r.g. miller | DCCM

Transmittal

VIA: Mail **DATE:** April 3, 2024

TO: Bluebonnet Groundwater Conservation District
1903 Dove Crossing Lane Suite A, P.O. Box 269
Navasota, Texas 77868

ATTN: Technical Review and Oversight Team (MC 159)

RE: East Waller County Management District t/s Sofi Lakes Water Plant Phase 1 Water Well No. 1
Project No. 4834.700

COPIES TO:

WE TRANSMIT: ☒ herewith ☐ under separate cover via
☐ in accordance with your request _____

FOR YOUR: ☒ approval ☐ distribution ☐ information ☐ review and comment
☐ records ☐ use ☐ payment ☐ signature and return
☐ _____

THE FOLLOWING: ☐ plans ☐ specifications ☐ prints ☐ change order
☐ proposal ☐ copy of letter ☒ reports ☐ samples
☐ _____

Item No.	No. of Copies	Description
1	1	Non-Exempt Water Well Registration Application
2	1	Well Operating Permit Application
3	1	Cover Letter with Attachments
4	1	Check for Application and Report fees
5		

If enclosures are not as noted, please inform us immediately.

REMARKS: Feel free to contact me should you have any questions.

SIGNED:

Nicholas Kallmyer, P.E.
Water/ Wastewater – Team Leader
R.G. Miller Engineers, Inc.
nkallmyer@rgmiller.com

\\RGM-SRV14\Land\4928_East Waller County Management District\Sofi Lakes\04834.700 Sofi Lakes Water Plant\Engineering\Notes\BGCD permit app\Transmittal_RGM.docx

Bluebonnet Groundwater Conservation District
1903 Dove Crossing Lane Suite A, P.O. Box 269
Navasota, TX 77868
Phone: 936-825-7303 Fax: 936-825-7331
Email: BGCD@bluebonnetgroundwater.org

BGCD Well ID #: _____

NON-EXEMPT WATER WELL REGISTRATION APPLICATION

Please complete all questions. Please print or type information, or place an "x" in the appropriate space.

Drill New Well: X Register an Existing Well: _____ Replace Existing Well: _____ Increase Size of Existing Well: _____

Increase Pump Size of Existing Well: _____ Abandon/Cap/Plug Existing Well: _____ Perform Dye Trace: _____

Well Owner East Waller County Management District Phone 713-398-7927

Address 401 Congress Ave, Suite 2100 c/o Winstead PC

Fax: _____ Email: rmartin@winstead.com & nkallmyer@rgmiller.com

Drilling Company TBD Phone _____

Address _____

Fax: _____ Email: _____

Driller _____ License# _____

Well Location: County Waller Well Site Address or Location: _____

Latitude 29.8810109 **Longitude** -95.8885946

Proposed Water Use: Public Water Supply: X Industrial: _____ Recreational: _____ Commercial: _____

Hydraulic Fracturing: _____ Transport Outside of District: _____

Proposed depth: 1,100 ft. Aquifer Evangeline Date drilling is scheduled to begin TBD

Proposed casing size: 24 in. Proposed casing depth: 800 ft. Pump depth: 400 ft. Pump size 200 hp.

Type Pump: Turbine: X Submersible: _____ Windmill: _____ Other (specify): _____

Pump fuel or power source: Electricity: X Natural Gas: _____ Wind: _____ Other (specify): _____

Pump Bowls: Size 14 inch # of Stages: TBD Pump Column: Inside Diameter: 10 in. Length: 500 ft.

Pump discharge pipe: Size 12 in. Rated pump horsepower: 200 **Pump Discharge**: 1,200 gpm

Water bearing formation: Evangeline Aquifer

Estimated Annual Water Production: _____ Acre-Feet or 292,000,000 Gallons

If the water produced from this well will be used in whole or in part on property other than the property where the well is located, **describe the location where the water will be used.** Transportation of water produced and moved to another location may require a District Transportation Permit. See District Rules, Section 10 or contact the District office for information.

Public water supply to serve East Waller County Management District at well property location.

BLUEBONNET GROUNDWATER CONSERVATION DISTRICT

Permit form approved on: _____ By: _____ Zach Holland, General Manger

(Continued) NON-EXEMPT WATER WELL DRILLING PERMIT FORM (Continued)

The following documentation, attachments and fee payments must accompany this form when it is submitted for consideration by the District.

a. Plat or map showing location of the property and location on property of well for which form is submitted.
b. If owner and/or operator of a well is different from property owner, provide written documentation from property owner authorizing construction and operation of this well.
c. All the information and documentation required for the type and class of well for which authorization is requested by Section 8 of the District Rules and that information and documentation required by Rule 8.5.
d. Forms for non-exempt well authorizations must be accompanied by the information required by Rule 8.5A1:
    a. 8.5A1(e) – a statement of the projected effect of the proposed withdrawal on the aquifer or aquifer conditions, depletion, subsidence, or effects on existing permit holders or other groundwater users in the District;
    b. 8.5A1(f) – the applicant's water conservation plan or a declaration the applicant and subsequent user will comply with the District's management plan;
    c. 8.5A1(g)(2) – well construction diagram;
    d. 8.5A1(g)(3) – a map showing the location of the proposed well or wells, all existing well, hydrologic features, and geologic features located within half (1/2) mile radius of the proposed well or wells site;
    e. 8.5A1(h) – the applicant's well closure plan or a declaration the applicant will comply with well plugging guidelines and report closure to the applicable authorities, including the District.
e. Payment for applicable fees must accompany the form. Additional fees may apply as documented in the District's adopted Fee Schedule.

Well Development Fee	$75.00	
Operating Permit Application Fee	$375.00	
Hydrogeologic Report Fee – applicable if well completed with eight (8) inches or greater inside casing diameter		
	Phase I-a Report (less than 200MG/yr)	Phase I-b Report (> 200MG/yr)
District Prepared Report	$1,500.00	$7,500.00
Applicant Prepared/District Review	$500.00	$1,500.00

f. Forms for new non-exempt wells must be accompanied by an Operating Permit Application and, if appropriate, a Transport Permit Application.

I, the undersigned applicant, hereby agree and certify that:

a. this well will be drilled within 30 feet of the location specified and not elsewhere;
b. I will furnish the District with a copy of the completed driller's log, any electric log, the well completion report, and any water quality test report within 60 days of completion of this well and prior to production of water there from (other than such production as may be necessary to the drilling and testing of such well);
c. in using this well, I will avoid waste, achieve water conservation, protect groundwater quality and the water produced from this well will be for a beneficial use;
d. I will comply with all District and State well plugging and capping guidelines in effect at the time of well closure;
e. I agree to abide by the terms of the District Rules, the District Management Plan, and orders of the District Board of Directors currently in effect and as they may be modified, changed, and amended from time to time;
f. I hereby certify that the information contained herein is true and correct to the best of my knowledge and belief.

Signature: _____ Date: 4/3/2024

Printed Name: Nicholas Kallmyer Title: Water/Wastewater Team Leader

Bluebonnet Groundwater Conservation District
303 E. Washington Ave., P.O. Box 269
Navasota, TX 77868
Phone: 936-825-7303 Fax: 936-825-7331
Email: BGCD@bluebonnetgroundwater.org

BGCD Well ID #: _____

WELL OPERATING PERMIT APPLICATION

Please complete all questions. Please print or type information or place an "x" in the appropriate space.

Drill New Well: X Register an Existing Well: _____ Replace Existing Well: _____ Increase Size of Existing Well: _____

Increase Pump Size of Existing Well: _____ Abandon/Cap/Plug Existing Well: _____ Perform Dye Trace: _____

Well Owner East Waller County Management District Phone 713-398-7927

Address 401 Congress Ave, Suite 2100 c/o Winstead PC

Fax: _____ Email: rmartin@winstead.com & nkallmyer@rgmiller.com

Drilling Company TBD Phone _____

Address _____

Fax: _____ Email: _____

Driller _____ License# _____

Well Location: County Waller 911 address of well site _____

Latitude _____ Longitude _____

Proposed Water Use: Public Water Supply: X Industrial: _____ Recreational: _____ Commercial: _____

Hydraulic Fracturing: _____ Transport Outside of District: _____

Status of well as of application date:

_____ Operating Well (Date drilled _____)

_____ Well Completed but not operating (Date Drilled _____)

X Well Development permit attached or awaiting approval

Authorization to produce the following quantity of water annually from this well is: _____ Gallons

A well operating permit is normally issued for a period of one year (12 months). If a permit for a longer period of time is requested, attach a statement detailing the reasons for a longer permit period and the period of time requested.

If the water produced from this well will be used in whole or in part on property other than the property where the well is located, **describe the location where the water will be used.** Transportation of water produced and moved to another location may require a District Transportation Permit. See District Rules, Section 10 or contact the District office for information.

Public water supply to serve East Waller County Management District

BLUEBONNET GROUNDWATER CONSERVATION DISTRICT

Permit application approved on: _____ By: _____ Zach Holland, General Manger

(Continued) WELL OPERATING PERMIT APPLICATION (Continued)

The following documentation, attachments and fee payments must accompany this application when it is submitted for consideration by the District.

a. Plat or map showing location of the property and location on property of well for which application is submitted.
b. If the owner and/or the operator of well is different from the property owner, provide written documentation from the property owner authorizing construction and operation of this well.
c. All the information and documentation required for the type and class of well for which authorization is requested by Section 8 of the District Rules and in particular that information and documentation required by Rule 8.5.
d. If this permit application is for a well completed with an inside casing diameter of eight (8) inches or greater, or for any of the conditions enumerated in District Rule 8.5 F, a current hydrogeological report (a report completed within 18 months of the date of this application is considered current) shall be submitted with this application.
e. Payment for applicable fees must accompany application. For a non-exempt well the appropriate Operating Permit Application Fee ($375.00 +$750.00 if inside casing diameter is eight (8) inches or greater) must be included.
f. The applicant's water conservation plan and if any subsequent user of the water is a municipality or entity providing retail water services, the water conservation plan of that municipality or entity shall also be provided. In lieu of a water conservation plan, a declaration that the applicant and/or a subsequent user if any subsequent user is a municipality or entity providing retail water services will comply with the District Management Plan.
g. The applicant's Drought Contingency Plan and a copy of any subsequent user's Drought Contingency Plan or a declaration that the applicant or a subsequent user will comply with District rules, policies and Board actions in drought conditions.

I, the undersigned applicant, hereby agree and certify that:

a. in using this well, I will avoid waste, achieve water conservation, protect groundwater quality and the water produced from this well will be for a beneficial use;
b. I will comply with all District and State well plugging and capping guidelines in effect at the time of well closure;
c. I agree to abide by the terms of the District Rules, the District Management Plan and orders of the District Board of Directors currently in effect and as they may be modified, changed and amended from time to time;
d. I hereby certify that the information contained herein is true and correct to the best of my knowledge and belief.

Signature: _____ Date: 4/3/2024

Printed Name: Nicholas Kallmyer Title: Water/Wastewater Team Leader

April 3, 2024 Via: Mail

Bluebonnet Groundwater Conservation District
1903 Dove Crossing Lane Suite A
Navasota, Texas 77868

Re: Sofi Lakes Water Plant Phase 1 Water Well No. 1
East Waller County Management District
R.G. Miller Project #4834.700

To Whom it May Concern,

East Waller County Management District (the "District") is proposing to construct a new municipal water treatment plant with a 1,200 gpm water well within the boundaries of the District. The District is currently in the process of acquiring the water plant site property. The District is in coordination with the owner and the owner is aware of the District's plan.

The District is in the beginning stage of organization and has yet to adopt a Water Conservation Plan nor a Drought Contingency Plan. The District will comply with Bluebonnet Groundwater Conservation District's Water Conservation Plan and Drought Contingency Plan. The District also agrees to comply with well plugging guidelines and report closure to the applicable authorities, including the Bluebonnet Groundwater Conservation District.

Attached are the following documents:

1. Maps showing location of the property and location on property of the well for which form is submitted
2. Well construction diagram
3. Maps showing the location of the proposed well, hydrological features and geologic features located within half (1/2) mile radius of the proposed well site
4. Water Well Siting Study

The water well is expected to be completed with an inside casing diameter of over eight (8) inches and will require a hydrogeological report. The District is requesting the Bluebonnet Groundwater Conservation District to perform the Phase I-b hydrogeological report.

The District understands that there are fees in the amount of $75.00 for the Well Development Fee, $375.00 for the Operating Permit Application Fee, and $7,500.00 for Hydrogeologic Phase I-b Report Fee. Included with this application is a check in the amount of $7,950.00.

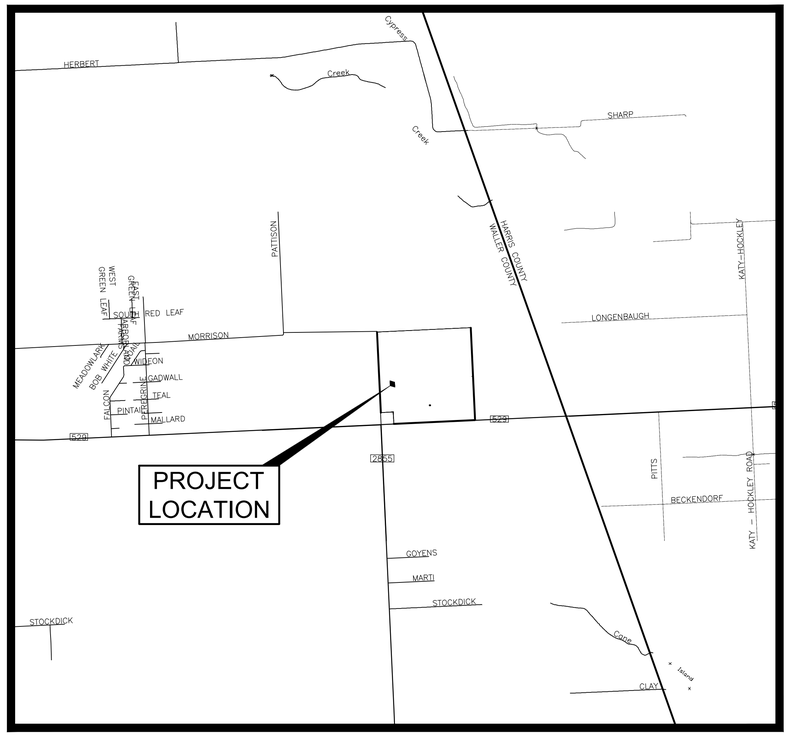
If you have any questions regarding this project, please contact me at 713-461-9600 or by email at nkallmyer@rgmiller.com.

Regards,

R.G. Miller Engineers, Inc.

Nicholas Kallmyer, P.E.
Water/ Wastewater – Team Leader
nkallmyer@rgmiller.com

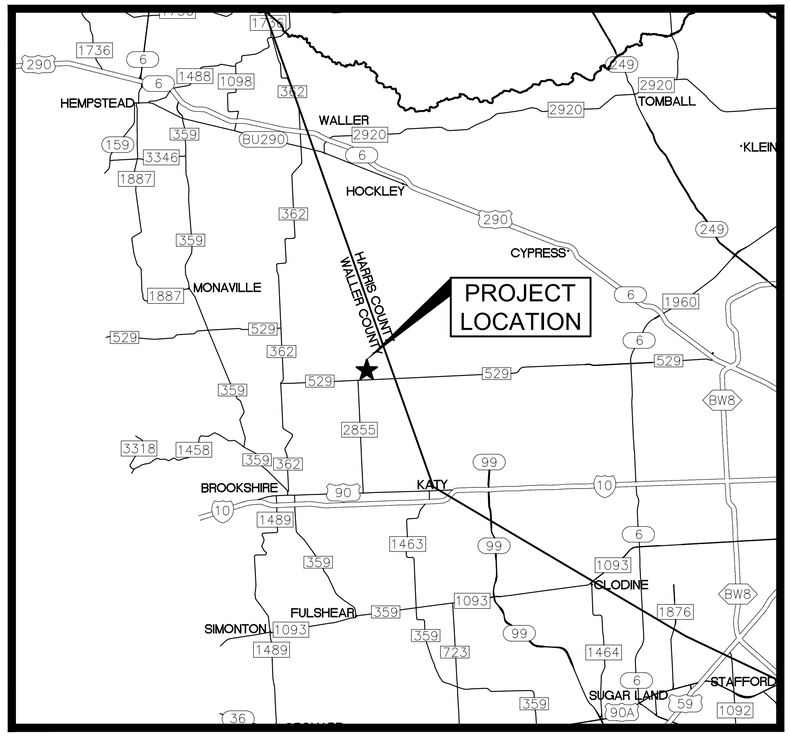
\\RGM-SRV14\Land\4928_East Waller County Management District\Sofi Lakes\04834.700 Sofi Lakes Water Plant\Engineering\Notes\BGCD permit app\LTR_RGM.docx



N.T.S.

VICINITY MAP

KEY MAP 433J, 433K, 433N, 433P
ZIP CODE 77493



N.T.S.

