivity values used in Case 2 cause it to be much more conservative toward predicting higher drawdowns locally than would Case 1.

In addition, because the surficial aquifer is unconfined, it was necessary to calculate a value for the evapotranspiration reduction rate (Etr) used in the NSSCOU model for both simulations. An Etr of 0.0019 was calculated based on an annual average evaporation rate in the site area of 41.7 inches per year and an annual average water table elevation change of 5 ft. Table 3 presents a summary of the aquifer parameter values used to define the NSSCOU input parameters for both Cases 1 and 2.

The NSSCOU simulations used a withdrawal rate (Q) of 187,180 cubic feet per day (ft^3/day) (1.4 MGD) from the Upper Floridan aquifer in both Case 1 (SRWMD Model parameter values) and Case 2 (site-specific transmissivities).

3.2.2 NSSCOU ANALYTICAL MODELING RESULTS

Table 4 summarizes the NSSCOU analytical model results for both Case 1 and 2. For the surficial aquifer, the NSSCOU simulation using the regional parameters in Case 1 predicts 0.0007 ft of drawdown at a distance of 100 ft from the well. The much more conservative Case 2 predicts 0.07 ft of drawdown in the surficial aquifer at a distance of 100 ft from the withdrawal well, as shown on Table 4.

Table 3. Summary of NSSCOU Ground Water Modeling Parameters

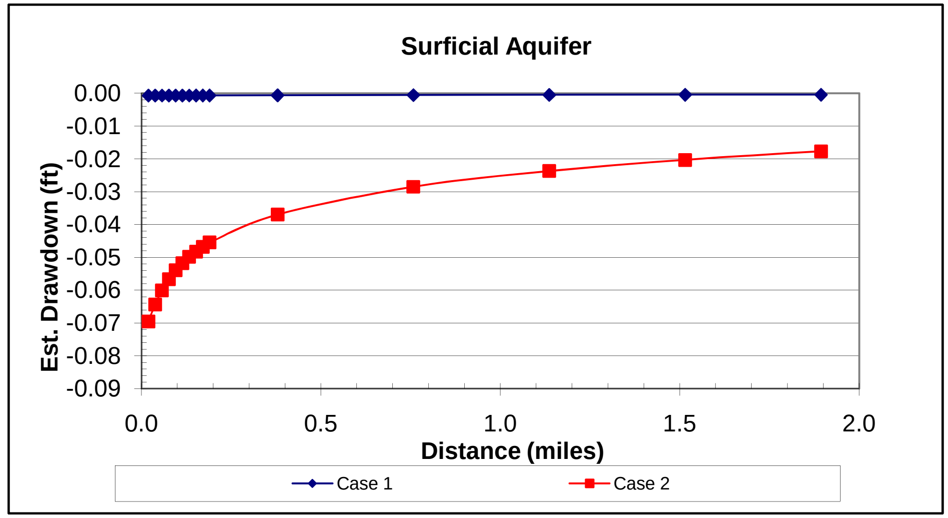
Hydrogeological Data	Case 1 SRWMD Model Parameter Values	Case 2 Site Specific Transmissivity Values
SAS		
Transmissivity (ft^2/day)	1,908	15.0
Annual average ET rate (in/yr)	-	41.7
Annual average water table elevation change (ft)	-	5.0
Etr or leakance (1/day)	1.90E-03	1.90E-03
Specific yield-steady-state	0.00E+00	0.00E+00
IAS		
Vertical hydraulic conductivity (ft/day)	0.0027	0.0027
Thickness (ft)	84.5	84.5
Leakance (1/day)	3.2E-05	3.2E-05
UFA		
Transmissivity (ft^2/day)	4,048,725	40,000
Storage - steady-state	0.00E+00	0.00E+00

Source: ECT 2009, SRWMD Model (Groundwater Vistas).

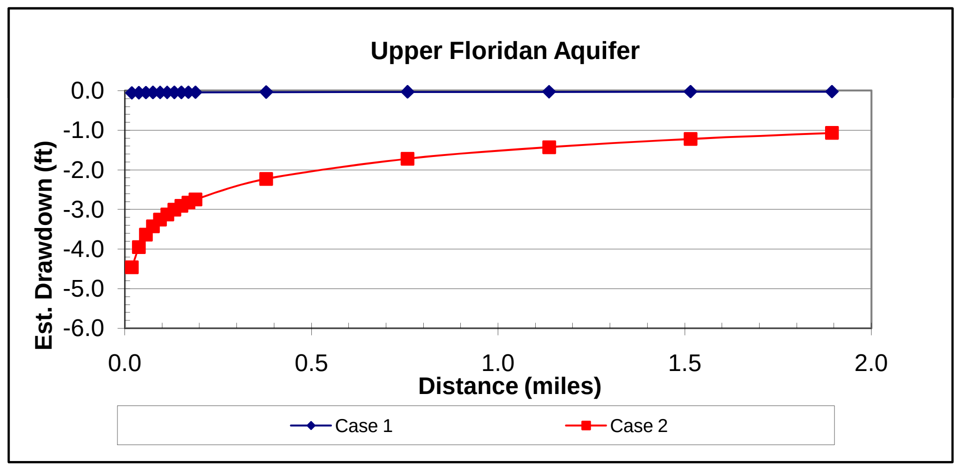
Table 4. Summary of Predicted Steady-State NSSCOU Drawdown For GREC

Case 1 Uses SRWMD District Model Parameter Values
Case 2: Uses Lower Transmissivity for Surficial (15.0 ft2/day) and Upper Floridan (40,000 ft2/day)

Radial Distance - R		Surficial Aquifer Estimated Drawdown (ft)	
ft	miles	Case 1	Case 2
100	0.0	-7.17E-04	-6.96E-02
200	0.0	-7.14E-04	-6.44E-02
300	0.1	-7.11E-04	-6.01E-02
400	0.1	-7.08E-04	-5.67E-02
500	0.1	-7.03E-04	-5.40E-02
600	0.1	-6.99E-04	-5.18E-02
700	0.1	-6.95E-04	-4.99E-02
800	0.2	-6.90E-04	-4.83E-02
900	0.2	-6.85E-04	-4.68E-02
1,000	0.2	-6.80E-04	-4.55E-02
2,000	0.4	-6.33E-04	-3.70E-02
4,000	0.8	-5.61E-04	-2.85E-02
6,000	1.1	-5.13E-04	-2.37E-02
8,000	1.5	-4.78E-04	-2.03E-02
10,000	1.9	-4.51E-04	-1.77E-02



Radial Distance - R		Upper Floridan Aquifer Estimated Drawdown (ft)	
ft	miles	Case 1	Case 2
100	0.0	-6.11E-02	-4.46E+00
200	0.0	-5.60E-02	-3.95E+00
300	0.1	-5.30E-02	-3.64E+00
400	0.1	-5.09E-02	-3.43E+00
500	0.1	-4.92E-02	-3.26E+00
600	0.1	-4.79E-02	-3.13E+00
700	0.1	-4.68E-02	-3.01E+00
800	0.2	-4.58E-02	-2.91E+00
900	0.2	-4.49E-02	-2.83E+00
1,000	0.2	-4.41E-02	-2.75E+00
2,000	0.4	-3.90E-02	-2.23E+00
4,000	0.8	-3.39E-02	-1.72E+00
6,000	1.1	-3.10E-02	-1.43E+00
8,000	1.5	-2.88E-02	-1.22E+00
10,000	1.9	-2.72E-02	-1.07E+00



Note: NSSCOU - Coupled Aquifer Drawdown Program (Denis & Motz, 1998).