LOCATION MAP

SOFI LAKES
WATER PLANT NO. 1
PHASE NO. 1

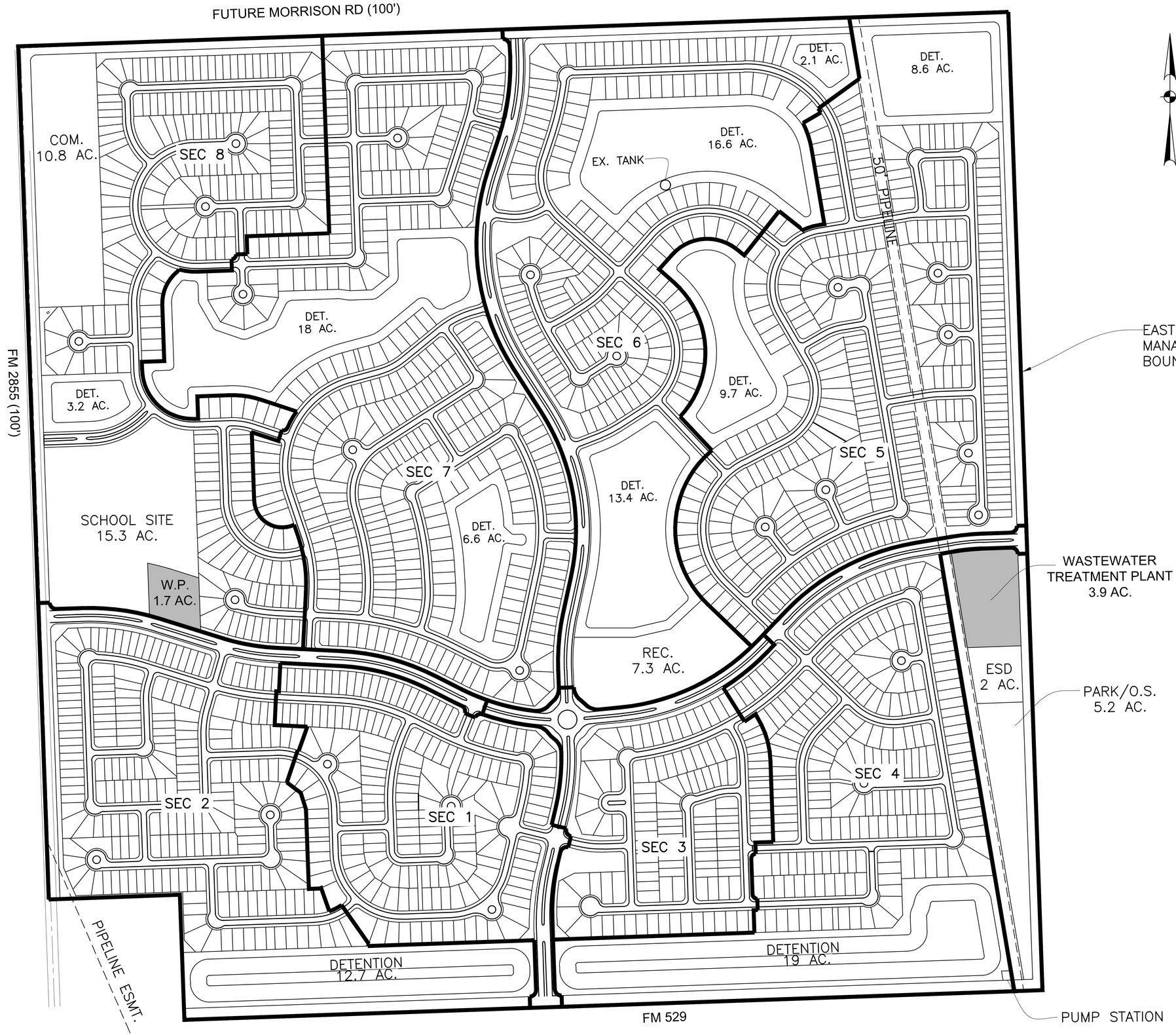
VICINITY MAP

r.g. miller

DCCM

R.G. Miller Engineers, Inc. | TxEng F - 487
16340 Park Ten Place, Ste 350
Houston, TX 77084
713.461.9600 | rgmiller.com

DATE: SCALE:

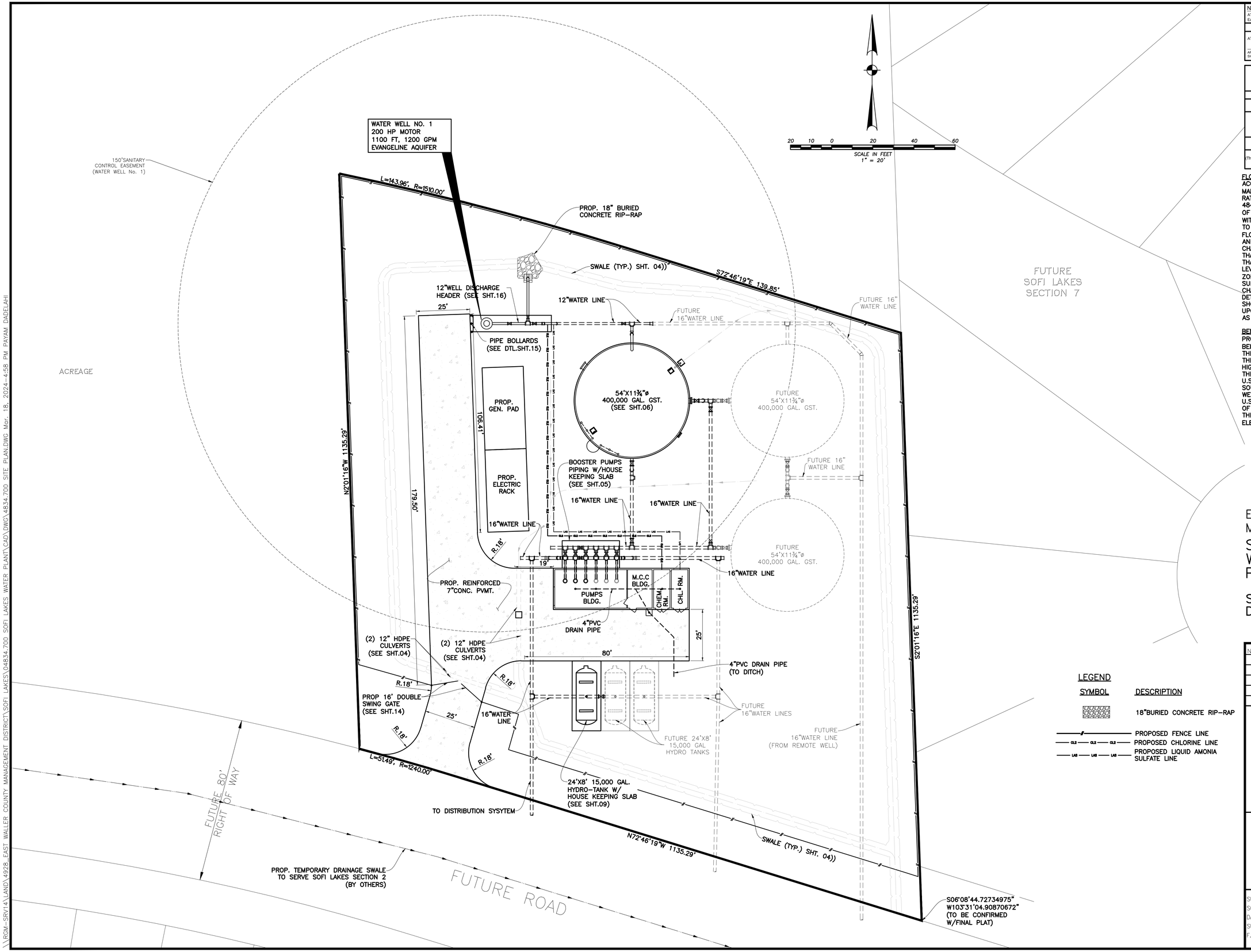


SOFI LAKES
WASTEWATER TREATMENT PLANT

SERVICE AREA MAP EXHIBIT

r.g. miller
DCCM
R.G. Miller Engineers, Inc. | TxEng F - 487
16340 Park Ten Place, Ste 350
Houston, TX 77084
713.461.9600 | rgmiller.com

DATE: NOV. 2023 SCALE: N.T.S.



NOTICE:
AT LEAST 48 HOURS BEFORE EXCAVATING IN STREET R.O.W. OR EASEMENTS CALL THE LONE STAR NOTIFICATION 713-223-4567.

PRIVATE UTILITY LINES SHOWN

AT&T TEXAS/SWBT UTILITY LINES SHOWN

DATE:

APPROVED FOR AT&T TEXAS/SWBT UNDERGROUND CONDUIT FACILITIES ONLY
SIGNATURE VALID FOR ONE YEAR

NOTICE:
For your safety, you are required by Texas Law to call 811 at least 48 hours before you dig so that underground line can be marked.
This signature does not fulfill your obligation to call 811.

VERIFICATION OF PRIVATE UTILITY LINES

Date

CenterPoint Energy natural gas utilities shown. (Gas service lines are not shown).
This Signature not to be used for conflict verification.

Signature Valid for six months.

Date

CenterPoint Energy/UNDERGROUND Electrical Facilities Verification ONLY.
(This signature verifies existing underground facilities - not to be used for conflict verification.
Signature Valid for six months.

FLOODPLAIN

ACCORDING TO THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP NUMBERS 48473C0275E AND 48473C0300E, BOTH HAVING AN EFFECTIVE DATE OF 02/18/2009, THE SURVEYED PROPERTY LIES WITHIN ZONE "X" (UNSHADED), AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, ZONE "X" (SHADED), AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD AND ZONE "AE", SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD EVENT, BASE FLOOD ELEVATION DETERMINED. THE FLOOD ZONE SEPARATION LINES SHOWN HEREON ARE APPROXIMATE AND BASED UPON GRAPHIC REPRESENTATION OF SUCH LINES AS PER SAID FEMA FLOOD INSURANCE RATE MAP.

BENCHMARK

PROJECT BENCHMARK: NGS F 768 (PID: AW0121) BEING A BRASS DISK STAMPED "F 768 1943" ON THE TOP OF A CONCRETE BRIDGE ABUTMENT AT THE SOUTH END OF THE EAST ABUTMENT OF THE HIGHWAY BRIDGE OVER BESSIES CREEK. TO REACH THE BENCHMARK HEAD 2.1 MILES WEST ALONG U.S. HWY 90 FROM THE JUNCTION OF F.M. 359 SOUTH IN BROOKSHIRE, BEING ABOUT 0.25 MILE WEST OF THE JUNCTION OF DONIGAN ROAD AND U.S. HWY. 90, 0.2 MILE EAST OF THE JUNCTION OF U.S. HWY. 90 LEADING INTO I-10 WEST AND THE ACCESS ROAD.
ELEVATION = 130.50' NAVD88

LEGEND

SYMBOL	DESCRIPTION
	18"BURIED CONCRETE RIP-RAP
—F—	PROPOSED FENCE LINE
—CL2— CL2— CL2—	PROPOSED CHLORINE LINE
—LAS— LAS— LAS—	PROPOSED LIQUID AMONIA SULFATE LINE

EAST WALLER COUNTY MANAGEMENT DISTRICT
SOFI LAKES WATER TREATMENT PLANT PHASE 1

SITE, PIPING AND DIMENSION PLAN

No.	DATE	REVISION

r.g. miller
DCCM
R.G. Miller Engineers, Inc. | TxEng F - 487
16340 Park Ten Place, Ste 350
Houston, TX 77084
713.461.9600 | rgmiller.com

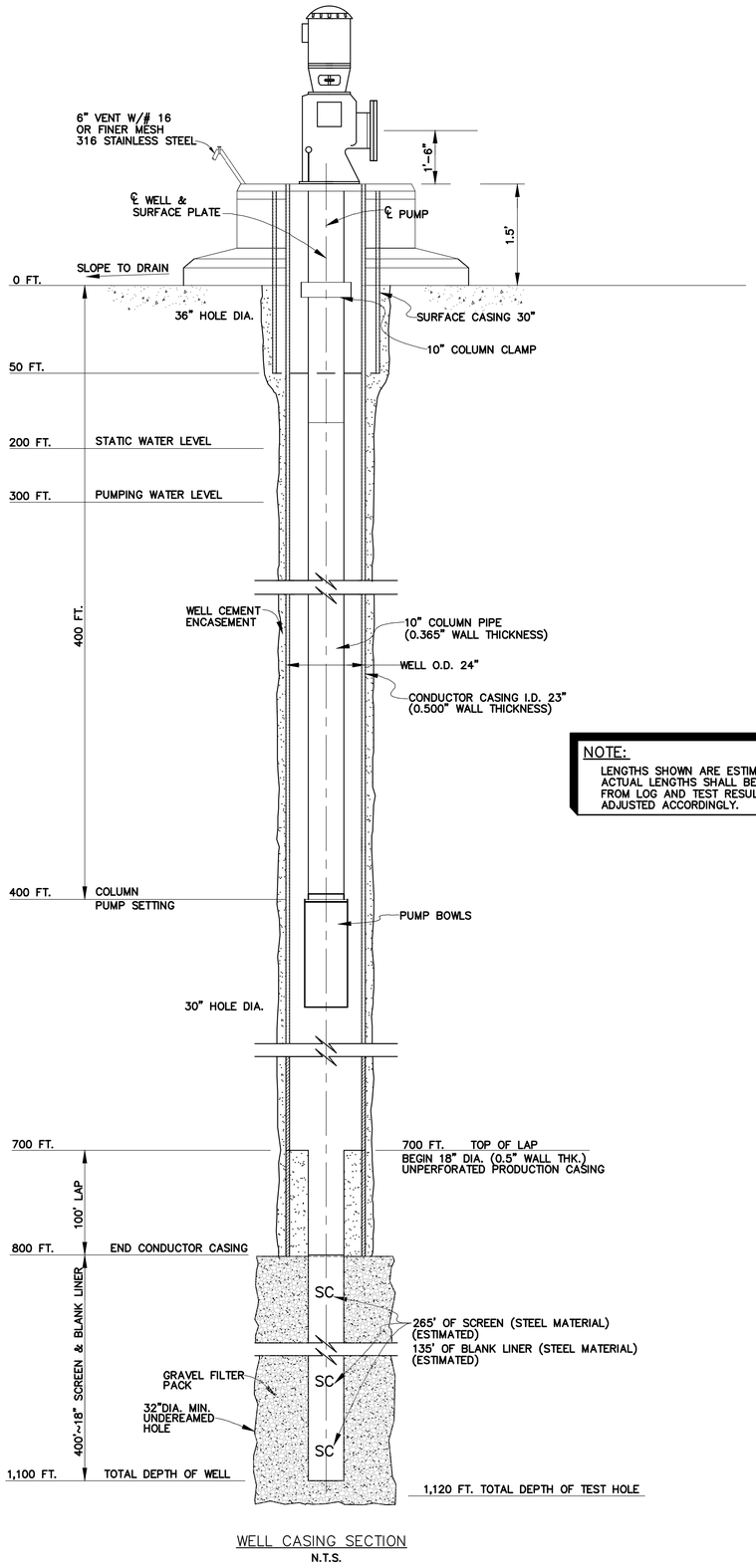
INTERIM REVIEW ONLY
DOCUMENT INCOMPLETE:
Not Intended for permit, or construction.

Engineer: Nicholas A Kallmyer
P.E. License No. 149213
DATE: March, 2024

SUBMITTED:
SCALE: 1" = 20'
DATE: FEBRUARY, 2024
SURVEY BY: MILLER SURVEY
F.B. NO.

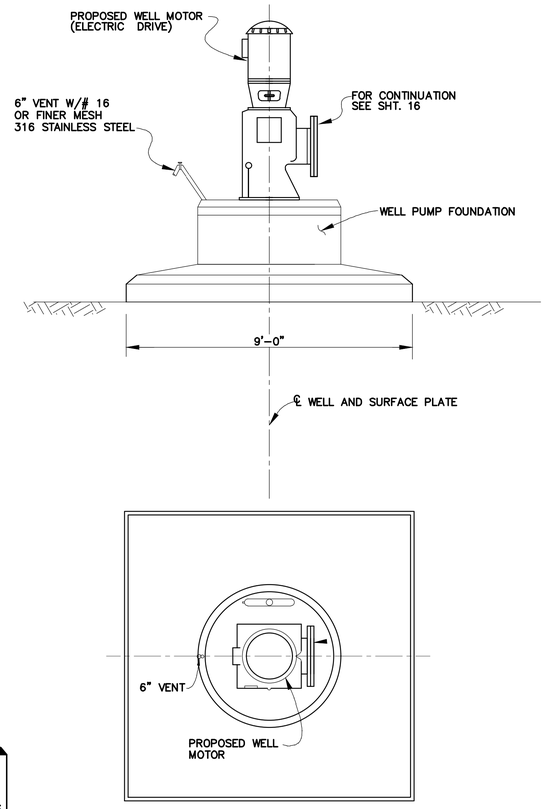
DESIGNED BY: J.T.
DRAWN BY: N.B.G.
SHEET NO. 03 OF 23 SHEETS
CITY DWG NO:

\\RGM-SRV14\LANDY\4928_EAST WALLER COUNTY MANAGEMENT DISTRICT\SOFI LAKES\04834.700 SOFI LAKES WATER PLANT\CAD\DWG\04834.700 SITE PLAN.DWG Mar. 18, 2024 - 4:58 PM PAYAM DADELAHI

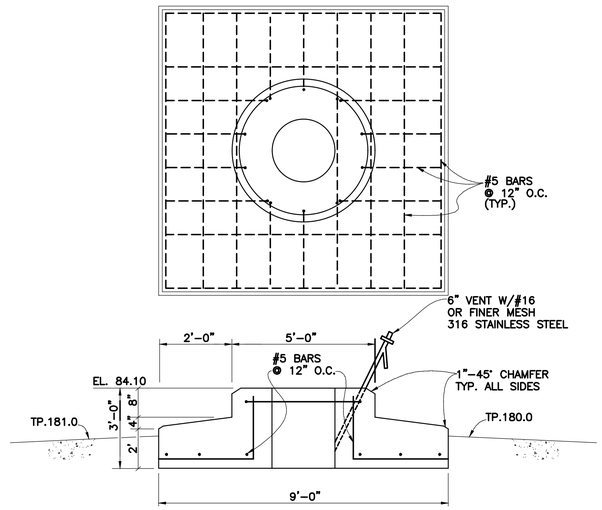


WELL CASING SECTION
N.T.S.

NOTE:
LENGTHS SHOWN ARE ESTIMATED.
ACTUAL LENGTHS SHALL BE DETERMINED
FROM LOG AND TEST RESULTS AND QUANTITIES
ADJUSTED ACCORDINGLY.



PLAN VIEW



NOTE:
SURFACE CASING SHALL EXTEND
TO TOP OF FOUNDATION

WELL PUMP
FOUNDATION
N.T.S.

WELL PUMP SCHEDULE	
G.P.M. (MINIMUM)	1,200
T.D.H. (ESTIMATED)	440
PUMP SETTING	410
STATIC WATER LEVEL (EST.)	250
DRAW DOWN (EST.)	160
R.P.M.	1770
HORSE POWER	200 H.P.
VOLTAGE, PHASE	460V – 3 PHASE
MFG. – MODEL	

EAST WALLER COUNTY
MANAGEMENT DISTRICT
SOFI LAKES WATER TREATMENT PLANT PHASE 1

WATER WELL DETAILS

No.	DATE	REVISION

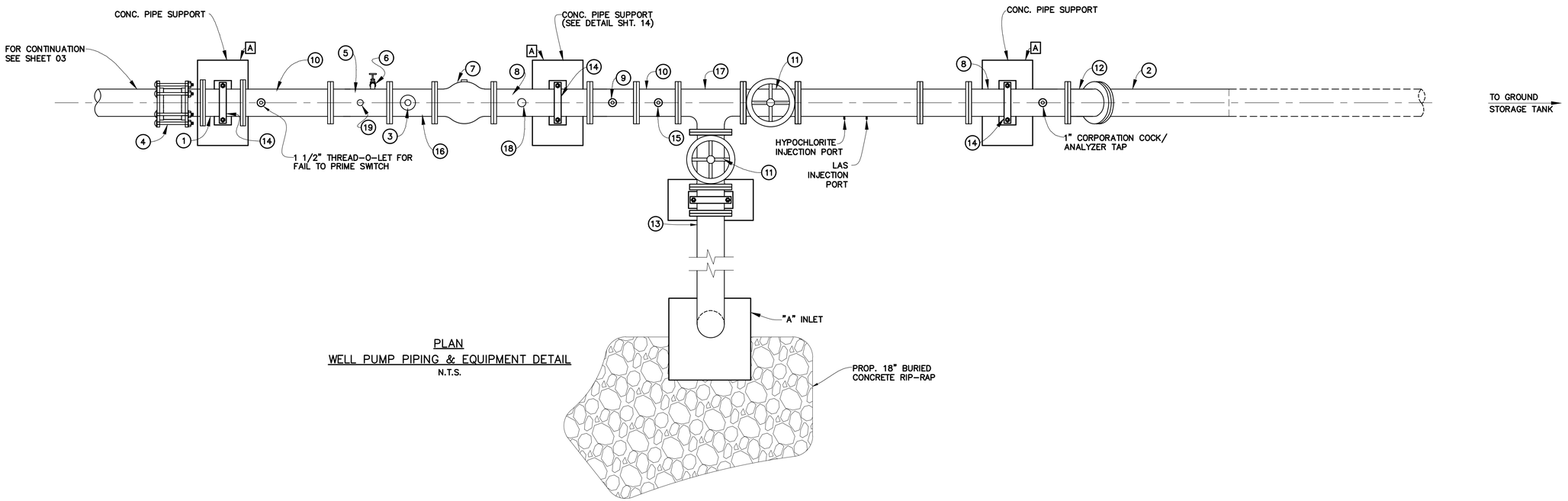
r.g. miller
DCCM
R.G. Miller Engineers, Inc. | TxEng F - 487
16340 Park Ten Place, Ste 350
Houston, TX 77084
713.461.9600 | rgmiller.com

INTERIM REVIEW ONLY
DOCUMENT INCOMPLETE:
Not intended for permit, or construction.

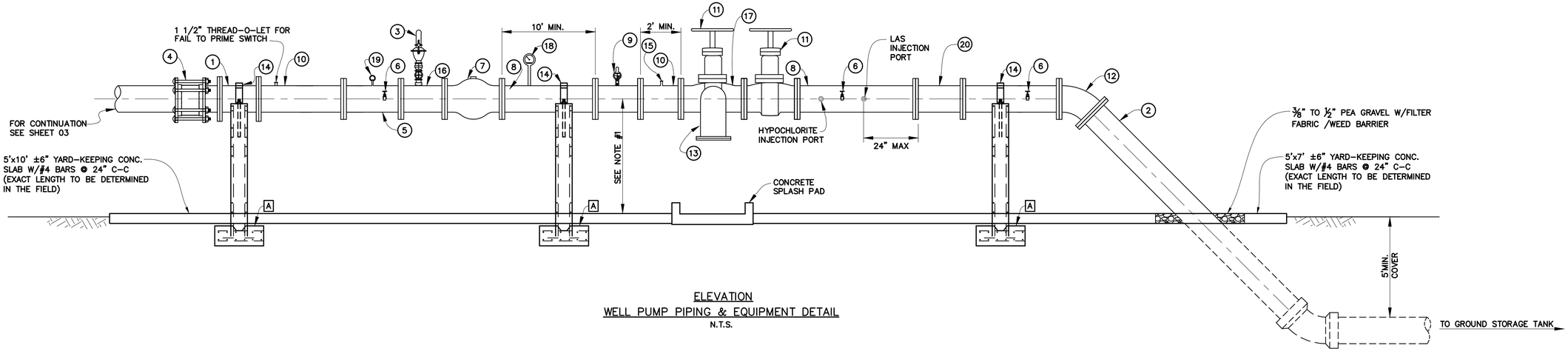
Engineer: Nicholas A Kallmyer
P.E. License No. 149213
DATE: March, 2024

SUBMITTED:
SCALE: N.T.S.
DATE: FEBRUARY, 2024
SURVEY BY: MILLER SURVEY
F.B. NO.

DESIGNED BY: J.T.
DRAWN BY: N.B.G.
SHEET NO. 17 OF 23 SHEETS
CITY DWG NO:



PLAN
WELL PUMP PIPING & EQUIPMENT DETAIL
N.T.S.



ELEVATION
WELL PUMP PIPING & EQUIPMENT DETAIL
N.T.S.

PIPING SCHEDULE	
ITEM	DESCRIPTION
1	12" SPOOL FE/FE
2	12" WELDED STL. PIPE FE/PE
3	3" AIR RELEASE & VACUUM RELIEF VALVE ASSEMBLY
4	12" FLEXIBLE COUPLING (DRESSER STYLE 38)
5	12" WELDED STL. PIPE FE/FE W/ 3/4" THREAD-O-LET SAMPLE CONN.
6	SAMPLING COCK ASSEMBLY
7	12" SILENT CHECK VALVE, FE/FE
8	12" WELDED STL. PIPE, FE/FE (10 PIPE DIAMETERS IN LENGTH MIN.)
9	12" WATER FLOW METER W/STRAIGHTENING VEINS
10	12" WELDED STL. SPOOL, FE/FE (2 PIPE DIAMETERS IN LENGTH MIN.)
11	12" GATE VALVE, BEVEL GEAR OPERATED, FE/FE
12	12"X45° STL. ELBOW, FE/FE
13	12"X90° ELBOW, FE/FE
14	12" PIPE-HOLD DOWN BRACKET
15	1" THREAD-O-LET WELL OUTLET
16	12" WELDED STL. PIPE W/3" FLANGED OUTLET FOR VACUUM RELIEF VALVE ASSEMBLY
17	12"X12" WELDED STL. TEE, FE/FE/FE
18	PRESSURE GAUGE
19	MERCOID HIGH PRESSURE CUT OFF SWITCH
20	STATIC MIXER APPARATUS
A	CONCRETE PIPE SUPPORT w/NEOPRENE RUBBER INSULATION BETWEEN PIPE & BRACKET (SEE SHT. 14 FOR DETAIL)

GENERAL NOTES:

1. DIMENSIONS TO BE SET BY PUMP DRIVE VENDOR WITH PRIOR APPROVAL BY THE ENGINEER.
2. FOR PIPING SCHEDULE, SEE THIS SHEET.
3. ALL ABOVE GROUND PLANT PIPING SHALL BE DUCTILE IRON, CLASS 53 OR HDG SCH 40 STEEL.
4. A MINIMUM OF 60 INCHES IS REQUIRED ON THE UPSTREAM SIDE OF THE WATER FLOW METER.

EAST WALLER COUNTY MANAGEMENT DISTRICT
SOFI LAKES WATER TREATMENT PLANT PHASE 1

WATER WELL PIPING

No.	DATE	REVISION

r.g. miller
DCCM
R.G. Miller Engineers, Inc. | TxEng F - 487
16340 Park Ten Place, Ste 350
Houston, TX 77084
713.461.9600 | rgmiller.com

INTERIM REVIEW ONLY
DOCUMENT INCOMPLETE:
Not intended for permit, or construction.

Engineer: Nicholas A Kallmyer
P.E. License No. 149213
DATE: February, 2024

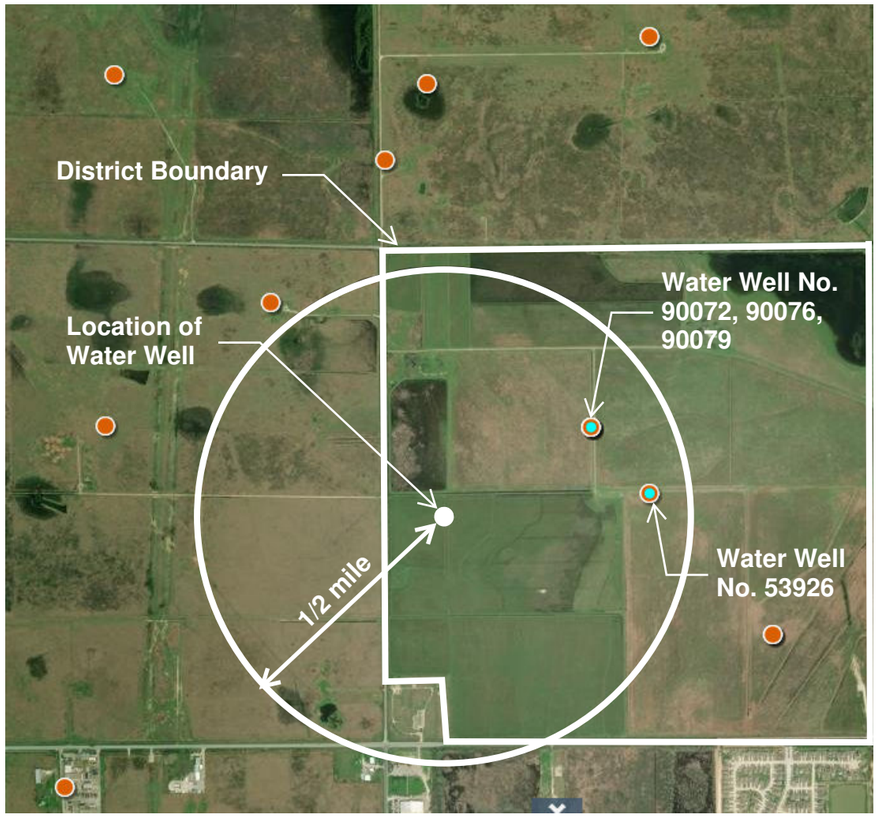
SUBMITTED:
SCALE: N.T.S.
DATE: FEBRUARY, 2024
SURVEY BY: MILLER SURVEY
F.B. NO.

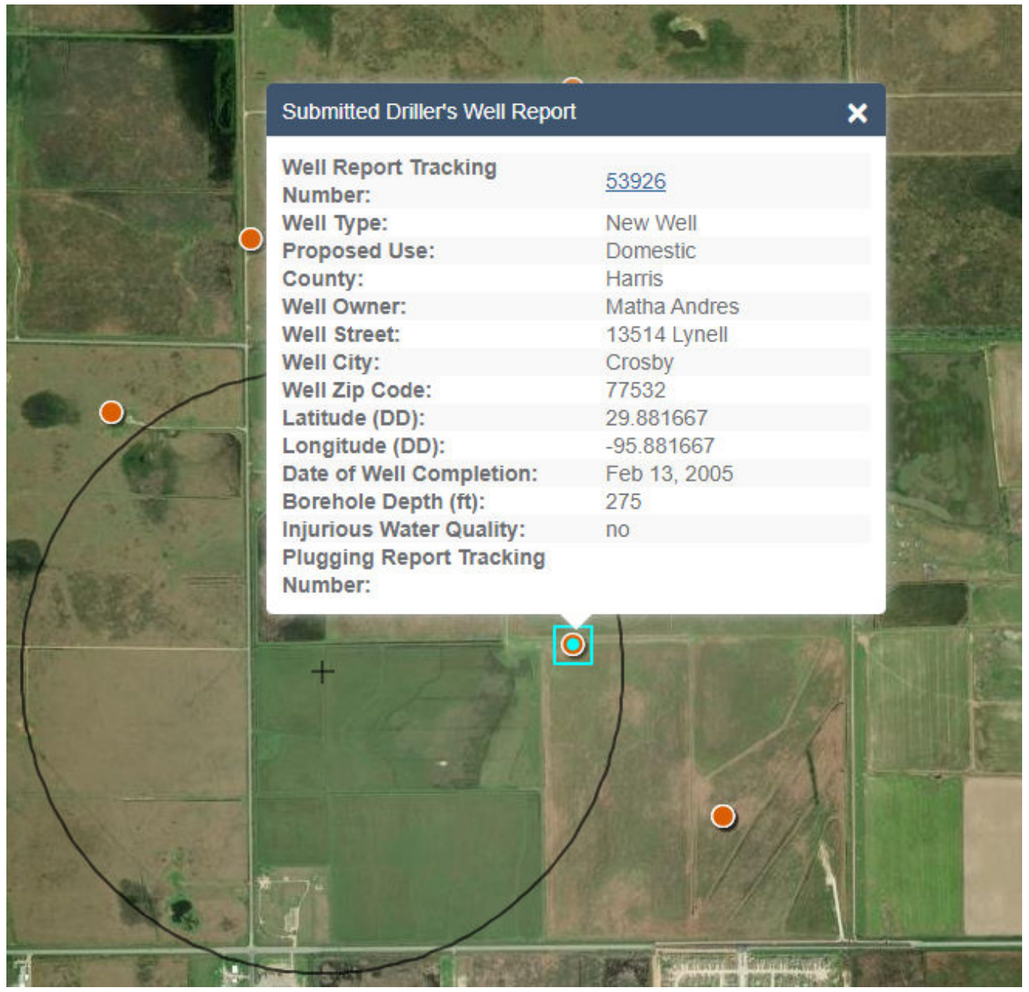
DESIGNED BY: J.T.
DRAWN BY: N.B.G.
SHEET NO. 16 OF 23 SHEETS
CITY DWG NO:

L:\4928_EAST WALLER COUNTY MANAGEMENT DISTRICT\SOFI LAKES\04834.700 SOFI LAKES WATER PLANT\CAD\DWG\4834.700WELL-PIPING.DWG Mon, 13, 2024 - 2:08 PM NOE GARCIA

TWDB Groundwater 0 | BRACS Database 0 | Well Reports 4 | Plugging Reports 0

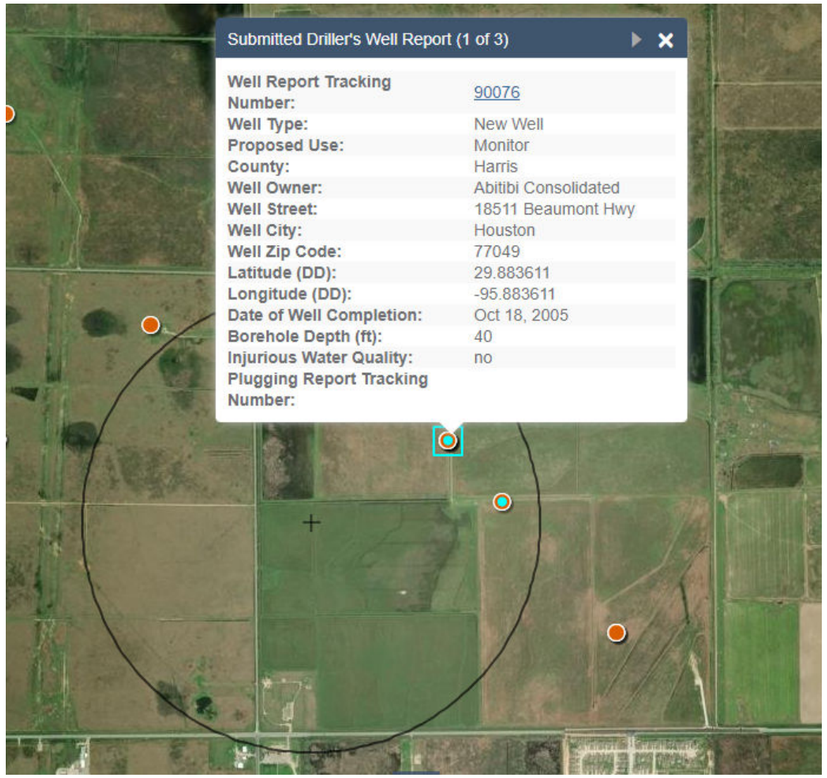
Well Report Tracking Number	Well Type	Proposed Use	County	Well Owner	Well Street	Well City	Well Zip Code	Latitude (DD)	Longitude (DD)	Date of Well Completion	Borehole Depth (ft)	Injurious Water Quality
53926	New Well	Domestic	Harris	Matha Andres	13514 Lynell	Crosby	77532	29.881667	-95.881667	Feb 13, 2005	275	no
90072	New Well	Monitor	Harris	Abitibi Consolidated	18511 Beaumont Hwy	Houston	77049	29.883611	-95.883611	Oct 18, 2005	40	no
90076	New Well	Monitor	Harris	Abitibi Consolidated	18511 Beaumont Hwy	Houston	77049	29.883611	-95.883611	Oct 18, 2005	40	no
90079	New Well	Monitor	Harris	Abitibi Consolidated	18511 Beaumont Hwy	Houston	77049	29.883611	-95.883611	Oct 19, 2005	40	no