Source: ECT 2009

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4.0 DISCUSSION AND CONCLUSIONS OF IMPACTS ASSESSMENT

This section provides discussion and interpretation of the various groundwater modeling results presented in Section 3.0, and it provides conclusions regarding the assessment of potential impacts from the proposed groundwater withdrawal of 1.4 MGD. This section also provides discussion and conclusions regarding other conditions for issuance of permits that are not directly related to groundwater modeling.

4.1 REASONABLE— BENEFICIAL USE

On August 21, 2009, SRWMD formally proposed significant amendments to Chapter 40B-2, F.A.C. The exact text from the proposed Section 40B-2.301, F.A.C., is printed in Section 1.0 of this document. To determine whether a proposed use of water is a reasonable-beneficial use, the SRWMD language in the proposed Rule 40B-2.301(2), F.A.C., identifies 11 elements to be considered. This assessment takes into consideration that proposed rule language as guidance. Each of those 11 elements (draft 40B-2.301[2], paragraphs [a] through [k]) is reprinted in the following, and each is addressed in sequence.

"(a) The use must be in such quantity and quality as is necessary for economic and efficient use."

The GREC Project will provide Gainesville Regional Utilities (GRU) and its customers with clean, reliable, and economical electric power. The efficient generation of electricity requires the use of water for cooling (i.e., cooling tower makeup water) and various process/service water uses (see GREC water balances in Attachment 1 of this appendix). The GREC Project has been designed to minimize the use of water by maximizing the recycling/reuse of water to the extent practicable. This efficient use of water will be accomplished with the proposed use of several water treatment systems and a zero liquid discharge (ZLD) system.

The various water uses within a power plant require very high- to relatively high-quality water to maintain the efficiency of the plant systems and equipment, as well as prevent equipment fouling and damage. Even though water from the proposed UFA source is relatively high quality, treatment will be needed to meet the quality requirements of certain plant uses such as demineralization treatment for boiler makeup water. The GREC Project design also includes softener/clarifier treatment for the raw water supply and two-pass reverse osmosis treatment prior to the ZLD system (i.e., brine concentrator/crystallizer) to enhance the efficient recycling/reuse of plant wastewater streams. The use of water with lower initial quality than the quality of the proposed UFA source would require more extensive and costly treatment to meet the plant quality requirements, as well as would require a higher volume of water to replace water lost during the additional treatment processes and would produce additional treatment sludges requiring disposal in an offsite landfill.

Through use of the ZLD system, the GREC Project will have no industrial wastewater discharges to surface or groundwaters. The ZLD system will also provide for the repeated recycling/reuse of plant wastewaters to minimize water use. Therefore, the proposed quantity and quality of water for the GREC Project has been designed and minimized to the extent practicable to meet the water requirements for economic and efficient electric power generation use.

"(b) The use must be for a purpose that is both reasonable and consistent with the public interest."

The proposed water use is required for the operation of the GREC renewable, biomass energy electrical generating facility. The purpose of GREC is to provide GRU with a clean, reliable supply of electricity to meet its customers' needs at a reasonable cost. As discussed in Chapter 2.0 of this SCA, GREC, LLC, and GRU have jointly filed an application for determination of need for the proposed GREC Project with the Florida Public Service Commission (FPSC) on September 18, 2009. Information in this application demonstrates that the GREC Project will provide numerous economic, environmental, and regulatory benefits to GRU, its customers, and the public, including but not limited to the following:

- GREC will help maintain generating system reliability and integrity and provide adequate electricity at a reasonable cost.

- GREC will provide fuel diversity, increase fuel supply reliability, and reduce fuel price volatility.
- GREC will add value to GRU's generation portfolio by materially improving the age distribution of the system's generation fleet.
- The renewable energy from GREC will allow GRU to meet any of the renewable energy portfolio standards that have been seriously considered at a state or federal level to date.
- The accompanying carbon credits from GREC will provide a valuable hedge against future carbon constraint legislation.
- GREC will support Gainesville's ethics for recycling and greenhouse gas reduction.

Further, the Gainesville City Commission selection of the GREC Project was the result of an extensive planning and public outreach process, including 43 public workshops and the Gainesville City Commission meetings, several dozen presentations to civic and community groups, as well as competitive bidding process.

Based on the need for and benefits of the GREC Project, the proposed water use is for a purpose that is both reasonable and consistent with the public interest.

"(c) The source of the water must be capable of producing the requested amounts and appropriate quality of water."

The water source is groundwater from the UFA (locally, the entire FAS). The FAS is approximately 1,450 ft thick and is highly transmissive in the area of the GREC Site, as described in Section 3.0 (see Table 1) and in the SCA Section 3.3.2. The UFA is clearly capable of physically producing the requested 1.4 MGD.

The UFA is also capable of producing an appropriate quality of water, which is the lowest quality water that is locally feasible for its intended use. Local groundwater quality is described in detail within Section 3.3.2.1 of the SCA. Please also refer to the alternate water supply feasibility assessment in Attachment 3 of this WUP application appendix.

"(d) The use will not degrade the source from which it is withdrawn."

The SRWMD Model results predict extremely small drawdowns would occur in the UFA (see Figure 7) and the SAS (see Figure 11); less than 0.05 ft of drawdown is predicted everywhere in all aquifers. This miniscule hydraulic influence will cause no significant changes in groundwater flow rates or directions in any aquifer; it is probable that any such changes would be too small to measure. Therefore, it is highly improbable that the miniscule hydraulic influence induced by the requested withdrawal would have any measurable influence on any type of degradation of the UFA.

The criteria for degradation of water sources is described in Section 3.1.11 of SRWMD's July 16, 2009, Draft Water Use Permitting Guide. The requested use of 1.4 MGD of groundwater from the UFA will not degrade the source aquifer.

Please also refer to the discussion in the following Item (i) for additional information relevant to the concept of water quality degradation.

"(e) The use will not cause or contribute to flooding."

The SRWMD Model results for the surficial aquifer predict less than 0.044 ft of drawdown everywhere (see Figure 11). Similarly small drawdowns are predicted locally by the NSSCOU model for the surficial aquifer (see Table 4); at a distance of 100 ft away from the pumping well, Case 1 predicts only 0.0007 ft of drawdown, and Case 2 predicts 0.07 ft of drawdown. These extremely small drawdowns in the surficial aquifer would not adversely impact any surface feature and would not influence flooding in any manner.

The proposed use of 1.4 MGD of groundwater will have no influence on flooding.

"(f) The use will not harm offsite land uses."