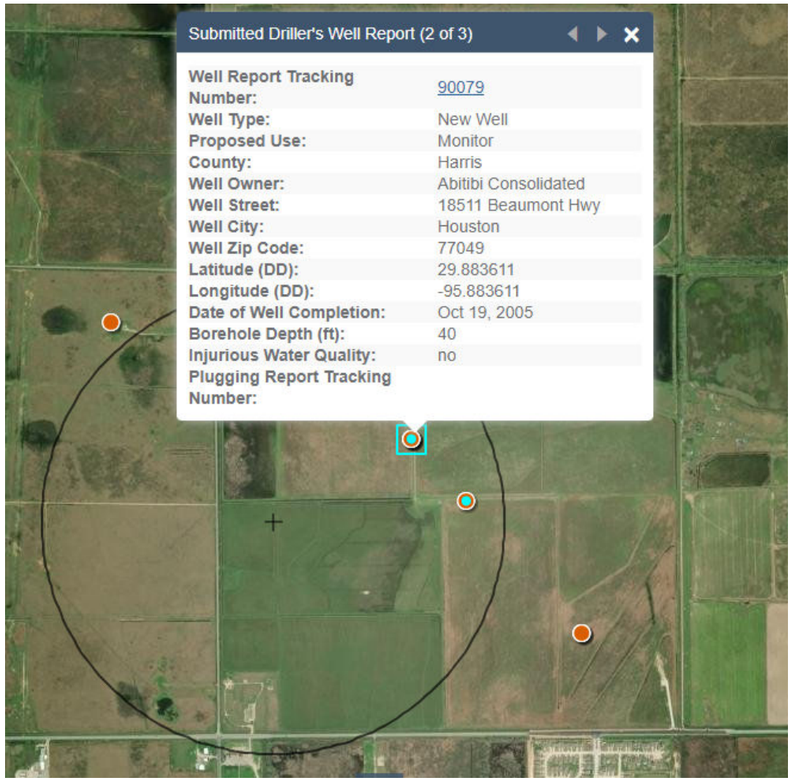


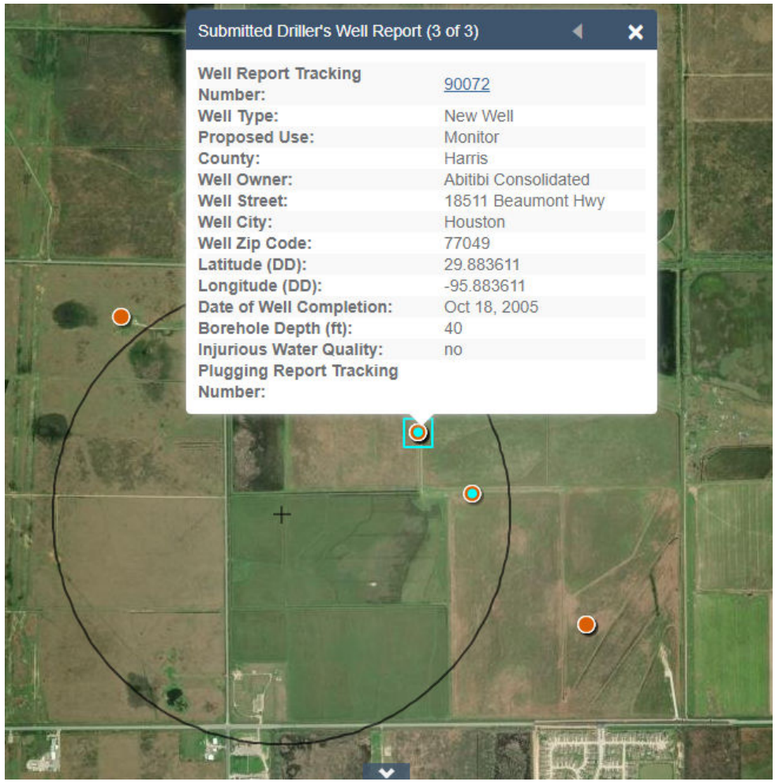


TWDB Groundwater 0 | BRACS Database 0 | Well Reports 4 | Plugging Reports 0

Well Report Tracking Number	Well Type	Proposed Use	County	Well Owner	Well Street	Well City	Well Zip Code	Latitude (DD)	Longitude (DD)	Date of Well Completion	Borehole Depth (ft)	Injurious Water Quality
53926	New Well	Domestic	Harris	Matha Andres	13514 Lynell	Crosby	77532	29.881667	-95.881667	Feb 13, 2005	275	no







TWDB Groundwater 0 | BRACS Database 0 | Well Reports 4 | Plugging Reports 0

Well Report Tracking Number	Well Type	Proposed Use	County	Well Owner	Well Street	Well City	Well Zip Code	Latitude (DD)	Longitude (DD)	Date of Well Completion	Borehole Depth (ft)	Injurious Water Quality
90072	New Well	Monitor	Harris	Abitibi Consolidated	18511 Beaumont Hwy	Houston	77049	29.883611	-95.883611	Oct 18, 2005	40	no
90076	New Well	Monitor	Harris	Abitibi Consolidated	18511 Beaumont Hwy	Houston	77049	29.883611	-95.883611	Oct 18, 2005	40	no
90079	New Well	Monitor	Harris	Abitibi Consolidated	18511 Beaumont Hwy	Houston	77049	29.883611	-95.883611	Oct 19, 2005	40	no

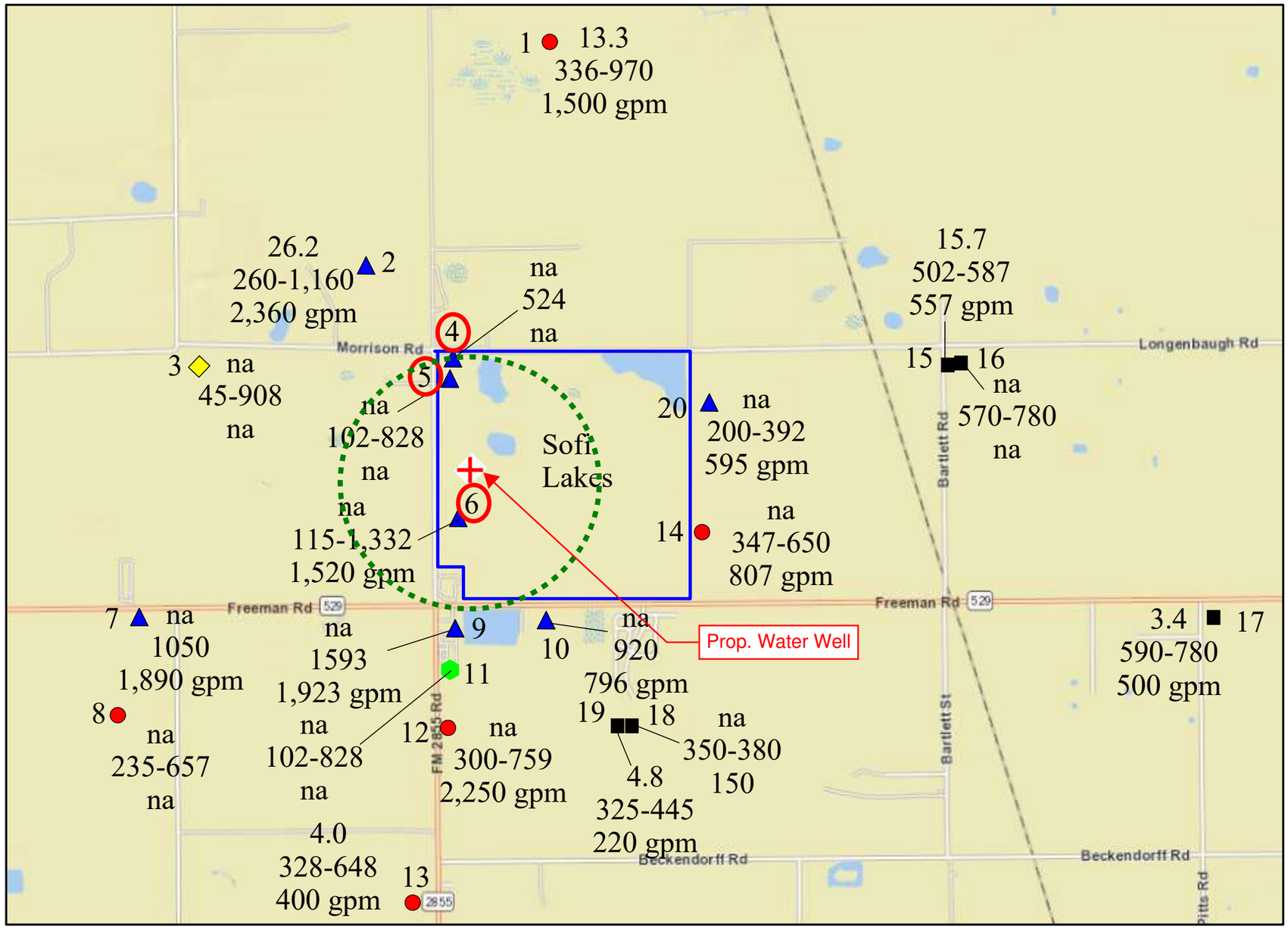
FIGURE 1
WELL LOCATION AND
PUMPING RATE DATA

GROUND WATER CONSULTANTS

LEGEND

Well No.	Specific Capacity, gpm/ft of Drawdown	Screened Interval, ft.
1	13.3	336-970
2	26.2	260-1,160
3	na	45-908
4	na	524
5	na	102-828
6	na	115-1,332
7	na	1050
8	na	235-657
9	na	1593
10	na	920
11	na	102-828
12	na	300-759
13	4.0	328-648
14	na	347-650
15	15.7	502-587
16	na	570-780
17	3.4	590-780
18	na	350-380
19	4.8	325-445
20	na	200-392

■ Public Supply Well ▲ Unused Well
● Irrigation Well ◇ Abandoned Well
⬢ Industrial Well



Report Well Number/State Well Number	Well Owner and Well Name	Drilling Contractor	Year Com-pleted	Total Depth of Well (feet) 1/	Casing and Screen Data 1/				Water-Level Data		Well Performance Data			Use of Water
					Screened Interval (feet)	Total Screen in Interval (feet)	Casing Diameter (inches)	Screen Diameter/s (inches)	Depth to Static Water Level (feet)	Date Measured	Pumping Rate (gpm)	Specific Capacity (gpm/ft)	Date Measured	
4 65-01-906	Eba Hebert	Harry Hebert	1930	524			16	16 and 12	44 61	2/11/1931 3/15/1966				Unused
5 65-01-903	Eba Hebert	Layne Texas	1941	884	102-828	362	20	20,12 and 10						Unused
6 65-01-902	Eba Hebert	Katy Drilling	1951	1332?	115-1332	1004	24	24,12, 10	96	2/17/1966	1,520		8/11/1965	Unused

Water Well Siting Study
For Sofi Lakes Development

Prepared for

Sofi Lakes Development
and
R. G. Miller/DCCM

Submitted to

R. G. Miller/DCCM
Houston, Texas

By

Ground Water Consultants, LLC
Katy, Texas

February 12, 2024

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Figure

Appendix

Ground Water Consultants, LLC

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713-444-7238

February 12, 2024

Mr. Nicholas Kallmyer, P. E.
Water/Wastewater-Team Leader
R. G. Miller/DCCM
16340 Park Ten Place, Suite 350
Houston, Texas 77084
NKallmyer@rgmiller.com

Re: Well Siting Study for Sofi Lakes Development in East Waller County

Dear Mr. Kallmyer:

Our firm has performed a well siting study for a production well with a desired pumping rate of 1,800 gallons per minute (gpm). The use of the water will be for public supply for the Sofi Lakes Development (the Lakes) located just north of FM 529 and just east of FM 2855 in the east part of Waller County. The general location of the Lakes is shown on Figure 1. The aquifer providing water to wells in the area is principally the Evangeline Aquifer because the base of the Chicot Aquifer is estimated to occur at a depth of only about 200 to 250 feet. The Chicot and Evangeline aquifers are composed of unconsolidated layers of sand and clay. The study has included the collection and evaluation of hydrogeological data from various public and private sources including the Texas Water Development Board (TWDB), U S Geological Survey (USGS), well construction contractors, an electric log library, a well testing company and our files. Field visits were performed to locate large-capacity water wells that were not listed in public databases, an irrigation well located on the property and the general surface and urban development features in the area. There is limited urban development to the immediate east of the Lakes and even less development to the west. All of the data were evaluated, and the report prepared to provide guidance regarding aquifer productivity, aquifer water quality, the potential pumping rate of a large capacity well and planning for a public supply production well. A summary and conclusions section is provided at the end of the report.

MAJOR AQUIFERS

The Chicot and Evangeline aquifers occur in the area with the base of the Chicot Aquifer at a depth of about 200 to 250 feet and the base of the Evangeline Aquifer at a depth of about 1,450 feet. The depths to the base of the aquifers are based on Texas Water Development Board (Texas Department of Water Resources in 1979) Report LP-103, A Digital Model For Simulation of Groundwater Hydrology in the Houston Area, Texas published in 1979. An

electric log for an oil test hole was not available that is located on the Lakes and logs through the aquifer sands but an electric log is available for the Wilpitz B-1 test hole located about 1.25 miles southwest of the Lakes and it shows that the base of sands in the Evangeline Aquifer for screening in a well occurs at a depth of about 1,000 to maybe 1,100 feet. Below a depth of about 1,000 to 1,100 feet the limited sands of the Evangeline Aquifer do not appear favorable for screening in a well due to the resistivity of the sands indicating higher levels of total dissolved solids (TDS) above 1,000 mg/l. The electric log shows that the layers of sand vary in thickness from about 10 to 50 feet and that the layers of clay range from about 10 to 140 feet thick with the prevalence of clay increasing with depth. The location of the test hole is shown an an aerial map provided in the Appendix. The Chicot Aquifer outcrops at land surface in the area and the outcrop extends to the northwest about 20 miles to just north of the City of Hempstead and the Evangeline Aquifer outcrops in the area of about 10 miles wide that is about 25 to 35 miles to the northwest. The outcrops extend in a northeast to southwest direction with the formations dipping downward toward the coast at a rate of 20 feet per mile for the Chicot Aquifer and about 30 feet per mile for the Evangeline Aquifer. The outcrop areas serve as recharge zones for the aquifers and the two aquifers are described as a slightly leaky artesian aquifer system.

Below the Evangeline Aquifer is the Burkeville Confining Unit and below that the Jasper Aquifer dipping downward to the southeast at the rate of about 50 to 60 feet per mile. The Jasper Aquifer occurs in the depth interval from about 1,900 to 2,200 feet and also is composed of interbedded sands and clays. The aquifer water quality is not known at the Lakes because the nearest well that screens the aquifer is located about 16 miles to the northwest and is about 1,400 feet deep or another well is about 15 miles to the northeast and is about 1,900 feet deep. Electric logs for oil test holes located about 0.5 to 1.25 miles outside the Lakes indicate that potentially 100 to 130 feet of sand might be available for screening in a well screening the Jasper Aquifer.

ELECTRIC/GEOPHYSICAL LOG DATA

Electric or dual induction electric logs provide data regarding the depth, thickness and resistivity of sand layers with the resistivity values somewhat indicative of the productivity of the aquifer sands and of the water mineralogical quality or TDS content. The Lakes is located in the Katy Gas Field that was an active gas field beginning in about the 1940s and is not as productive of gas now due to depletion of the reserve. There were field rules regarding the casing setting depth required to help protect the freshwater sands. With those rules, the number of electric logs is reduced that log through the freshwater sands that occur above a depth of about 1,100 feet as casing was normally set in a test hole to depths of 2,100 to 2,400 feet before any electric log was run in the test hole. Electric log data are not available for oil or gas test holes located on the Lakes but are available for a few test holes located about 0.25 to 1.35 miles outside the Lakes. The approximate locations of the oil or gas test holes are provided on a map in the appendix. An electric log for the Humble Oil, Wilpitz B-1 test hole, mentioned previously, shows about 90 feet of sand occurs in the about 300 to 500-foot depth interval, about 70 feet of sand occurs in the about 500 to 650-foot depth interval and about 55 feet of sand occurs in the about 650 to 1,150-foot depth interval, no sand occurs in the 1,150 to 1,950-foot

depth interval and about 120 feet of sand in the Jasper Aquifer in the depth interval from 1,950 to 2,220 feet. A drillers log for Well 19, with its location shown on Figure 1 and located about 0.5 miles south of the Lakes, lists about 70 feet of sand in the 360 to 450-foot depth interval but unfortunately the static water level in a well constructed at that site was 200 feet below ground level limiting the available drawdown in any well that would screen the 360 to 450-foot depth sands. The drillers log lists clay as occurring from 450 to 700 feet the total depth of drilling. The Waller County MUD 9B is constructing its third well because of water demand in the MUD and due to the limited pumping rate of their two existing wells of between about 150 and 220 gpm.

An electric log for Well 1 shows about 150 feet of sand in the about 520 to 1,000-foot depth interval that was acceptable for screening in a well. Well 1 is located about 1.35 miles to the north of the north edge of the Lakes. Fortunately, the electric log did not show any depth intervals with elevated gamma ray readings which can indicate aquifer sands that can produce water with elevated levels of radiological constituents.

The single point electric log for Well 2 located just northwest of the Lakes extends to a depth of 1,350 feet and shows about 110 feet of sand in the depth interval from 650 to 1,000 feet and essentially no sand in the depth interval from 1,000 to 1,350 feet. A single point electric log can be indicative of sand but is not as definitive as an induction or electric log run in the other wells or test holes discussed in this section.

The electric log for Well 17 located about 2 miles east of the Lakes shows about 80 feet of sand in the 390 to 500-foot depth interval but there are high gamma ray readings in the interval. The electric log also shows about 170 feet of sand in the about 530 to 1,040-foot depth interval with no elevated gamma ray readings in the interval. A public supply well is being constructed at the site screening about 135 feet of sand in the 590 to 780-foot depth interval and will provide about 500 to 600 gpm.

Regarding estimates of Jasper Aquifer depth and sand thickness, an electric log for Stanolind Oil, Pattison #2 test hole located about 0.6 miles west of the Lakes shows about 130 feet of sand in the about 1,900 to 2,100-foot depth interval and the Humble Oil, Abert #1 test hole electric log shows about 100 feet of sand in the about 1,940 to 2,120-foot depth interval. The resistivities shown on the electric logs indicate that the water could contain less than 1,000 mg/l of TDS. The locations of the two test holes are shown on an aerial map in the Appendix.

In summary, the electric log data show that if the aquifer sands in the about 500 or 600 to 1,100-foot depth interval of the Evangeline Aquifer in the Lakes are similar to what is being shown by electric logs outside the Lakes it might be possible to construct a well that could be pumped at an estimated rate of about a 1,000 to possibly 1,500 gpm. The depth and thickness of the aquifer sands vary in the area and the pumping rate potential of a well will depend on the site-specific conditions that are encountered including not only sand thickness and depth but also the presence or absence of elevated gamma ray readings in sands.

For the Jasper Aquifer, the data show that there could be adequate sand thickness in the about 1,900 to 2,200-foot depth interval for a well providing 1,000 gpm or more but the water quality

would have to be assessed during the drilling of a well by taking isolated depth interval water sampling using the gravel up method. There are no wells located within 14 miles that screen sands of the aquifer to provide any water quality data. There is one well located about 15 miles to the southeast in Cinco Ranch that screens the Jasper Aquifer at a depth of about 3,000 feet and it produces brackish water that contains some natural gas and elevated levels of iron.

WELL RECORDS, PUMPING RATES AND SPECIFIC CAPACITY DATA

Records were obtained for 20 mostly large-capacity wells located in the vicinity of the Lakes and the records are provided in Table 1 and as stated previously, their locations are shown on Figure 1. The use of the well is provided with symbols on Figure 1 and in print in Table 1. Many of the irrigation wells in the area are not used or have been abandon because rice farming has become very limited over the past 30 years. A small-capacity well is defined as producing less than 200 gpm and large-capacity wells as producing 200 or more gpm. Construction, water level, and pumping rate data also are given in Table 1. Information regarding the well pumping rates, specific capacities and screened intervals is provided on Figure 1. The search was for wells that screen sands in the Evangeline aquifer because the base of the Chicot Aquifer is at a depth of about 200 to 250 feet. There are no wells within the study area that screen sands of the Jasper Aquifer. Public supply wells are located to the east or just to the south with the pumping rates of the wells ranging from about 150 to 557 gpm.

Well specific capacity is a useful measurement of the performance of a well (Roscoe Moss Company, 1990). It is defined as the well discharge at a constant rate in gpm divided by the water level drawdown in feet in the well bore after a given time (normally at least one to three hours of continuous pumping). The units of specific capacity are gallons per minute of production per foot (gpm/ft) of drawdown. Wells with higher specific capacities normally are reflective of good well development by the contractor and of aquifers that have a greater ability to transmit water at higher rates.

Wells 2 through 7 and Wells 9, 10, 11 and 20 are unused irrigation wells with any pumping rates for them dating back to 1965. The pumping rates reported for Wells 2, 6, 9, 10, 12 and 20 are for wells that screened some of the very shallow sands plus some deeper sands and were pumped on a seasonal basis to provide water for irrigation. The shallow sands are not utilized for long-term use public supply wells that are pumped on a year-round basis. Many of the irrigation wells have not been tested to provide specific capacity data.

The pumping rate and static water level data provided for Wells 18 and 19 show that screening the sands in the 300 to 450-foot depth interval does not provide adequate available drawdown in the future for a 600 gpm or higher rate well as the static water levels measured in the two wells were about 193 to 200 feet four to six years ago and most likely have declined some since then with the continuing urbanization to the east that is dependent on groundwater. As mentioned previously the MUD served by the two wells is constructing another well needed to provide additional water for the MUD.

Well 15 had a specific capacity of 15.7 gpm/ft of drawdown while screening sands in the 502 to 587-foot depth interval. If that same sand package exists in the Lakes it would be part of the

depth interval that could be considered for screening in a well. Well 1 screens sands in 336 to 970-foot depth interval, had a static water level of 180 feet in October 2022 and had a specific capacity of 13. 3 gpm/ft of drawdown. The electric log shows about 150 feet of sand in the about 520 to 1,000-foot depth interval. If similar aquifer sand depth and thickness conditions exist in the Lakes or in the north part of the Lakes that would be positive for a higher pumping rate well. Well 1 is used on an as needed basis to provide water for wildlife habitat and not irrigation.

In summary, the well pumping rate, specific capacity and screened interval data are showing that if there are deeper layers of aquifer sands below a depth of about 500 feet that are at least about 130 feet thick in total there is the potential to construct a higher pumping rate well of possibly 1,000 to maybe 1,500 gpm. The well data are showing that to the immediate south of the Lakes the 325 to 459-foot depth sands are not good candidates for supporting high capacity wells partly due to their productivity and also the limited available drawdown. The pumping rate and specific capacity data for wells located to the north may indicate that there is a higher likelihood of a higher pumping rate well in that part of the Lakes. Proper well design, the existence of adequate aquifer sand thickness and then construction and thorough well development by an experienced and successful contractor are essential for obtaining a higher pumping rate well.

GROUNDWATER PUMPING

Groundwater pumping from the Chicot and Evangeline aquifers is reasonably low in the area because there is limited population except to the east and south a few miles. Large scale groundwater pumping for the irrigation of rice ended a few decades ago resulting in a significant reduction in local groundwater pumping. There is not a large industrial user in the area that is dependent on groundwater as its supply. As the population and local urbanization occur, there will be an increase in groundwater pumping that will result in the lowering of the artesian pressure in the aquifer observed as declines in static water levels in wells.

Groundwater pumping from the Jasper Aquifer is nonexistent in the area.

STATIC WATER LEVELS IN WELLS

Representative static water-level measurements collected from wells are given on the right side of Table 1. The data show that static water levels in wells that screen the 325 to 450-foot depth interval can be 190 to 200 feet. Well 17 to the east had a static water level of 253 feet while screening sands in the 590 to 780-foot depth interval. Data from wells a number of miles to the southeast show that if a well is constructed that just screens the deeper sands below a depth of about 800 feet, the static water level probably would be about 300 to 350 feet.

Data for Well 11 located immediately south of the Lakes and screening sands in the 117 to 714-foot depth interval shows that since 1951 the static water level has declined from 74 to 123 feet indicating that the water level in the shallow sands is declining.

If overall pumping in the area increases in the future, there will be some static water-level

decline that occurs, and the amount of decline will vary directly with the magnitude of the pumping increase.

If a well is constructed screening sands of the Jasper Aquifer it is estimated that the static water level could be about 50 to 100 feet below land surface.

GROUNDWATER CHEMICAL QUALITY DATA

The results of chemical analyses of water from local wells are given in Tables 2 and 3 and the locations of the wells are shown on Figure 1. The data summarized in Table 2 indicate that the hydro-chemical character of the groundwater is essentially a sodium-bicarbonate and calcium-bicarbonate water. There are a limited number of wells with water quality data due to the lack of urban development in the area. The total hardness of the water sampled ranges from about 110 to 198 mg/l as CaCO4 meaning the water has moderate to higher hardness. The calcium and magnesium in the water are the large contributors to the total hardness values. TDS levels in the samples collected ranges from 278 to 408 mg/l indicating a low to modest level of TDS. The Secondary Limit for TDS for water used for public supply is 1,000 mg/l.

The chloride level in the water samples varies from about 38 to 120 mg/l with the Secondary Drinking Water Standard for chloride being 300 mg/l. The chloride level of 120 mg/l is for Well 6 that has a reported screened interval from 115 to 1,332 feet somewhat indicating that the higher level of chloride is due to the deeper sands screened which can have higher levels of chloride. Water that does not meet the secondary constituent levels may not be used for public drinking water without written approval of the executive director of the Texas Commission on Environmental Quality (TCEQ).

The levels of iron and manganese available for three of the 20 wells were below the Secondary Maximum Contaminant Levels (SMCLs) recommended by the TCEQ of 0.30 and 0.05 mg/l, respectively as listed in the middle columns of Table 2. The fluoride content in the water available for four of the 20 wells in Table 1 ranged from <0.1 to 0.5 mg/l with the secondary limit for fluoride of 2.0 mg/l for drinking water and the primary limit being 4.0 mg/l.

The primary drinking water limit for arsenic in water used for public supply is 0.01 mg/l or 10 micrograms/l as given at the bottom of Table 3. Analyses for arsenic could be found for two of the 20 wells in Table 1. The water systems provided water by Wells 15, 16 18 and 19 did not report that arsenic was an issue with the water from their wells, but the wells only extend to a maximum depth of 780 feet thus data are not available regarding levels of arsenic in sands below that depth.

Results for samples analyzed for radiological constituents also are provided in Table 3 for two wells. The data show that the levels of radiological constituents were below the current limits used by the TCEQ for public supply.

Data were not found that indicated that any of the wells in the area produced water that contained natural gas.

In summary, the limited data show that the water is low in mineralization and has moderate to higher total hardness. Analyses for all of the drinking water constituents were not found due to the limited public supply wells in the area. Discrete depth interval water sampling in a pilot hole drilled for a well is recommended and will provide data regarding site specific water quality that can be used in determining depth intervals for screening. Water samples should be collected during water sampling operations using the temporary gravel up well method and then the samples analyzed for at least all of the primary and secondary drinking water standards constituents regulated by the TCEQ to assess groundwater quality.

SUPPLY DEVELOPMENT

Based on the data collected and evaluated it is estimated that it may be possible to construct a well screening sands in the about 500 or 600 to 1,100-foot depth interval of the Evangeline Aquifer and obtain about 1,000 to maybe 1,500 gpm. If adequate sands have been deposited in the depth interval from 600 to 1,100 feet screening the deeper sands would be preferable and should provide a well with a greater amount of available drawdown, that is distance between the well static water level and the top of sands screened. The final well pumping rate will be known after pilot hole data are collected and evaluated and a well is constructed and thoroughly developed by a contractor efficient and effective at well construction and well development. Water quality also should be known after the pilot hole is drilled and multiple water samples collected, but the preliminary assessment is that the water could contain about 350 to 500 mg/l of TDS.

A total pumping rate of 1,800 gpm could be required by the development and if that water demand develops in the future, a second well could be required. Data from the first production well will be helpful in designing the second well and in determining its location. Spacing between wells can be required by the Bluebonnet Groundwater Conservation District (District) as described in their Rule 5.1. The amount of required spacing between wells is evaluated by the District on a well by well basis at the time a permit for a well is obtained and a hydrogeological report is prepared in accordance with District rules.

If there is interest in exploring the water production potential of the Jasper Aquifer the same procedure should be followed by the depth of a pilot hole would extend to about 2,300 feet as the aquifer occurs in the depth interval from about 1,900 to 2,200 feet.

Recommendations for well pilot hole drilling and water sampling and well construction for a planned well follow.

PILOT HOLE AND WATER SAMPLING RECOMMENDATIONS

Initially a pilot hole should be drilled to a depth of about 1,250 feet and below a depth of 200 feet sand samples collected at ten-foot intervals of any depth interval indicating sand. After drilling is completed, geophysical logs should be run over the total depth of the hole. If there is interest in exploring the Jasper Aquifer then the pilot hole should be drilled to a depth of about 2,300 feet. A dual induction log with gamma and a compensated neutron-formation density log should be included in the suite to check for the potential presence of any sands that might

indicate methane gas. The well drilling contractor should provide an electric log analyst to review the electric logs and provide their assessment regarding any high gamma ray readings and any indication from the logs that there is natural gas in any of the aquifer sands. A provision for collecting water samples from discrete depth intervals using the temporary well gravel up method should be included in the specifications as a base bid item in the schedule of unit price work. It is recommended that it be planned that four water samples be collected to obtain depth and site-specific water quality data and the number of water sampling operations could change based on information collected as the water sampling proceeds. Water samples should be collected and analyzed for iron, manganese, and arsenic with a one-day turnaround time by a laboratory so that water quality in a zone can be assessed in 24 hours or less of time after sample collection. That data could help determine the next shallower interval that should be sampled.

WELL CONSTRUCTION

A well that screens sands in potentially the about 500 or 600 to 1,100-foot depth interval could be constructed with 24-inch diameter casing and 18-inch diameter screen using the two-piece well construction architecture, that is the casing is set and cemented in place and the hole below the casing is enlarged to accommodate the screen liner that is gravel packed in place in the underreamed hole. The hole for the 24-inch diameter casing should be 30 inches in diameter and the underreamed hole for the 18-inch diameter screen should be about 30 to 32 inches in diameter. It is estimated that there might be about 100 to 140 feet of sand available for screening in the 500 or 600 to 1,100-foot depth interval based on extrapolating electric log data from outside the Lakes. The well construction casing and screen sizes could change depending on the depth, thickness and quality of water in the aquifer sands. If the sizes change, they could change to a well with possibly 20-inch diameter casing and 14-inch diameter screen.

CASING AND SCREEN COMPONENTS

It is recommended that the surface casing be API 5L carbon steel line pipe with a wall thickness of 0.50 inches. The 18-inch diameter screens should be constructed of 316L stainless steel wire wrapped on API 5L carbon steel pipe with a wall thickness of 0.50 inches. A well this size will accommodate setting a nominal 1,770 rpm line shaft turbine pump with up to a 14-inch diameter pump bowl assembly with a steep head-capacity pump curve.

The pipe base for the screen should be perforated to provide a minimum open area of about 18 percent. The contractor should recommend the screen opening size, subject to acceptance by the Owner and Engineer. The contractor should construct a well that will meet specific capacity and suspended solids performance requirements that are acceptable to the Engineer and are given on an initial basis in subsequent sections.

SILICA GRAVEL PACK MATERIAL

The depth interval for screening should be reamed to the appropriate diameter, 30 to 32 inches, and the well gravel packed with chlorinated gravel. The gravel should be composed primarily of silica sand obtained from the Hickory Sandstone near Brady, Texas and should meet

requirements on gradation, uniformity coefficient and iron and manganese content as given in AWWA A100-20. Sodium hypochlorite should be used as the disinfectant during the well gravel packing while maintaining a minimum chlorine residual of 50 mg/l and spring-type balloon centering guides should be placed on the blank sections of the screen at approximately 80-foot intervals to help hold the screen in the center of the reamed hole. One set of guides should be installed just below the bottom of the bottom screen.

WELL DEVELOPMENT AND PUMPING TEST

The contractor should thoroughly develop a well prior to performing the final pumping test using high volume air lift pumping, agitation, chemical treatment and pumping and surging at a high pumping rate up to about 2,000 to 3,000 gpm, with a variable speed turbine pump. The importance of thorough well development is crucial to the success of the well to maximize the long-term pumping rate. Development should continue until a well is at least about 75 percent efficient based on evaluation of tests performed before the final well pumping tests begin. The final well testing could consist of 78 hours of testing including an 18-hour series of three hours of pumping and three hours of recovery water level measurements during step tests followed by 12 hours of non-pumping, a 36-hour continuous pumping period to address the TCEQ requirements, and a 12-hour water-level recovery period.

The water produced should be clear, free of drilling and formation mud/clay/silt and have a suspended solids content of no greater than 5 parts per million at any time after 20 or 30 minutes of pumping at the final design rate and less, as measured with a properly installed and operating Rossum Sand Tester. If the well does not provide water that meets the suspended solids performance requirements, the well should not be accepted by the Owner and Engineer and the Contractor should remedy the deficiency. The contractor should be required to install a Rossum Sand Tester in the manner and configuration specified in Roscoe Moss Company Technical Memorandum 005-7 or in ANSI/AWWA A100-20.

INITIAL WELL OPERATING CONDITIONS

Roughly estimated initial operating conditions and requirements for a pump and motor are provided below in Table 4. The initial operating conditions could change after the pilot hole is drilled, water samples collected and analyzed and the well constructed and tested. The pump for the well could be a line shaft turbine pump with above-ground electric motor. A well with 24-inch diameter casing and 18-inch diameter screen will accommodate a line shaft turbine pump. The final pump components and pump column diameter should be selected after the well is constructed and thoroughly developed and at that time the pumping rate for the permanent pump can be assessed. With a well capable of producing 1,000 gpm, the pump column should be ten inches in diameter with 0.365-inch wall thickness.

If aquifer conditions are such that a well with a higher pumping rate of 1,500 gpm can be constructed then the pump setting most likely will be deeper and the motor size could increase to 250 to 300 horsepower.

Table 4. Estimated Initial Pump Operating Conditions and Requirements

	Production Well about 500 or 600 to 1,100-foot screened interval
A. Permanent Pump Design Pumping Rate, gpm	1,000
B. Estimated Static Water Level, ft.	250
C. Estimated Pumping Water Level, ft.	410
D. Estimated Discharge Head to GST Above Ground and Pump Column Losses, ft.	30
E. Estimated Total Dynamic Head, ft. of water	440
F. Maximum Diameter of Pump Bowls, in.	14
G. Column Setting, ft.	500
H. Column Diameter, in.	10
I. Minimum Column Wall Thickness, in.	0.365
J. Minimum Oil Tubing and Shafting Diameters, in.	3.0" x 1-15/16"
K. Minimum Motor Name Plate, hp	200
L. Motor Speed, rpm	1,770
M. Motor Voltage, volts	460
N. Minimum Pump Efficiency at Design Pumping Rate, percent	81

ON SITE IRRIGATION WELL

There is an irrigation well located in the northeast part of the Lakes and its location is shown on Figure 1 as Well 5 and data for the well are provided in Table 1. The well was constructed in 1941 and is reported to screen sands in the 102 to 828-foot depth interval. The well was visited and two pictures of the well are provided in the appendix. The well is equipped with a line shaft turbine oil lubricated pump and six-cylinder Caterpillar G342 natural gas fired engine. It appears the well has not been used for a number of years and whether it is in operating condition is not known and whether the gas supply to the engine is still available is not known. It is suggested that if there is interest in exploring using the well, most likely with other pumping equipment, that the previous well owner/operator be contacted to obtain more information regarding the well and its past performance. If the results are positive based on information from the previous owner/operator, the pump might be removed and new pumping equipment installed that is appropriate for a new intended well use. A three-phase power line is located on the east side of FM 2855 within 100 feet of the well so electrical service should be readily available. The previous well owner/operator could provide information regarding the well pumping rate and water quality and whether the well produced sand in any excessive amount.

SUMMARY AND CONCLUSIONS

- The data collected and evaluated show that it may be possible to construct a 1,000 to 1,500 possibly gpm well screening sands in the about 500 or 600 to 1,100-foot depth interval and that the water could contain about 350 to 500 mg/l of TDS. Well data are limited in proximity to the Lakes and local hydrogeologic data from pilot hole drilling are needed and could alter the estimates provided above. Data from a pilot hole should include sand samples, electric logs and water samples to assist in deciding which aquifer sands should be screened and to refine estimates of potential well pumping rate. The well pilot hole should initially be drilled to a depth of about 1,250 feet.

- The well should use two-piece well architecture with the casing 24 inches in diameter and the screen and blank liner being 18 inches in diameter. The well would have the underreamed gravel-packed type of construction with the diameter of the underreamed hole being about 30 to 32 inches.