The SRWMD Model results for the surficial aquifer predict less than 0.044 ft of drawdown everywhere (see Figure 11). Similarly small drawdowns are predicted locally by the NSSCOU model for the surficial aquifer (see Table 4); at a distance of 100 ft away from the pumping well, Case 1 predicts only 0.0007 ft of drawdown, and Case 2 predicts 0.07 ft of drawdown. These extremely small drawdowns in the surficial aquifer would not adversely impact any surface feature and would not adversely impact any type of offsite land uses.

The proposed use of 1.4 MGD of groundwater will not cause harm or adversely impact offsite land uses.

"(g) The use will not cause harm to wetlands or other surface waters. Harm to wetlands or other surface waters must be mitigated after completion of reduction or elimination of harm in accordance with sections 3.1.8. through 3.1.10. of the Water Use Permitting Guide."

The SRWMD Model results for the surficial aquifer predict less than 0.044 ft of drawdown everywhere (see Figure 11).

Attachment 1 to this WUP application appendix includes a map showing the proposed water supply well locations along with the locations of local wetlands. Each proposed water supply well is located at least 300 ft away from the nearest wetland. At a distance of 300 ft away from the pumping well, drawdowns predicted by the NSSCOU model for the surficial aquifer (see Table 4) are 0.0007 ft for Case 1 and 0.06 ft for Case 2. These extremely small drawdowns in the surficial aquifer would not adversely impact any surface feature, wetland, or other surface waters.

The effects of the proposed use of 1.4 MGD of groundwater will not constitute harm to wetlands or other surface waters.

"(h) The use will not cause or contribute to a violation of either minimum flows or levels."

As presented in Section 3.1.4 of this assessment report, the SRWMD Model was used to evaluate the impact of the proposed 1.4-MGD groundwater withdrawal on the MFLs set for the Upper Santa Fe River, specifically, the MFLs established for the gauges near Graham and at Worthington Springs regarding flows. Table 2 presents a summary of the calculated change in river flow for the target portion of the Upper Santa Fe River.

The grand total change in surface water flow predicted by the SRWMD Model from the headwaters of the Upper Santa Fe River to the gauge Near Graham (02320700), including the upstream Lake Hampton and tributary, was a net reduction of 0.00016 cfs. This miniscule change in flow complies with the MFLs specified at Rules 40B-8.061(1)(a) through (d), F.A.C. It also complies with Rules 40B-8.061(1)(e) through (g), F.A.C., because the predicted impacts are *de minimis* (immeasurably small).

The grand total change in surface water flow predicted by the SRWMD Model from the headwaters of the Upper Santa Fe River to the gauge at Worthington Springs (02321500), including all upstream tributaries, was a net reduction of 0.00341 cfs. This miniscule change in flow complies with the MFLs specified at Rules 40B-8.061(1)(a) through (d), F.A.C. It also complies with Rules 40B-8.061(1)(e) through (g), F.A.C., because the predicted impacts are *de minimis* (immeasurably small).

Therefore, on an individual basis, the requested 1.4-MGD withdrawal from the UFA would comply with the MFLs.

These results and conclusions were presented to SRWMD at a meeting on September 9, 2009, and SRWMD staff concurred with these conclusions. SRWMD staff also indicated that the predicted changes in flow are too small to even be considered in SRWMD's cumulative evaluation of impacts, because the results are lower than the precision and accuracy limits of the SRWMD Model.

"(i) The use will not cause or contribute to a violation of state water quality standards in waters of the state as set forth in Chapters 62-301, 62-302, 62-520, and 62-550, F.A.C."

As described previously in Item (d), the SRWMD Model results predict extremely small drawdowns would occur in the UFA (see Figure 7) and the SAS (see Figure 11); less than 0.05 ft of drawdown is predicted everywhere in all aquifers. This miniscule hydraulic influence will not cause any significant changes in groundwater flow rates or directions in any aquifer; it is probable that any such changes would be too small to measure. Therefore, it is highly improbable that the miniscule hydraulic influence induced by the requested withdrawal will have any significant influence on water quality changes or water quality violations in any aquifer or surface water, as further described in the following subsections.

Saline Water

Based on the small magnitude of the predicted drawdown, as well as the inland location of the GREC Site, lateral saltwater intrusion will not be induced into any aquifer to any measurable degree.

Similarly, saline water upconing is not likely to occur to any significant degree. FAS groundwater quality data as a function of depth is available from the deep injection test well constructed at the GRU Deerhaven Generating Station (DGS) facility in 1977. Select data results for chloride, total dissolved solids (TDS), and sulfate are summarized here in milligrams per liter (mg/L) as a function of depth in feet below land surface (ft bls) (G/ACRESUB, 1977):

Depth (ft bls)	Chloride (mg/L)	TDS (mg/L)	Sulfate (mg/L)
700	8	338	48
1,000	13	490	115
1,260	74	646	133
1,500	17	583	165
1,600	22	1,514	575
1,776	455	—	575

The base of the FAS occurs at a depth of 1,550 ft bls, which corresponds with the top of the Cedar Keys formation that is part of the sub-Floridan confining unit (SFCU) (Schneider *et al.*, 2008). SRWMD's July 16, 2009, Draft Water Use Permitting Guide defines *fresh water* as an aqueous solution with a chloride concentration equal to or less than 250 mg/L (whereas the term "saline water/brackish water" applies to water with greater than 250 mg/L chloride). On that basis, the entire thickness of the FAS is considered fresh water at the GREC Site. Consequently, it is highly probable that the miniscule

This view is further supported by recent data from the adjacent GRU facility. The GRU DGS groundwater supply wells have been in operation for more than 30 years, with groundwater withdrawal rates much higher than the GREC requested rate of 1.4 MGD. The chloride concentration at GRU supply well No. 4 was recently reported at 10 mg/L (SCA Table 3.3.2-13). Therefore, it is evident that the GRU groundwater withdrawals have not induced upconing of saline water, and it logically follows that the much lower GREC withdrawal rates will also not induce upconing of saline water.

Water Quality Relations Within and Between the SAS and UFA

The groundwater quality data for the GREC and GRU site area (SCA Section 3.3.2.1) shows that several analytes have elevated concentrations in the SAS. However, none of those particular analytes exceed a primary drinking water standard at the existing GRU DGS property boundaries (i.e., inclusive of the GREC Site). Further, the analytical data in Section 3.3.2.1 of the SCA indicate that the deeper UFA groundwater quality has been within drinking water quality standards. Thus, the analytical groundwater quality data suggest that the UFA underlying the DGS site is not affected by levels of certain analytes in the SAS.

As shown in SCA Figure 3.3.2-3, the apparent direction of groundwater flow is primarily westward in the SAS, with a northwesterly flow direction indicated for the extreme northeastern portion of the GREC Site. It also shows that the water table elevation is typically approximately 7 ft higher on the east (upgradient) side of the GREC Site as compared with the west (downgradient) side. The SAS groundwater elevation data also suggest the presence of a local groundwater divide; as such, the direction of groundwater flow in western portions of the adjacent GRU property appears to be primarily toward the south and southwest in the SAS. The onsite hydrogeologic parameter values suggest an average linear groundwater flow velocity of 15 feet per year (ft/yr) toward the west in the SAS at the GREC Site.