- The well construction materials should include carbon steel surface casing with 0.50-inch wall thickness set from land surface to the top of the screened interval. The screen and blank liner should be constructed with 316L stainless steel wire wrapped screens on carbon steel pipe base with 0.50-inch wall thickness for the 18-inch diameter screen.

- A suite of electric logs should be run in a well pilot hole and the specifications should include a provision for water sampling of an estimated four discrete depth intervals. The electric logs should include a dual induction with gamma ray and a compensated neutron-formation density log. During the water sampling process samples should be collected for iron, manganese, and arsenic when the water is clear and analyzed with a one-day turnaround time for results. This data could be helpful in deciding the next shallower interval for water sampling. Final selection of the aquifer sands for screening can occur after all of the pilot hole data are collected and evaluated.

- Any well should be thoroughly developed by a contractor with competency in that area and then pump tested and meet certain water clarity, specific capacity and suspended solids requirements. The testing should include a 36-hour continuous pumping test which is required by the TCEQ for wells to provide water for public supply.

- A line shaft turbine pump can be set in the well for 1,000 gpm, if the sands are very productive, and powered by a 200 hp, 460-volt, 1770 rpm motor. A potential set of design parameters could be a pump rated to provide 1,000 gpm at a total dynamic head of 410 feet of water assuming the well pumps to a nearby ground storage tank. The steel pump column should be 10 inches in diameter and 0.365-inch wall thickness with 3.0-inch oil tubing and 1-15/16-inch diameter shafting. An API Spec 5L Grade B standard pipe could be used for the threaded pump column. It is estimated that the well static water level could be about 250 feet below ground level. Final permanent pumping equipment selection should occur after the final pumping test is performed and evaluated.

- The location for a second well to obtain an overall pumping rate of 1,800 gpm can be evaluated after a first well is constructed and tested. There are rules of the Bluebonnet Groundwater Conservation District that address well spacing and a hydrogeological report that is required for non-exempt wells which are applicable for public supply wells.

- If there is interest in exploring constructing a well screening sands of the Jasper Aquifer a pilot hole should be drilled to a depth of about 2,300 feet, sand samples collected, electric logs run and isolated zone water samples collected to obtain data regarding water quality. After evaluating the pilot hole data decisions can be reached regarding the acceptability of a well to provide water for public supply.

- The irrigation well, constructed in 1941, located in the northeast part of the Lakes could have a potential for providing water for a non-public water supply use and is equipped with a line shaft turbine pump powered by a natural gas engine. The well pump has not been used for several years. The applicability of using the well as a supplemental water supply can be further explored by first contacting the previous well owner/operator to obtain historical data regarding the wells past use and performance. Testing of the well could occur with a temporary pump if initial inquiries regarding the well are positive. All indications are the well has not been constructed to public water supply well standards.

- A well permit and Phase I and Phase II hydrogeologic studies and reports are required by the Bluebonnet Groundwater Conservation District for a Non-Exempt well. Instructions and requirements regarding the permit and reports are available from the District.

We appreciate assisting your firm as a water supply for an urban development is planned. If you or others with R. G. Miller/DCCM have questions while reviewing the report, please contact us and we will be available to answer them.

Submitted by:

W. John Seifert, Jr. P.E.
Principal, February 12, 2024
Ground Water Consultants, LLC

TABLES

Table 1. Well Data

Report Well Number/State Well Number	Well Owner and Well Name	Drilling Contractor	Year Com-pleted	Total Depth of Well (feet) 1/	Casing and Screen Data 1/				Water-Level Data		Well Performance Data			Use of Water
					Screened Interval (feet)	Total Screen in Interval (feet)	Casing Diameter (inches)	Screen Diameter/s (inches)	Depth to Static Water Level (feet)	Date Measured	Pumping Rate (gpm)	Specific Capacity (gpm/ft)	Date Measured	
1	Waller County Land and Cattle	J&S Water Wells	2022	980	336-970	256	16	16 and 12	180	10/1/2022	1,500	13.3	10/1/2022	Irri
2 65-01-910	Eba Hebert	Layne Texas	1967	1,160	260-1160	531	20	20 and 12	230	7/2/1967	2,360	26.2	7/3/1967	Unused
3 65-01-904	A. E.Thompson	Layne Texas	1937	926	45-908	161	18	18 and 12	57 68 77 85 92 86	10/7/1940 11/21/1950 11/22/1960 3/4/1970 12/10/1980 2/22/1984				Abd
4 65-01-906	Eba Hebert	Harry Hebert	1930	524			16	16 and 12	44 61	2/11/1931 3/15/1966				Unused
5 65-01-903	Eba Hebert	Layne Texas	1941	884	102-828	362	20	20,12 and 10						Unused
6 65-01-902	Eba Hebert	Katy Drilling	1951	1332?	115-1332	1004	24	24,12, 10	96	2/17/1966	1,520		8/11/1965	Unused
7 65-09-304	John Bollinger	Katy Drilling	1964	1050			20, 12	12			1,890		9/8/1965	Unused
8	TP Farms	Weisinger Inc.	2011	667	235-657	300	12	12	67	6/21/2011				Irri
9 65-09-303	TUBA Partnership	Katy Drilling	1961	1593?			20,12	20,12,8	94.4	2/16/1966	1,923		6/22/1965	Unused
10 65-09-306	T:UBA Partnership	Layne Texas	1949	920			16,10	10	65 94	4/13/1949 2/16/1966	796		9/13/1965	Unused

Table 1. Well Data

Report Well Number/State Well Number	Well Owner and Well Name	Drilling Contractor	Year Com-pleted	Total Depth of Well (feet) 1/	Casing and Screen Data 1/				Water-Level Data		Well Performance Data			Use of Water
					Screened Interval (feet)	Total Screen in Interval (feet)	Casing Diameter (inches)	Screen Diameter/s (inches)	Depth to Static Water Level (feet)	Date Measured	Pumping Rate (gpm)	Specific Capacity (gpm/ft)	Date Measured	
11 65-09-307	TUBA Partnership	Layne Texas	1928	767	117-714		16	12,8	48 58 74 83 100 108 107 123	2/10/1931 1/22/1941 11/14/1951 3/27/1961 3/11/1971 1/15/1991 1/31/2001 1/5/2010				Unused
12 65-09-305	TUBA Partnership	Katy Drilling	1964	759	300-759	459	20	12	106	2/16/1966	2,250		9/15/1965	Irri
13	Maldonado Nursery & Landscape	J&S Water Wells	2021	668	328-648	150	12	12	240	11/12/2021	400	4	11/12/2021	Irri
14 65-02-706	J. H. Longenbaugh	Katy Drilling	1963	650	347-650	301	20	12	100	2/16/1966	807		9/8/1965	Irri
15	H C MUD 465 Well 1	Bussell and Sons	2020	592	502-587	85	10	6	177 184	3/1/2020 5/6/2020	557	15.7	5/7/2020	PS
16	H C MUD 465 Well 2	Johnstons Water Well Drilling	2022	790	570-780	120	8	8	204	4/6/2022				PS
17	H C MUD 539	J&S Water Wells	2/15/24	800	590-780	130	20	14	253	12/8/2023	500	3.4	2/5/2024	PS
18 65-09-315	Waller County MUD 9A Well 1	Johnstons Water Well Drilling	2018	390	350-380	30	6	6	200	7/27/2018	150		7/27/2018	PS
19	Waller County MUD 9A Well 2	Johnstons Water Well Drilling	2020	445	325-445	80	6	4	193	12/30/2020	220	4.8	12/30/2020	PS
20 65-02-701	J. H. Longenbaugh	Justman Drilling	1950	392	200-392	192	20	12	94	2/21/1966	595		6/14/1965	Unused

Table 1. Well Data

Report Well Number/State Well Number	Well Owner and Well Name	Drilling Contractor	Year Com-pleted	Total Depth of Well (feet) 1/	Casing and Screen Data 1/				Water-Level Data		Well Performance Data			Use of Water
					Screened Interval (feet)	Total Screen in Interval (feet)	Casing Diameter (inches)	Screen Diameter/s (inches)	Depth to Static Water Level (feet)	Date Measured	Pumping Rate (gpm)	Specific Capacity (gpm/ft)	Date Measured	

EXPLANATION

1/ Total depth of well and casing and screen data shown based on well contractors' construction data and may be different than camera survey data, etc.

Abd = Abandoned

PS = Public supply well

Irri = Irrigation

Unused = Well not in use

Table 2. Water Quality Data

Well Name & State Well Number	Screened Interval (feet)	Laboratory 1/	Date Sampled	Silica (SiO_2) mg/l	Calcium (Ca) mg/l	Magnesium (Mg) mg/l	Sodium (Na) mg/l	Potassium (K) mg/l	Iron (Fe) mg/l	Manganese (Mn) mg/l	Sulfate (SO_4) mg/l	Chloride (Cl) mg/l	Bicarbonate (HCO_3) mg/l	Nitrate (NO3) mg/l	Fluoride (F) mg/l	Dissolved Solids 2/ mg/l	Total Hardness as $CaCO_3$ mg/l	Conductance (micromhos/cm at 25°C)	pH
3 65-01-904	45-908	USGS	8/11/1947								2	51	158				110	404	
5 65-01-903	102-828	USGS	8/11/1947								3	44	206				128	452	
6 65-01-902	115-1332	USGS	5/12/1965	26	52	4	91	1.30			24	120	182	0.20	0.5	408	146	735	7.70
9 65-09-303	1593?	LCRA	5/8/2001	20.7	46	7.50	47.9	1.90	0.05	0.025	20	55.7	204	0.09	0.21	300	146	515	7.41
10 65-09-306	920	USGS	6/7/1949	33	43	4.90	51.0				6	38	217	1.20		283	127	470	7.60
11 65-09-307	117-714	USGS									2	48	204				148	459	
15	502-587	ENV	5/7/2020	16	60	16.40	27.6	<2.0	0.10	0.003	3	51	179	<0.5	<0.1	372	165.7	470	7.62
20 65-02-701	200-392	USGS	6/14/1965 8/12/1965	30.0 30.0	71 72	4.6 4.50	20.0 21.0	1.00	0.001		1 1	40 41	226 226	0.00 0.50	0.2 0.2	278 281	196 198	489 483	7.7 7.5

Explanation:

1/ ENV = Envirodyne laboratories, Houston, Texas
LCRA - Lower Colorado River Authority
USGS = United States Geological Survey

2/ Dissolved solids as a residue or reported TDS minus (-) (Bicarbonate x 0.508).

Table 3. Arsenic, Radon, and Radionuclides

Well Number	Screened Interval (feet)	Date Sampled	Gross Alpha (pCi/l) 1/	Gross Beta (pCi/l) 2/	Radium 226 (pCi/l)	Radium 228 (pCi/l)	Radon-222 (pCi/l)	Arsenic (micrograms/L) 3/
9	1593?	5/8/2001	1.3	3.8				2.0
15	502-587	5/7/2020	1.7+/-0.7	3.2+/-1.1	1.0+/-0.4	1.5+/-0.5		1.0

1/ = Current MCL allowed by the TCEQ for water used for public supply is 15 pCi/l

2/ = Current MCL allowed by the TCEQ for water used for public supply is 50 pCi/l

3/ = Current MCL allowed by the TCEQ for water used for public supply is 10 micrograms/l.

Laboratory = LCRA for Well 9

Laboratory = KNL Environmental Testing of Tampa, Florida for Well 15

FIGURE

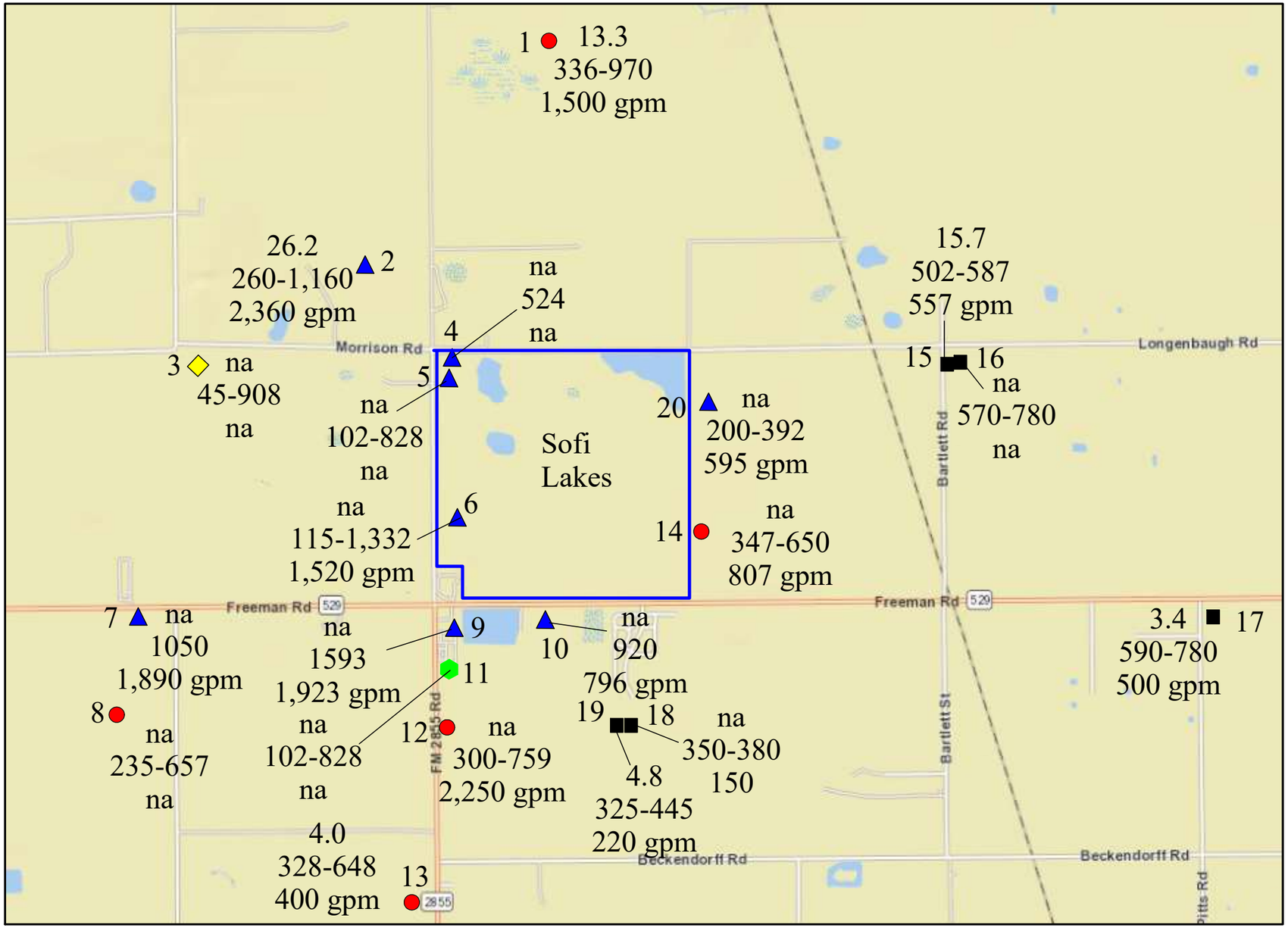
FIGURE 1
WELL LOCATION AND
PUMPING RATE DATA

GROUND WATER CONSULTANTS

LEGEND

Well No.	Specific Capacity, gpm/ft of Drawdown	Screened Interval, ft.
1	13.3	336-970
2	26.2	260-1,160
3	na	45-908
4	na	524
5	na	102-828
6	na	115-1,332
7	na	1050
8	na	235-657
9	na	1593
10	na	920
11	na	102-828
12	na	300-759
13	4.0	328-648
14	na	347-650
15	15.7	502-587
16	na	570-780
17	3.4	590-780
18	na	350-380
19	4.8	325-445
20	na	200-392

■ Public Supply Well ▲ Unused Well
● Irrigation Well ◆ Abandoned Well
⬢ Industrial Well



APPENDIX

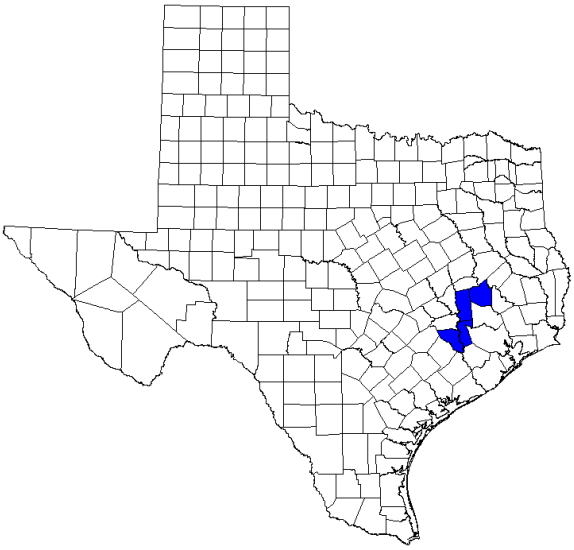
Locations of Oil or Gas Test Holes with Electric Logs


Irrigation Well 5 Natural Gas Powered Engine
CATERPILLAR
G342
Incoming Natural Gas

Unused Irrigation Well 5 in Report

Final Report

Phase 1-b Report: East Waller County Management District Proposed Well Application (BWLL-0165) Submitted on April 3, 2024 by R.G. Miller Engineers, Inc.



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April 19, 2024

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This report was prepared by William R. Hutchison, Ph.D., P.E., P.G., who is licensed in the State of Texas as follows:

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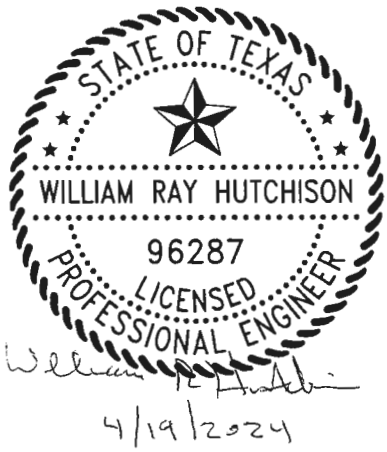
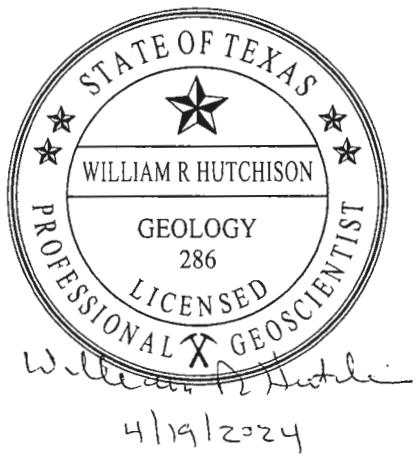
- Engineering Firm Registration No. 14526
- Professional Geoscientist (Geology) No. 286





1.0 Introduction

The East Waller County Management District has submitted a Non-Exempt Water Well Registration to the Bluebonnet Groundwater Conservation District (BGCD) for a new public water supply well. The proposed well locations and estimated total water production are summarized below:

- Latitude: 28.8810109°
- Longitude: -95.8885946°
- Estimated Annual Water Production: 292 million gallons.

The rules of BGCD require the applicant to submit Phase I and Phase II hydrogeologic reports for non-exempt wells with an inside diameter casing of eight inches or greater as part of the permit application process. These reports include hydrogeologic information addressing, and specifically related to, the impacts of the proposed well (e.g. area of influence, drawdown, recovery time, and potential for subsidence).

Because the requested permit amount is greater than 200 million gallons per year, a Phase I-b report is required. In general, the Phase I-b report is intended to be a preliminary report that relies on existing regional information and data, and the Phase II report is intended to be a final report that relies on site specific data, information, test results and analyses.

As required in the Guidelines for Submitting Data and Information and the Preparation of Hydrogeologic Reports in Support of Applications for the Permitted Use of Groundwater (dated April 14, 2023), this report contains the Phase I-a tables and the results of a simulation using the Groundwater Availability Model of the area that adds the proposed wells to the most recent run that was used to establish the desired future condition.

All files associated with this report are available for download at the following location:

https://www.dropbox.com/scl/fo/38i0jwa8n1hae654cxzte/h?rlkey=8t4ip0hki10rtrbofywn7l3wm&dl=0

2.0 Phase I-a Tables

2.1 Well Locations on HAGM Grid

The latitude and longitude data provided in the application were used to convert the location data to x- and y-coordinates in the GAM coordinate system using Surfer, a commercial gridding program. In addition, registered wells within one mile of the proposed well were identified and their latitude and longitude coordinates were also converted to x- and y-coordinates.

The Fortran program *PointRC.exe* was used to find the HAGM cell for the x- and y-coordinates of the proposed production well. The Fortran program *PointRCReg.exe* was used to find the HAGM cells for the x- and y-coordinates of the registered wells. The results are summarized in Table 1.

Table 1. Well Location Coordinates

Well ID	Proposed Pumping Well	BWLL-9016	BWLL-5754
Distance to Proposed Well (ft)	0	3739	4589
Estimated Well Depth (ft)	1100	495	300
Latitude	29.8810109	29.883611	29.893611
Longitude	-95.8886	-95.9000	-95.8892
x-Coordinate (ft - GAM)	6221616.812	6217975.731	6221265.382
y-Coordinate (ft - GAM)	19210218.32	19211031.18	19214799.23
HAGM Row	49	48	48
HAGM Column	80	80	81

2.2 HAGM Grid Parameters

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel file named *East Waller CMD Phase I-a Tables.xlsx*. The tab named *gridparam* contains the HAGM grid data and is presented as Table 2. Please note that all model layers for the proposed well location (HAGM Row 49, Column 80) are included.

Table 2. HAGM Grid Parameters for Proposed East Waller CMD Well

County Name	Waller	Waller	Waller	Waller
County Code	237	237	237	237
Outcrop Layer	1	1	1	1
Layer	1	2	3	4
Row	49	49	49	49
Column	80	80	80	80
x-coordinate (GAM-ft)	6222389	6222389	6222389	6222389
y-coordinate (GAM-ft)	19208334	19208334	19208334	19208334
Surface Elevation (ft MSL)	178	178	178	178
Cell Top Elevation (ft MSL)	178	-44	-1299	-1594
Cell Bottom Elevation (ft MSL)	-44	-1299	-1594	-2328
Cell Thickness (ft)	222	1255	295	734
Clay Thickness (ft)	104	730	168	495
Clay Thickness (% of Cell Thickness)	46.85	58.17	56.86	67.44

2.3 HAGM Aquifer Parameters

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel file named *East Waller CMD Phase I-a Tables.xlsx*. The tab named *HAGMparam* contains the HAGM aquifer parameter data and is presented as Table 3. Please note that all model layers for the proposed well location (HAGM Row 49, Column 80) are included.

Table 3. HAGM Aquifer Parameters for Proposed East Waller CMD Well

County Name	Waller	Waller	Waller	Waller
County Code	237	237	237	237
Outcrop Layer	1	1	1	1
Layer	1	2	3	4
Row	49	49	49	49
Column	80	80	80	80
Hydraulic Conductivity (ft/day)	20.40	3.45	0.01	1.88
Transmissivity (gpd/ft)	33,867	32,387	21	10,305
Leakage (1/day)	1.20E-05	9.50E-06	1.15E-08	0.00E+00
Storativity (dimensionless)	1.00E-01	3.60E-04	2.90E-04	2.10E-04
Elastic Storativity (dimensionless)	3.00E-05	5.00E-05	1.70E-07	4.76E-06
Inelastic Storativity (dimensionless)	3.00E-03	5.00E-03	1.70E-05	4.76E-04

2.4 HAGM Results

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel file named *East Waller CMD Phase I-a Tables.xlsx*. The tab named *HAGMresults* contains the HAGM results and is presented as Table 4. Please note that all model layers for the proposed well location (HAGM Row 49, Column 80) are included.

Table 4. HAGM Results for Proposed East Waller CMD Well

County Name	Waller	Waller	Waller	Waller
County Code	237	237	237	237
Outcrop Layer	1	1	1	1
Layer	1	2	3	4
Row	49	49	49	49
Column	80	80	80	80
Groundwater Elevation in 2009 (ft MSL)	43	25	25	77
Groundwater Elevation in 2080 (ft MSL)	-22	-88	-88	-147
DFC Drawdown (ft)	65	113	113	223
Artesian Head (ft)	-135	69	1324	1671
Subsidence in 2009 (ft)	0.9	0.9	0.9	0.9
Subsidence in 2080 (ft)	1.37	1.37	1.37	1.37
Subsidence from 2009 to 2080 (ft)	0.47	0.47	0.47	0.47
Cell Pumping in 2009 (AF/yr)	0	50.69	0	0
Cell Pumping in 2080 (AF/yr)	0	38.63	0	0

2.5 Theis Parameters

The Excel spreadsheet named *BGCD Parameters.xlsx* contains all the data needed for the review and Phase 1-a calculations. The data for the proposed well were extracted and saved in the Excel file named *East Waller CMD Phase I-a Tables.xlsx*. The tab named *theisparam* contains the Theis parameters and is presented as Table 5. The Theis parameters are associated with the estimation of drawdown using the Theis equation as described below. Please note that only data from the Evangeline (Layer 2) and Jasper (Layer 4) for the proposed well location (HAGM Row 49, Column 80) are included.

Table 5. Theis Parameters for Proposed East Waller CMD Well

County Name	Waller	Waller
County Code	237	237
Outcrop Layer	1	1
Layer	2	4
Row	49	49
Column	80	80
Drawdown in Production Well at 100 gpm for 36 hours	6.69	20.35
Drawdown 1/2 mile from Production Well at 100 gpm for 36 hours	0.66	1.48
Drawdown 1/2 miles from Production Well at 100 gpm for 1 year	2.57	7.40
Drawdown-Pumping Ratio for Production Well for 36 hours	0.06689	0.20351
Drawdown-Pumping Ratio for 1/2 mile from Production Well for 36 hours	0.00656	0.01476
Drawdown-Pumping Ratio for 1/2 mile from Production Well for 1 yr	0.02567	0.07396

2.6 Theis Results

Groundwater production data from the permit application were used along with the drawdown-pumping ratios contained in Table 5 to develop three estimates of drawdown:

- Scenario 1: drawdown in the production well after 36 hours of pumping at three times the average annual pumping rate.
- Scenario 2: drawdown in a well ½ mile from the production well after 36 hours of pumping at three times the average annual pumping rate.

- Scenario 3: drawdown in a well ½ mile from the production well after one year of pumping at the average annual pumping rate.

Results of these calculations for the Evangeline Aquifer (Layer 2) are presented in Table 6.

Table 6. Theis Results for Proposed East Waller CMD Well

Production Summary	Value
Annual Permit Production Limit (gallons)	292,000,000
Annual Permit Production Limit (acre-feet)	896
Average Pumping Rate (gpm)	556
Average Pumping Rate (cfd)	106952
3X Average Pumping Rate (gpm)	1667

	Evangeline	
Drawdown Calculations	Drawdown-Pumping Ratios	Calculated Drawdown (ft)
Production Well - 36 hours (3X avg pumping)	0.06689	111.48
1/2 mile from Production Well - 36 hours (3X avg pumping)	0.00656	10.93
1/2 mile from Production Well - one year (avg pumping)	0.02567	14.26

3.0 Phase I-b Results

Phase I-b requirements include the results of a simulation using the HAGM for the area that adds the proposed well to the most current model simulation that was used to establish the desired future condition. The documentation of BGCD implementation of the most recent desired future condition simulation is contained in Hutchison (2021).

As required in the Phase I-b guidelines, this section of the report contains the results of the simulation:

- Drawdown hydrographs
- Subsidence hydrographs
- Summary tables of drawdown and subsidence
- A county-aquifer level groundwater budget that includes a comparison of the HAGM simulation with the proposed well and the groundwater water budget of the desired future condition simulation.

3.1 Drawdown Hydrographs

The data from the two nearby wells (within one mile) in Table 1 are between about 300 and 500 feet, which place them in the upper part of the Evangeline Aquifer. It is possible that other wells (non-registered) are completed in the shallower Chicot Aquifer based on the material provided in the application.

Drawdown hydrographs at the location of the proposed well (Row 49, Column 80) for the Chicot (the overlying formation) and the Evangeline (the production formation) are shown in Figures 1 and 2, respectively. These hydrographs present the predicted drawdown for the DFC run of the HAGM and for the run where the proposed well is added to the DFC run. Figure 3 presents the difference between the two scenarios, or the drawdown that is attributable to the proposed well in both the Chicot and the Evangeline. Similar drawdown hydrographs for the two nearby registered wells presented in Table 1 are presented in Appendix A.

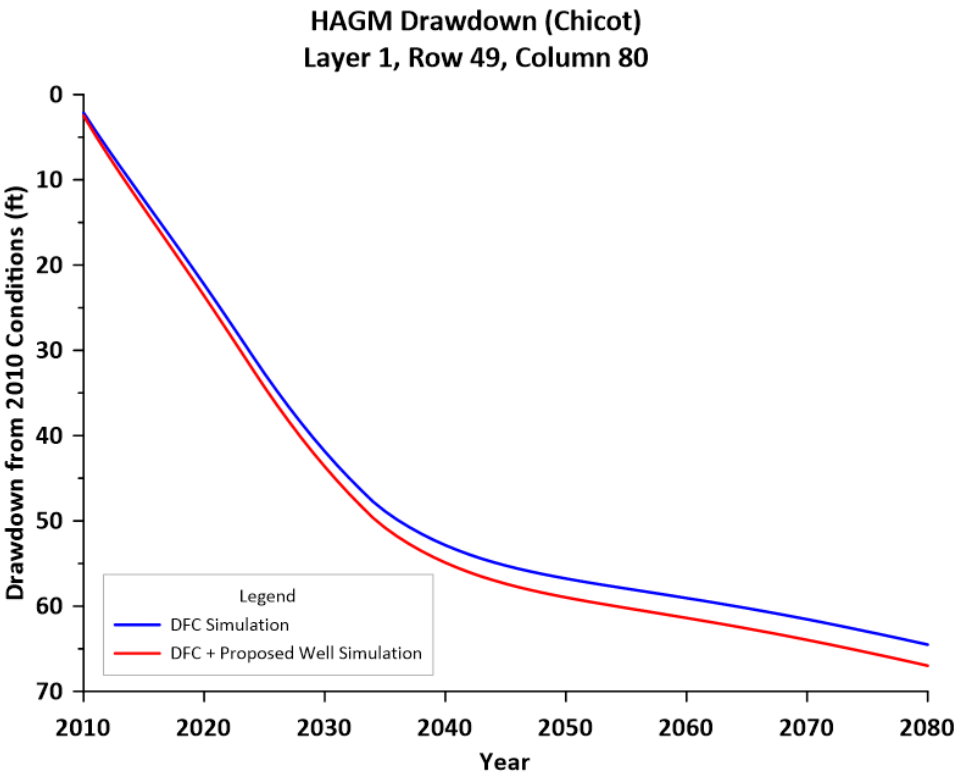


Figure 1. Drawdown Hydrograph for Row 49, Column 80 (Chicot)

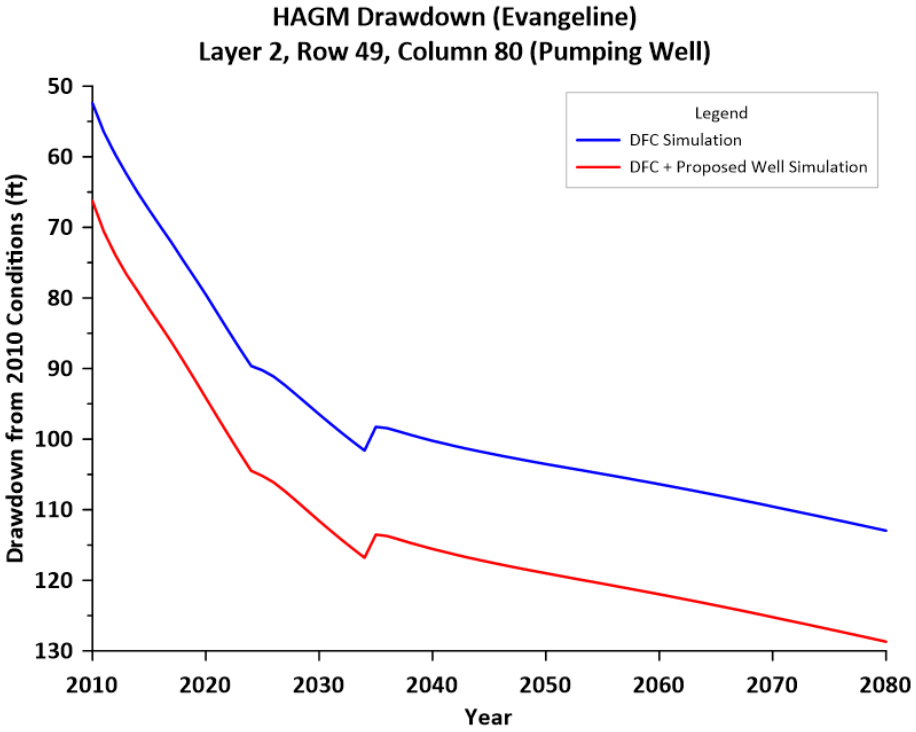


Figure 2. Drawdown Hydrograph for Row 49, Column 80 (Evangeline)

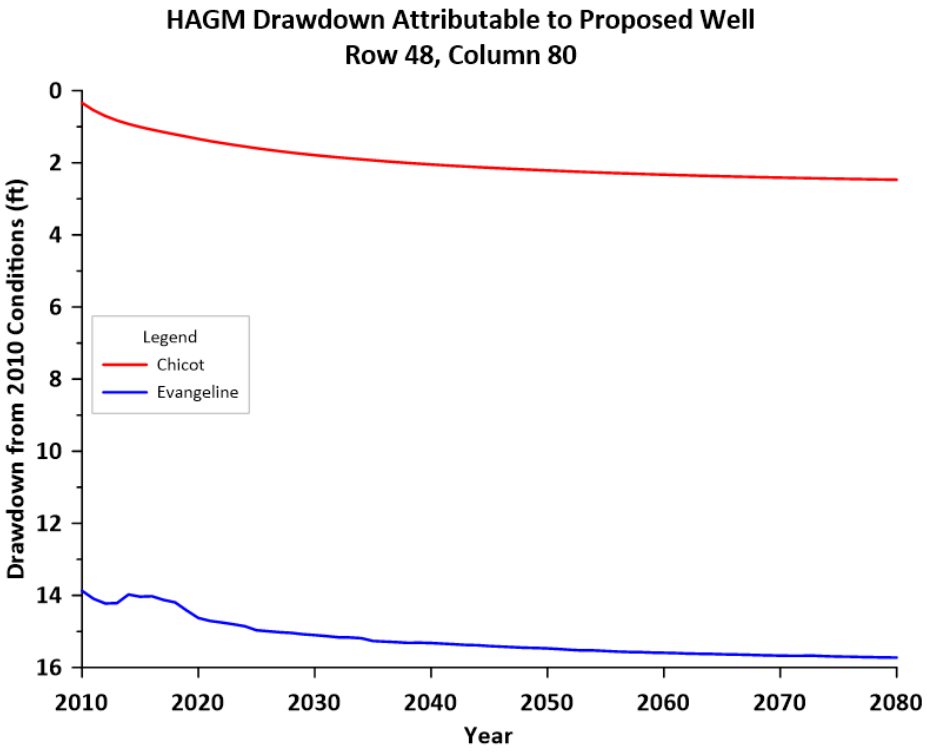


Figure 3. Drawdown Attributable to Proposed Pumping for Row 49, Column 80

3.2 Subsidence Hydrographs

The subsidence hydrograph at the location of the proposed well (Row 49, Column 80) is presented in Figure 4. This hydrograph presents the predicted subsidence for the DFC run of the HAGM and for the run where the proposed well is added to the DFC run. Figure 5 presents the difference between the two scenarios, or the subsidence that is attributable to the proposed well. Similar subsidence hydrographs for the two nearby registered wells presented in Table 1 are presented in Appendix B.