The local NSSCOU model results (see Table 4) predict that almost no drawdown would occur in the SAS from the 1.4-MGD UFA groundwater withdrawal. The miniscule drawdown in the SAS will cause no perceptible change in the local groundwater flow directions. That is, considering that the water table slopes approximately 7 ft across the site, the predicted drawdowns (less than 0.07 ft everywhere) will cause no perceptible shift in the water table elevation contours. Accordingly, there will be no significant influence on the migration of any water quality impacts in the SAS. Therefore, the proposed use of 1.4 MGD of groundwater from the UFA will have no perceptible influence on water quality anywhere in the SAS.

As shown in SCA Figure 3.3.2-3, the water table of the SAS at the GREC typically exists at elevations ranging from approximately 173 to 180 feet-National Geodetic Vertical Datum of 1929 (ft-NGVD). In contrast, the potentiometric surface of the FAS typically exists at elevations ranging from approximately 38 to 48 ft-NGVD beneath the GREC Site. As such, the hydraulic head difference between the SAS and the FAS is typically approximately 130 ft; this is due to the presence of the IAS, which separates the overlying SAS from the underlying UFA. This indicates that the IAS serves as an effective confining unit locally. The onsite hydrogeologic parameter values suggest an average rate of downward vertical movement of groundwater of 0.6 ft/yr through the IAS at the GREC Site (SCA Section 3.3.2.1).

Comparisons of the groundwater quality data for the SAS and the UFA collected by GRU on the DGS property (SCA Section 3.3.2.1) further suggest that the intermediate confining unit is effective at preventing downward migration of impacts from the SAS to the UFA. Those laboratory data results show the UFA water is of potable quality. The difference between the SAS and the UFA groundwater quality data suggests that the UFA underlying the DGS property is not affected by the levels of certain analytes reported in the site's shallow groundwater (SAS). This is due to the presence of the IAS that effectively separates the SAS from the UFA, along with the natural attenuation and adsorption typically affected by clayey sediments like those that comprise the local confining unit.

The GRU DGS groundwater supply wells have been in operation for more than 30 years, with groundwater withdrawal rates much higher than the GREC requested rate of 1.4 MGD. The SAS water quality impacts have apparently not been induced or migrated downward to impact the UFA. Therefore, it logically follows that the much lower GREC withdrawal rates will not induce the SAS water quality impacts to migrate downward to impact the UFA water quality.

Therefore, the proposed GREC use of 1.4 MGD of groundwater from the UFA will have no significant influence on water quality in the UFA.

"(j) The use is otherwise a reasonable-beneficial use as defined in Section 373.019(2), F.S., with consideration given to the factors set forth in subsection 62-40.410(2), F.A.C."

As discussed in Items (a) and (b), the proposed water use is required for the operation of the GREC biomass electric generating facility. GREC has been selected by the Gainesville City Commission as the best alternative for GRU to reliably and cost-effectively meet the electricity needs of its customers. The Commission's decision to select GREC was based on the numerous economic, environmental, and regulatory benefits of the project (see Item [b]), as well as on an extensive public outreach process. GREC has been designed to minimize water use and maximize water conservation through recycling/reuse. As discussed in many of the other items in this subsection, the proposed water use will have no significant impacts on surface water (i.e., MFLs) or groundwater resources, natural resources, water quality, saltwater intrusion, public health, or other legal users.

Further, to conserve groundwater resources in the region and minimize potential impacts of the proposed use in the vicinity of the Site, GREC LLC and GRU have an agreement that GRU will reduce its existing groundwater use approval for DGS by 1.4 MGD after site certification approval of GREC and prior to the initiation of withdrawals for GREC operations (see Attachment 4 in this appendix). Therefore, the approved groundwater use in the immediate site area will not be increased by the proposed water use for GREC.

Thus, the proposed water use is considered to be a reasonable, beneficial use relative to the factors set forth in Rule 62-40.410(2), F.A.C.

"(k) A permit applicant's proposed reasonable-beneficial use of an alternative water supply is presumed to be in the public interest."

Based on SRWMD's draft rule Chapter 40B-2, F.A.C., and WUP Permitting Guide, an alternative water supply feasibility assessment was conducted for GREC. The results of this assessment are presented in Attachment 3 of this appendix. Based on a review of potential alternative water supplies in the area of the GREC Site, the assessment focused on the feasibility of using reclaimed water from either the city of Alachua's domestic wastewater treatment facility (WWTF) or from GRU's Main Street or Kanapaha water reclamation facilities (WRFs). As discussed in the assessment in Attachment 3, the use of these alternative water supplies was not considered to be feasible based on environmental, technical, and economic factors and issues at the present time. However, GREC LLC would consider potentially using reclaimed water in the future to meet GREC's cooling water makeup water needs to the extent that the reclaimed water is reasonably available and economically feasible.

As discussed in the previous items in this subsection, the currently proposed use of 1.4 MGD of groundwater from the UFA is considered to be a reasonable, beneficial use and consistent with public interest and will have no significant impacts on water and other environmental resources.

4.2 INTERFERENCE WITH EXISTING LEGAL USE OF WATER

According to Section 3.1.13 in SRWMD's July 16, 2009, Draft Water Use Permitting Guide, "[i]nterference is considered to occur when the requested use would impair the withdrawal capacity of an existing legal use to a degree that the existing use would require modification or replacement of the withdrawal facilities."

Existing water uses in the area of the GREC facility are described in Section 3.3.3.2 of the SCA. As described in this section, more than 90 percent of the groundwater wells in this region use the UFA, whereas less than 10 percent of the wells use the IAS. The locations of existing wells in the region of the GREC Site are shown in the SCA Figures 3.3.3-1 and 3.3.3-2, and water well details are included in SCA Table 3.3.3-1.

Considering the proposed 1.4-MGD withdrawal from the UFA, the SRWMD Model results for the UFA predict less than 0.05 ft of drawdown everywhere (see Figure 7). Similarly, the SRWMD Model results for the IAS predict less than 0.044 ft of drawdown everywhere (see Figure 10). These extremely small drawdowns will not cause interference with any existing legal use of water.

4.3 CONSISTENT WITH THE PUBLIC INTEREST

The purpose of GREC is to provide GRU and the City of Gainesville with a clean, reliable supply of electricity to meet its customers' needs at a reasonable cost. The proposed water use is required for the efficient operation of the GREC facilities. The Gainesville City Commission's decision to select GREC to meet these needs was the result of an extensive integrated planning and public outreach process, including 43 public workshops and the Gainesville City Commission meetings, several dozen presentations to civic and community groups, as well as a competitive bidding process. Therefore, the broad-based public interests and concerns of the City of Gainesville and Alachua County residents, as well as environmental and other public groups, were considered in the selection of GREC, and GREC is consistent with the public interest of these communities.

4.4 CONCLUSIONS

In conclusion, the information contained in this assessment report demonstrates that the proposed GREC water use will comply with all applicable SRWMD requirements for a water use permit, including, but not limited to, SRWMD's recent amendments to Chapter 40B-2, F.A.C., and SRWMD's new Water Use Permitting Guide.

5.0 REFERENCES

Anderson, M.P., and Woessner, W.W. 1992. Applied Groundwater Modeling: Simulation of Flow and Advective Transport. Academic Press, Inc., New York, 381 pp.

Denis, R.E., and Motz, L.H. 1998. Drawdowns in Coupled Aquifers with Confining Unit Storage and ET Reduction. Groundwater, Vol. 36, No. 2, p. 201-207.

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G. 2000. MODFLOW-2000, the U.S. Geological Survey Modular Ground-Water Model -- User Guide to Modularization Concepts and the Ground-Water Flow Process. U.S. Geological Survey Open-File Report 00-92, 127 p.

Harbaugh, A.W., and McDonald, M.G. 1996. User's Documentation for MODFLOW-96, an Update to the U.S. Geological Survey Modular Finite-Difference Ground-Water Flow Model U.S. Geological Survey Open-File Report 96-485 56 p.

McDonald, M.G., and Harbaugh, A.W. 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model, USGS TWRI Chapter 6-A1, 586 pp.

Motz, L.H. 1978. Steady-State Drawdowns in Coupled Aquifers. Journal of the Hydraulics Division, American Society of Civil Engineers 104, No. HY7: 1061-1074.

Motz, L.H. 1996. Nonsteady-State Drawdowns in Two Coupled Aquifers. Journal of Irrigation and Drainage Engineering, Division, American Society of Civil Engineers 122, No. 1: 19-23.

Sepulveda, N., 2002. Simulation of Ground-Water Flow in the Intermediate and Floridan Aquifer Systems in Peninsular Florida. U.S. Geological Survey Water-Resources Investigations Report 02-4009.

Schneider, J.W., Upchurch, S.B., Chen, J., and Cain, C. 2008. Simulation of Groundwater Flow in North Florida and South-Central Georgia: A Three-Dimensional Model of Groundwater Flow in the Surficial, Intermediate, and Floridan Aquifer Systems. Suwannee River Water Management District, revised August 2008, 92 pp.

ATTACHMENT 3

ALTERNATIVE WATER SUPPLY FEASIBILITY ASSESSMENT

ALTERNATIVE WATER SUPPLY FEASIBILITY ASSESSMENT

Prepared for:

Gainesville Renewable Energy Center
An American Renewables Company

Prepared by:

ECT
Environmental Consulting & Technology, Inc.
3701 Northwest 98th Street
Gainesville, Florida 32606

ECT No. 090408-0100

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1.0 INTRODUCTION

Gainesville Renewable Energy Center, LLC (GREC, LLC), is proposing to construct and operate a nominal 100-megawatt (MW) net woody biomass-fueled electric generating facility within the city of Gainesville in northern Alachua County, Florida. The Gainesville Renewable Energy Center (GREC) will be located on an approximately 131-acre Site leased from the city of Gainesville within the site boundaries of the Gainesville Regional Utilities (GRU) existing Deerhaven Generating Station (DGS). The electrical power output of the proposed GREC will be purchased by GRU to reliably meet its customers' power needs at a reasonable cost.

On August 21, 2009, the Suwannee River Water Management District (SRWMD) published proposed amendments to its water use rules in Chapter 40B-2, Florida Administrative Code (F.A.C.), and its Water Use Permitting Guide. Under these proposed rules and permitting guide, an applicant for a water use permit (WUP) must consider the availability and use of the lowest quality water that is technologically and economically feasible for the intended use. Further, to meet the conditions for issuance of a WUP, SRWMD's draft permitting guide states that an applicant must provide a feasibility assessment for alternative water supplies. The assessment of the feasibility of alternative water supplies will be based on environmental, technical, and economic feasibility criteria.

This report provides the alternative water supply feasibility assessment for the proposed GREC water supply.

2.0 PROPOSED WATER USE AND SUPPLY

The GREC Project will require the use of water to provide for the efficient generation of electricity. The required water uses primarily include evaporative cooling tower makeup water and various process/service water uses. The GREC Project has been designed to minimize the use of water by maximizing the recycling/reuse of water to the extent feasible. The Project's water conservation design features include several water treatment systems and a zero liquid discharge (ZLD) system, which also eliminates industrial wastewater discharges from the facility to surface or groundwaters.

Based on these efficient designs, GREC's required water use will be approximately 1.4 million gallons per day (MGD) on an annual average basis and approximately 1.5 MGD on a maximum daily basis. Currently, these water requirements are proposed to the supplied by groundwater withdrawn from the Upper Floridan aquifer (UFA) through two new supply wells constructed on the Site. Each well will be designed and have pumping capacity to provide up to approximately 20 percent more than the 1.5-MGD maximum daily water requirement to ensure the availability and reliability of the proposed water supply.

As part of the comprehensive environmental licensing/permitting efforts for the GREC Project, detailed modeling and analyses of the proposed use of 1.4 MGD of groundwater from the UFA have been conducted to assess the potential impacts of the proposed use. The results of these assessments show that the proposed use will not harm nor adversely impact groundwater levels and quality, surface waters, wetlands, existing legal users, or other environmental resources on and in the vicinity of the Site.

Further, as part of the proposed water supply plan, GREC, LLC, and GRU have an agreement that GRU would voluntarily reduce its existing groundwater use approval for DGS by 1.4 MGD after the certification approval for the GREC Project. Therefore, under the proposed plan, the approved groundwater use in the Site area will not increase.

3.0 POTENTIAL ALTERNATIVE WATER SUPPLIES

SRWMD's proposed water use rules in Chapter 40B-2, F.A.C., and draft Water Use Permitting Guide define alternative water supplies to include the following:

> "Saltwater; brackish surface and ground water; surface water captured primarily during wet-weather flows; sources made available through the addition of new storage capacity for surface or ground water; water that has been reclaimed after one or more public supply, municipal, industrial, commercial, or agricultural uses; the downstream augmentation of water bodies with reclaimed water; storm water and any other water supply sources that is [*sic*] designed as non-traditional for a water supply planning region in the applicable regional water supply plan."

Due to the location and characteristics of the GREC Site and the surrounding regions, many of these potential alternative water supplies are not available or are not considered feasible for evaluation in this assessment. For example, the Site is located a significant distance from a saltwater source (i.e., 70 miles from the Atlantic Ocean) and from a brackish surface water source (i.e., 50 miles from the St. Johns River). There are no surface water sources with sufficient flows located in the vicinity of the Site to allow for capture of water during wet-weather flows. The Santa Fe River, located approximately 8 miles north, is the closest larger surface water body to the Site. The Site contains significant areas of sensitive wetland communities and is too small to allow for construction of new water storage facilities. Further, there are no significant industrial, commercial, or agricultural sources of reclaimed water or wastewater in the vicinity of the Site.

Based on these locational and site factors and discussions with SRWMD staff, the only potential alternative water supply sources that may be considered feasible for the GREC Project are:

- Reclaimed water from the city of Alachua water reclamation facility (WRF).
- Reclaimed water from either GRU's Main Street or Kanapaha WRF.

The feasibility of using each of these alternative water supplies is assessed in the following subsections.

4.0 CITY OF ALACHUA RECLAIMED WATER

At the recommendation of SRWMD, Environmental Consulting & Technology, Inc. (ECT), the GREC Project environmental consultant, contacted Mr. Mike New, Public Services Director of the City of Alachua, on July 23 and August 11, 2009, to obtain information regarding the city's domestic wastewater treatment and reclaimed water facilities. The following descriptions of the city of Alachua's existing facilities and planned facility upgrades and expansion are based on information provided by Mr. New and from other available sources, such as the revised domestic wastewater facility permit issued by the Florida Department of Environmental Protection (FDEP) on June 19, 2008, for the planned upgrade/expansion.

4.1 EXISTING SYSTEM

The city of Alachua's existing domestic wastewater treatment facility is located to the southeast of the downtown area, south of U.S. Highway 441 (U.S. 441) and County Road (CR) 2054, at the southern terminus of Northwest 126th Terrace. The existing facility has a permitted capacity of 0.937 MGD annual average daily flow (AADF). The facility consists of two separate wastewater treatment trains: (1) complete mix activated sludge train, and (2) extended aeration activated sludge train. The effluent from the two trains is combined and then routed to sand filters and disinfected in a chlorine contact basin using a sodium hypochlorite solution. According to Mr. New, the current, actual flows for the facility average approximately 0.5 MGD.

Reclaimed water (i.e., treated wastewater) from the facility is currently disposed by two land application systems. One disposal system is the slow-rate restricted public access land application system consisting of an 84-acre sprayfield owned by the city adjacent to the treatment facility. This sprayfield has an existing disposal capacity of 0.937 MGD. The other disposal system is the slow-rate public access land application system consisting of the 197-acre Turkey Creek Golf Course located approximately 5 miles southeast of the facility. Reclaimed water is pumped to a lake at the Turkey Creek Golf Course through a 10-inch pipeline located along the west side of U.S. 441 until it turns south along the western edge of the development. The existing pipeline system is unpressurized, and the reclaimed water is only pumped from the treatment facility to the lake when the treatment facility is staffed. Reclaimed water is pumped from the lake, as needed, for irrigation of the golf course. The golf course also has several permitted groundwater wells to provide irrigation water as necessary.

According to Mr. New, the city of Alachua has had an agreement with the Turkey Creek Golf Course to provide up to 0.4 MGD of reclaimed water; however, typically, the golf course actually only takes approximately 0.2 MGD. Mr. New also indicated that the city's agreement with the golf course had expired, but the city was still providing reclaimed water, as needed.

4.2 PLANNED SYSTEM UPGRADES/EXPANSION

According to information provided by Mr. New, the city of Alachua is currently planning to upgrade and expand its wastewater treatment facility and reclaimed water system. Ultimately, the city intends to expand and upgrade its wastewater treatment facilities to a 3.0-MGD design capacity to replace the existing facility, but currently has funding and permit approvals for only Phase I. Phase I will consist of the construction of a new 1.5-MGD biological nutrient removal treatment facility, sand filters, chlorine contact basin with high-level disinfection, and various pumps and storage facilities. The new facilities will be named the City of Alachua Advanced Water Reclamation Facility (AWRF).

The new facility will also include a new 5.0-MGD reclaimed water pump station and 5.0-MGD reclaimed water storage tank, and the pipeline to Turkey Creek Golf Course will be pressurized. Further, the city's sprayfield will be expanded from 84 to 105 acres.

These new facilities have been approved under the revised domestic wastewater facility permit issued by FDEP in June 2008; however, the permitted capacity flow will be limited to 1.23 MGD, instead of the 1.5-MGD design capacity, due to limited disposal capacity of the city sprayfield even after its expansion to 105 acres.

According to Mr. New, the city plans to initiate construction of these new expanded/upgraded facilities in late 2009 and the expended in-service time frame for the facilities is spring 2011.

4.3 FEASIBILITY/ISSUES ASSESSMENT

4.3.1 ENVIRONMENTAL FEASIBILITY/ISSUES

The city of Alachua's planned new AWRF has been issued a permit by FDEP under the applicable provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules under Chapter 62-600, F.A.C. Reclaimed water from the planned AWRF will be treated to a level to allow disposal/use in an unrestricted public-access reuse system such as irrigation at the Turkey Creek Golf Course. Use of the reclaimed water as an alternative supply for the GREC project would require a revision of the existing domestic wastewater facility permit for the planned AWRF. Highly treated reclaimed water is currently used for cooling tower makeup water at several other power plants in Florida and elsewhere, so the required permit revision would be expected to be feasible.

The environmental feasibility of using city of Alachua reclaimed water would involve several other issues. First, use of the reclaimed water will require the design, permitting, and construction of a new approximately 2.1-mile pipeline from the existing pipeline to Turkey Creek Golf Course along U.S. 441 to the GREC Site. Figure 1 illustrates the most likely route for this new pipeline. To the extent possible, the pipeline route will parallel existing roadways; however, its construction will involve crossing under U.S. 441 and existing utilities along the highway and under the CSX Transportation, Inc. (CSX) railroad, as well as running through some residential areas. The availability of easements and issues associated with the environmental permitting (i.e., wetlands, tree removal, etc.) for this pipeline are uncertain at this time.

Second, the volume of reclaimed water currently available from the city of Alachua (i.e., 0.5 MGD) will only supply a portion (i.e., currently only one-third) of the GREC water needs (i.e., 1.4 MGD) even if all water were provided to GREC. Therefore, the GREC Project would still need to use groundwater for a significant portion of the needs and install wells and pumping equipment to provide 100 percent of the needs as backup in case

M:\acad\090408\Reclaimed Water Potential Route.dwg

Nov 17, 2009 - 2:35pm by jroberts

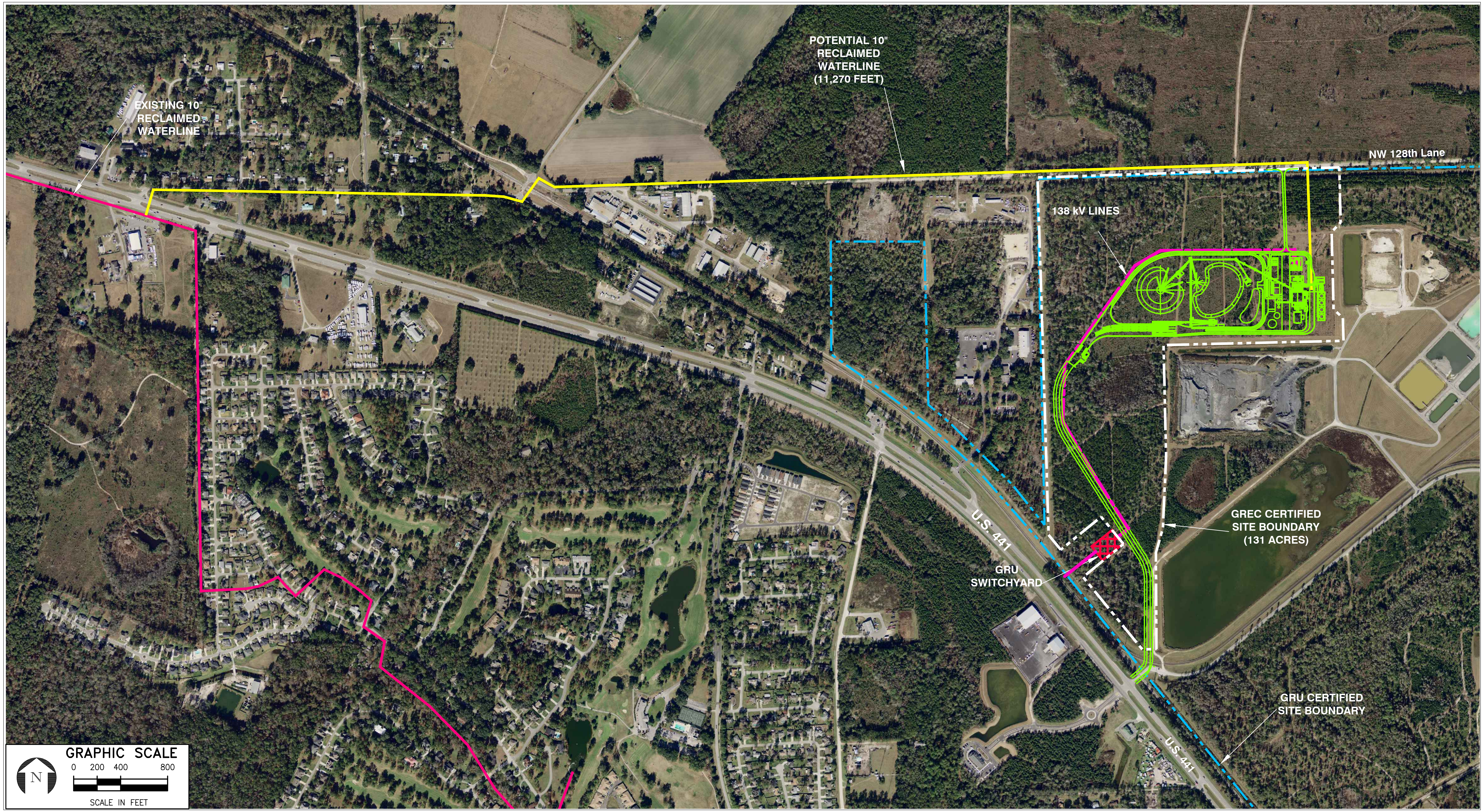

FIGURE 1.

POTENTIAL ROUTE FOR RECLAIMED WATER PIPELINE FROM CITY OF ALACHUA TO GREC SITE

Sources: FDOT, 2009; City of Alachua, 2009; Genesis, 2009; EDA, 2009; Zachery, 2009; ECT, 2009.

Gainesville Renewable Energy Center
An American Renewables Company

of upsets with the city facilities. Also, if GREC was provided all available reclaimed water, then the Turkey Creek Golf Course would need to use groundwater for its irrigation needs. Therefore, in practice, GREC's use of the alternative reclaimed water supply would not significantly reduce groundwater use in the Site area.

4.3.2 TECHNICAL FEASIBILITY/ISSUES

As discussed in Section 4.3.1, the city of Alachua reclaimed water supply distribution system is not available in the immediate vicinity of the GREC Site. A new approximately 2.1-mmile pipeline would need to be designed, permitted, and constructed from the city's distribution pipeline to the Turkey Creek Golf Course. According to Mr. New, the city of Alachua currently does not have a funding source for providing this pipeline to the GREC Site. GREC, LLC, estimates that construction of this pipeline will cost approximately $2 million, not including potential costs for obtaining easements. The pipeline costs are further discussed in the economic feasibility portion of this assessment.

Other potential issues associated with the use of the city's reclaimed water involve the quality of the water. Since GREC is currently scheduled to be in commercial operation in December 2013, the alternative reclaimed water would be provided from the city of Alachua's new AWRF, which is scheduled to be in service in spring 2011. Therefore, the specific quality of this future water supply is somewhat uncertain at this time. The future quality of the reclaimed water could also change over time depending on the types of future facilities (i.e., commercial, industrial) added to the city's domestic wastewater collection system. The future reclaimed water will be required to meet certain water quality limitations established by the FDEP permit. However, these limitations primarily include only standard parameters associated with domestic wastewater treatment facilities, such as residue chlorine, nutrients, fecal coliform, etc. For the efficient operation of a power plant, other water quality parameters, such as metals, total dissolved solids, silica, etc., need to be considered in the design, equipment selection, metallurgy, and water/wastewater treatment systems. The GREC facilities and water/wastewater systems have been specifically designed relative to the water quality constituents of the proposed groundwater supply from the UFA at the Site. Since the future quality of the reclaimed water is unknown at this time, additional treatment facilities may be needed on the GREC

Site to meet the Project's water quality requirements, as well as an additional onsite storage tank to facilitate flow equalization and mixing with the available reclaimed water with the groundwater supply. The additional onsite treatment would also result in additional treatment sludge wastes requiring disposal at an approved landfill. Further, since the GREC Project has been designed with a ZLD system to eliminate wastewater discharges and minimize water use, the future, unknown quality of the reclaimed water also creates uncertainty and potential issues with the quality of the brine waste from the ZLD system for offsite landfill disposal. These water quality-related unknowns for the reclaimed water create technical feasibility issues and uncertainties as well as additional costs for the Project.

4.3.3 ECONOMIC FEASIBILITY/ISSUES

The electrical power output of the GREC Project will be purchased by GRU under a 30-year power purchase agreement (PPA). The PPA was the result of extensive negotiations between GREC, LLC, and GRU/Gainesville City Commission to ensure the negotiated financial terms and power supply cost rates provided GRU's customers with reliable power at a reasonable cost. The terms of the PPA were based on detailed estimates of the construction, debt service, and fixed operation and maintenance costs for the GREC Project. Therefore, any significant, additional costs for the Project would adversely impact the PPA and the negotiated power supply rates to GRU and, ultimately, its customers.

As discussed in Section 4.3.1, construction of the 2.1-mile pipeline to deliver reclaimed water to the Site is estimated to cost approximately $2 million. This significant, additional cost would be borne by the Project since no other funding sources are currently available. Also, as discussed in Section 4.3.2, additional onsite treatment facilities and storage tank for the reclaimed water may be needed, depending on the future quality of the water. These additional facilities would potentially add approximately $500,000 in capital costs and $50,000 to $100,000 per year in operation and maintenance costs to the Project. These additional costs would adversely impact the economic feasibility of the GREC Project and/or the power supply rates to GRU and its customers. Another potential economic issue associated with the use of the city of Alachua reclaimed water is the uncertainty of whether or not the city would charge for the use of the water at some time in the future. Such charges would adversely impact the Project since any cost savings of using the reclaimed water versus pumping groundwater are considered minimal. The Project will still need to install and operate groundwater wells and pumping equipment to provide a significant portion of the water needs, as well as up to 100 percent of the needs as backup in case of the unavailability of reclaimed water.

5.0 CITY OF GAINESVILLE RECLAIMED WATER

The city of Gainesville has two domestic wastewater treatment facilities that produce high-quality reclaimed water: Main Street WRF and Kanapaha WRF. The Main Street WRF is located just south of the city's downtown area and serves the southeast and northeast areas of the city and portions of Alachua County. The facility is currently permitted to treat 7.5 MGD. The majority of the reclaimed water from the Main Street WRF is discharged to Sweetwater Branch, which flows to Paynes Prairie and enters the Alachua Sink.

The Kanapaha WRF is located in southwest Gainesville and serves the southwest and northwest areas of the city and portions of Alachua County. In 2003, the permitted treatment capacity of the facility was increased from 10 to 14.9 MGD. Reclaimed water from the Kanapaha WRF is reused for aesthetic water features at the nearby Kanapaha Botanical Gardens and for irrigation of the common grounds, golf course, and some residential areas in Haile Plantation; Alachua County Kanapaha Veteran's Park; Chapman's Pond and Nature Trails, TREEO Water Gardens; and Kanapaha Middle School. Excess reclaimed water from the facility is discharged to the Floridan aquifer.

5.1 ENVIRONMENTAL FEASIBILITY/ISSUES

Similar to the city of Alachua, the use of reclaimed water for cooling tower makeup for the GREC Project is considered environmentally permittable under the provisions of Chapter 403, F.S. Use of the reclaimed water would require a revision of the existing domestic wastewater facility permits for the WRFs.

The Main Street WRF and Kanapaha WRF are located significant distances from the GREC Site and would require the permitting and construction of a pipeline from either of the WRFs to the Site. In 2000, GRU conducted a conceptual evaluation of the potential alignment of a reclaimed water pipeline from each of the WRFs to DGS. Based on this evaluation, the pipelines from the Main Street WRF and the Kanapaha WRF to the DGS site were estimated to be approximately 13.7 and 14.9 miles, respectively, in length. The potential routes for these pipelines generally follow existing roadways; however, significant portions of these routes run through heavily urbanized commercial and residential areas. Therefore, the availability of easements and permitting for either of these new pipelines may result in significant issues.

5.2 TECHNICAL FEASIBILITY/ISSUES

The city of Gainesville reclaimed water system currently does not extend into north Gainesville. As discussed in Section 5.1, a new reclaimed water pipeline would need to be constructed from either the Main Street WRF (13.1 miles) or Kanapaha WRF (14.9 miles) to the GREC Site. If a pipeline were constructed, a sufficient amount of reclaimed water is available from either facility to meet GREC's water needs.

Further, based on information from GRU, the city of Gainesville has evaluated the possibility of constructing a new WRF on the DGS site to serve wastewater flows in north Gainesville. This WRF could provide reclaimed water for use by GREC as well as DGS. However, the new facility would not be constructed until at least the 2032 time frame.

5.3 ECONOMIC FEASIBILITY/ISSUES

As discussed in Section 4.3.3, any significant, additional capital or operation/maintenance costs for the GREC Project would adversely impact the PPA and negotiated power supply rates to GRU and its customers. Based on information from GRU, the estimated costs for constructing a new reclaimed water pipeline and required pumping facilities for either the Main Street or Kanapaha WRF to the DGS site area range from $16 to $18 million. The city of Gainesville currently has no available funding source for such construction; therefore, funding for pipeline costs would need to be provided by the GREC Project, which would need to be recovered by increased power purchase rates to GRU and its customers.

6.0 CONCLUSIONS OF FEASIBILITY ASSESSMENT

Based on the previous discussions and analyses, the use of reclaimed water from either the city of Alachua or the city of Gainesville as an alternative water supply for the GREC Project is not considered feasible at this time. This conclusion is primarily based on the additional costs associated with constructing a pipeline to deliver reclaimed water from the cities' reclaimed water systems to the GREC Site, as well as potential costs for additional onsite reclaimed water treatment and storage facilities. These additional costs would adversely impact (i.e., increase) the power supply rates to GRU and its customers.

However, GREC, LLC, would consider the use of reclaimed water as an alternative supply for cooling tower makeup in the future if reclaimed water was reasonably available and economically feasible for the GREC Project.

ATTACHMENT 4

GRU LETTER ON GROUNDWATER SUPPLY FOR GREC

GRU
More than Energy

GAINESVILLE REGIONAL UTILITIES
GENERAL MANAGER

November 3, 2009

Jim Gordon, Chief Executive Officer
Gainesville Renewable Energy Center LLC
75 Arlington Street, 5th Floor
Boston, Massachusetts 02116

Re: Groundwater Supply for Gainesville Renewable Energy Center

Dear Mr. Gordon:

On behalf of the City of Gainesville, d.b.a. Gainesville Regional Utilities (GRU), I am sending you this letter to confirm and supplement the information GRU has provided Gainesville Renewable Energy Center, LLC (GREC LLC), concerning the Gainesville Renewable Energy Center (GREC).

The construction and operation of GRU's Deerhaven Generating Station (DGS) Unit 2 was approved pursuant to the Florida Electrical Power Plant Siting Act (PPSA). The PPSA (Case No. PA 74-04) Conditions of Certification (Condition III.A) for the DGS authorizes GRU to withdraw 6.5 million gallons per day (MGD) of groundwater.

GREC LLC needs approximately 1.4 MGD (annual average) of groundwater for the operation of GREC. GRU agrees to voluntarily relinquish its right to withdraw 1.4 MGD (annual average) of groundwater if this action by GRU will enable GREC LLC to obtain approval for the groundwater withdrawals it needs. Accordingly, GRU agrees that the Florida Department of Environmental Protection (FDEP) may modify the PPSA Conditions of Certification (COC) for the DGS and thereby reduce the groundwater allocation for the DGS to 5.1 MGD (annual average), if the FDEP or the Suwannee River Water Management District (SRWMD) conclude that the existing groundwater allocation for the DGS needs to be reduced to offset the new groundwater allocation for GREC.

Please note, however, that any modification to the Conditions of Certification for the DGS should not take effect until GREC commences commercial operations. Although the PPSA COC modification for the DGS may be issued when the FDEP issues the site certification for GREC, the modification should state that the groundwater allocation to the DGS will not be reduced until GREC begins to withdraw groundwater for its operations.

GRU understands that this letter will be submitted to the FDEP and SRWMD with the GREC Site Certification Application. GRU's commitments in this letter are being made for the benefit of GREC LLC, the FDEP, and the SRWMD. These commitments are intended to be enforceable by GREC LLC, the FDEP, and the SRWMD against GRU.

Sincerely,

Robert E. Hunzinger

Robert E. Hunzinger
General Manager

CC: John Stanton, Assistant General Manager for Energy Supply
Ed Regan, Assistant General Manager for Strategic Planning
Raymond O. Manasco Jr., Utilities Attorney
Joshua Levine, GREC Project Manager