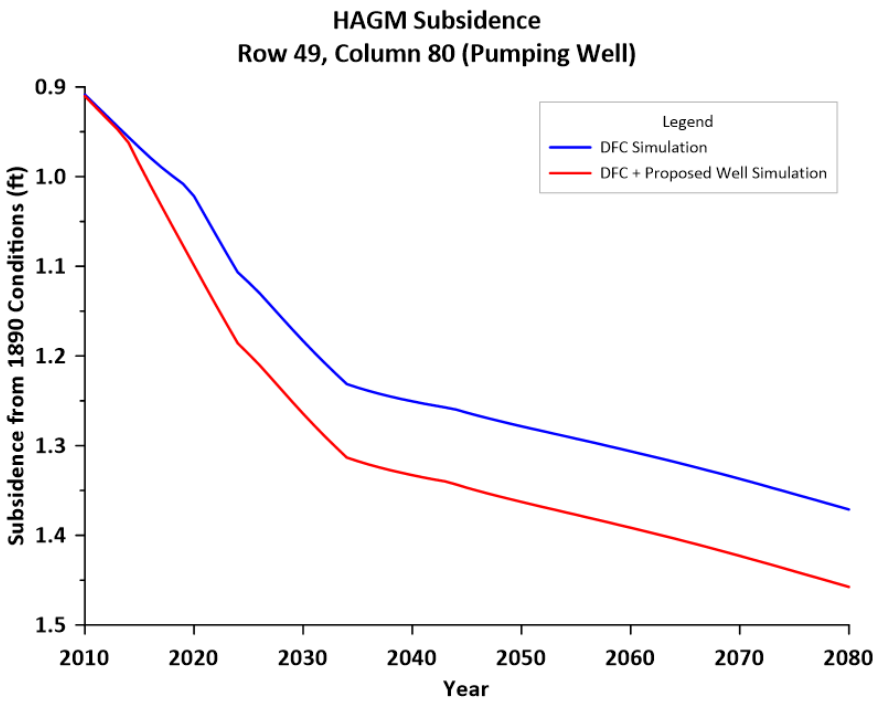


Figure 4. Subsidence Hydrograph for Row 49, Column 80

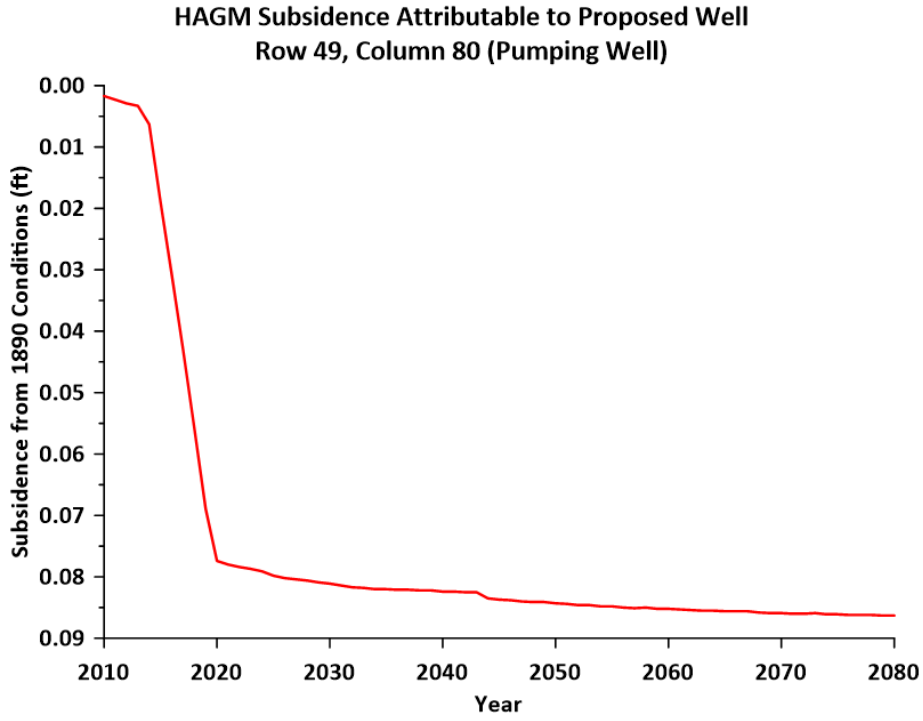


Figure 5. Subsidence Attributable to Proposed Well for Row 49, Column 80

3.3 Tabular Summary of Drawdown and Subsidence

The summary of drawdown and subsidence attributable to the proposed pumping for all well locations is presented in Table 7.

Table 7. Tabular Summary of Drawdown and Subsidence

Well ID	Proposed Pumping Well	BWLL-9016	BWLL-5754
Distance to Proposed Well (ft)	0	3,739	4,589
Estimated Well Depth (ft)	1,100	495	300
HAGM Row	49	48	48
HAGM Column	80	80	81
Chicot Aquifer Drawdown Attributable to Proposed Well (2010 to 2080, ft)	2.50	2.47	2.31
Evangeline Aquifer Drawdown Attributable to Proposed Well (2010 to 2080, ft)	15.73	8.90	6.91
Subsidence Attributable to Proposed Well (1890 to 2080, ft)	0.09	0.05	0.06

3.4 Groundwater Budget Comparison

The summary groundwater budget comparison of the DFC simulation and the simulation where the proposed well is added to the DFC simulation is presented in Table 8. Please note that about 28 percent of the production from the proposed well will come from groundwater storage (including interbed storage), and about 54 percent of proposed pumping will come from captured outflow that would have flowed to Fort Bend and Harris counties. The remaining 18 percent of the production of the proposed well is induced recharge and induced inflow from Austin County.

Table 8. Groundwater Budget Summary

	DFC Run (2010 to 2080)	East Waller Run (2010 to 2080)	Difference (AF/yr)	Diffference (% of Pumping Increase)
Inflow				
Recharge and Net Surface Water Inflow (GHB Boundary)	41,382	41,523	141	15.7
Interbed Storage	2,956	3,002	46	5.1
From Austin County	6,232	6,257	25	2.8
From Grimes County	1,816	1,816	0	0.0
From Washington County	1,243	1,243	0	0.0
Total Inflow	53,629	53,841		
Outflow				
Pumping	55,495	56,392	897	100.0
To Fort Bend County	10,422	10,318	-105	11.7
To Harris County	4,157	3,782	-376	41.9
To Montgomery County	5,922	5,922	0	0.0
Total Outflow	75,996	76,413		
Inflow - Outflow	-22,367	-22,572		
Model Calculated Storage Change	-22,366	-22,571	-205	22.8
Model Error	-1	-1		

4.0 Conclusions and Recommendations

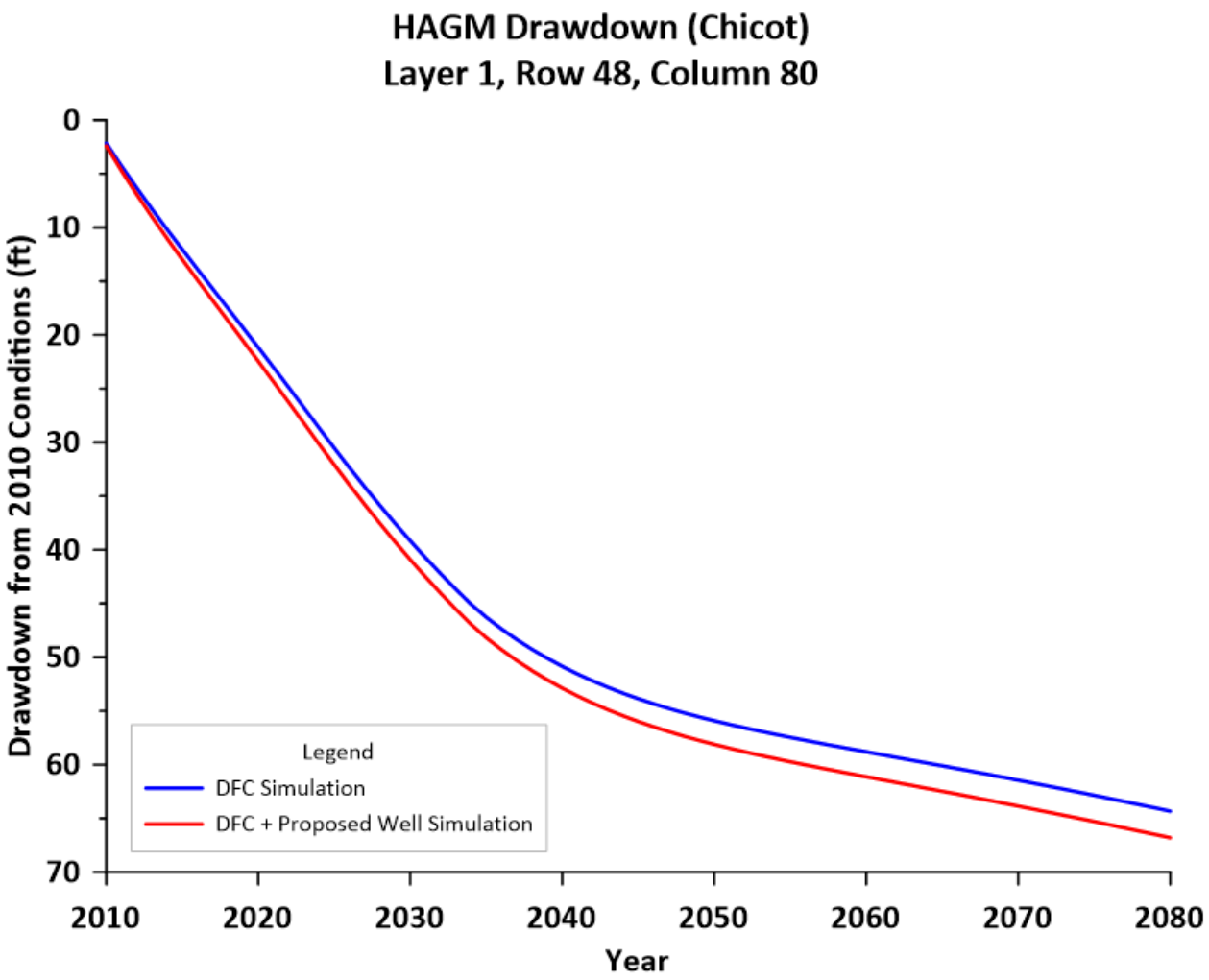
The permit application for this well should be approved to proceed to the Phase II activities.

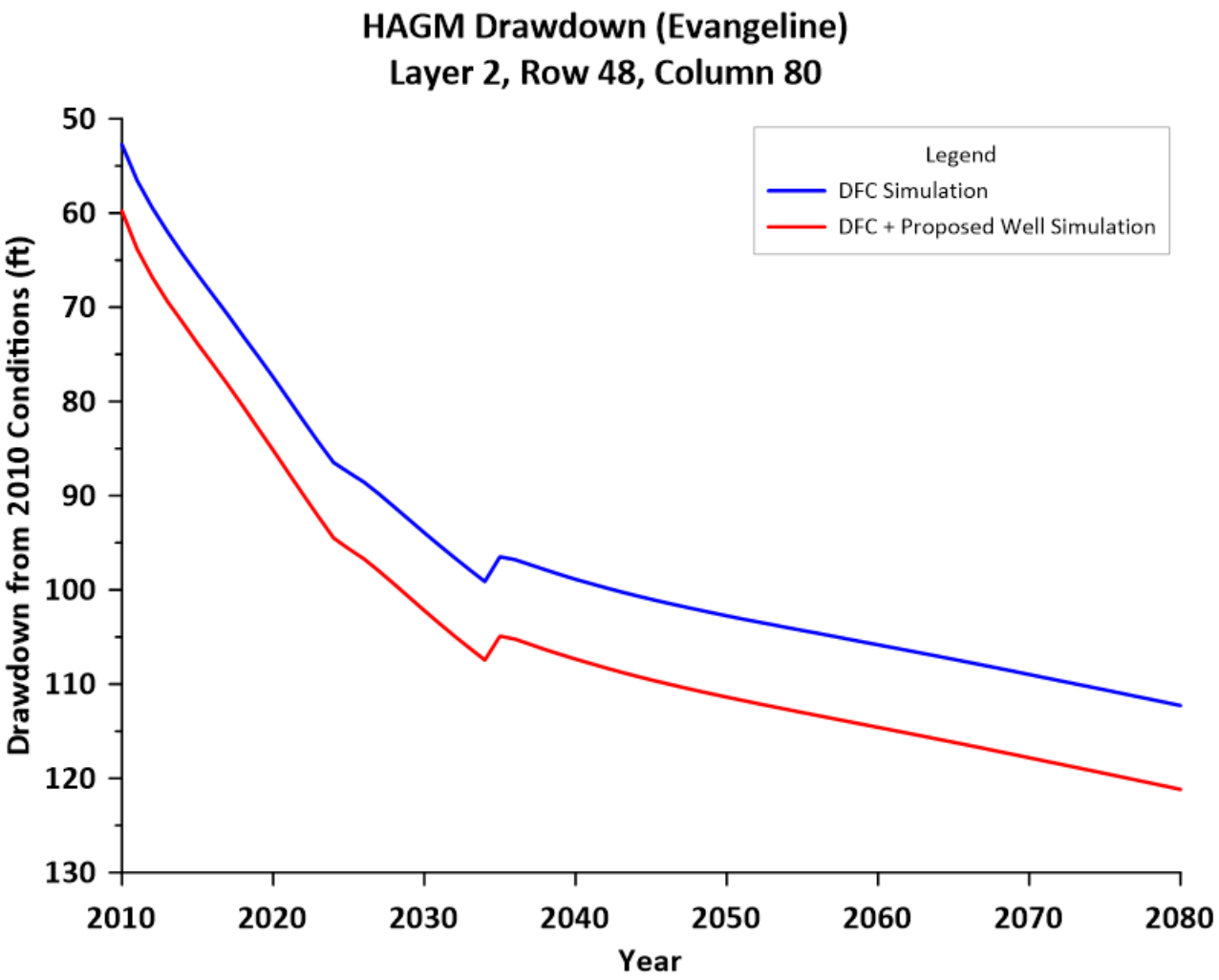
5.0 References

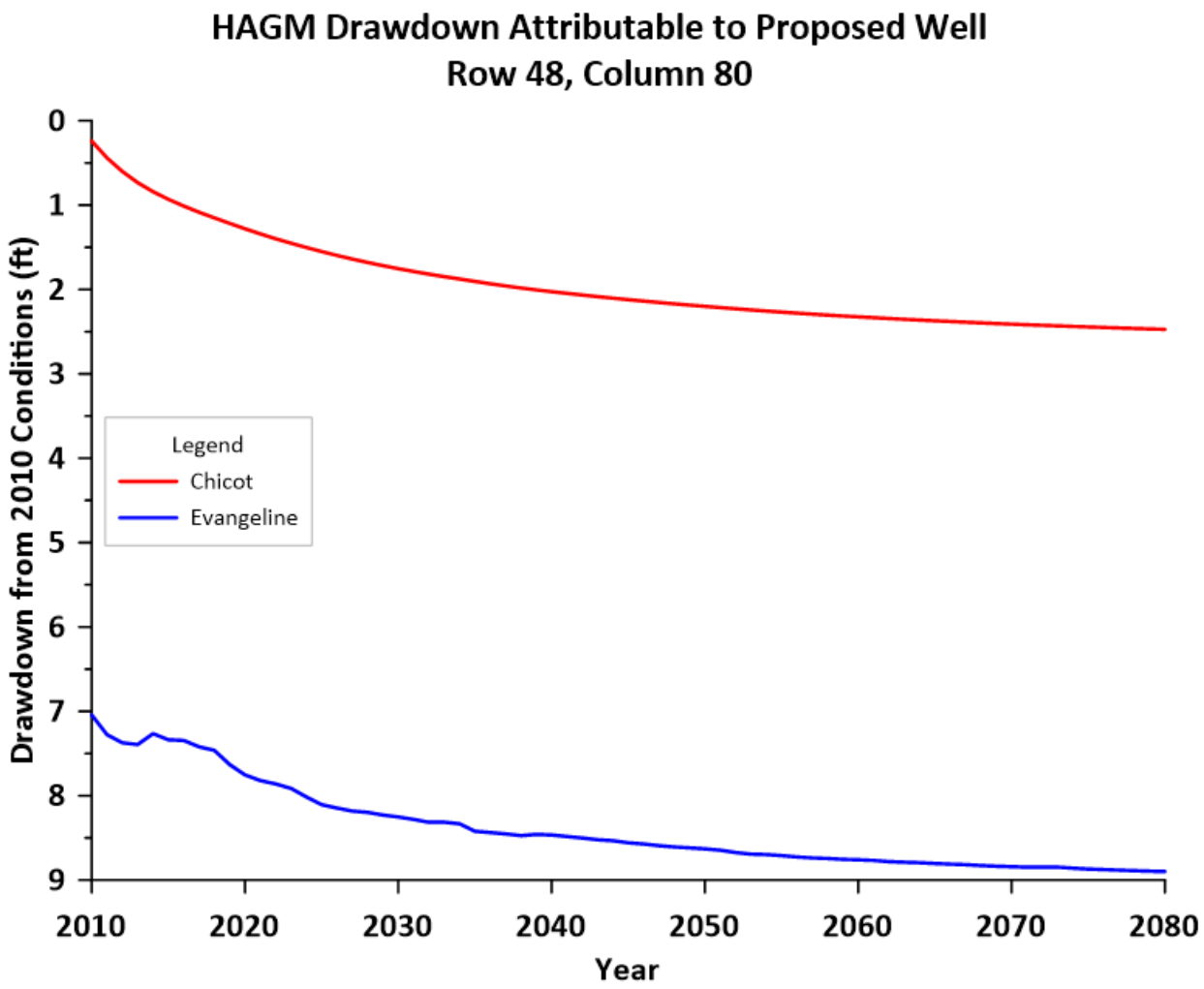
Hutchison, W.R., 2021. Implementation of GMA 14 Desired Future Condition Based on Multi-Metric Simulation (70% Available Drawdown, 1 Foot of Subsidence, 30K Pumping Limit, 2016 Pumping Distribution). Final Report to Zach Holland, General Manager of Bluebonnet Groundwater Conservation District, April 27, 2021, 54p.

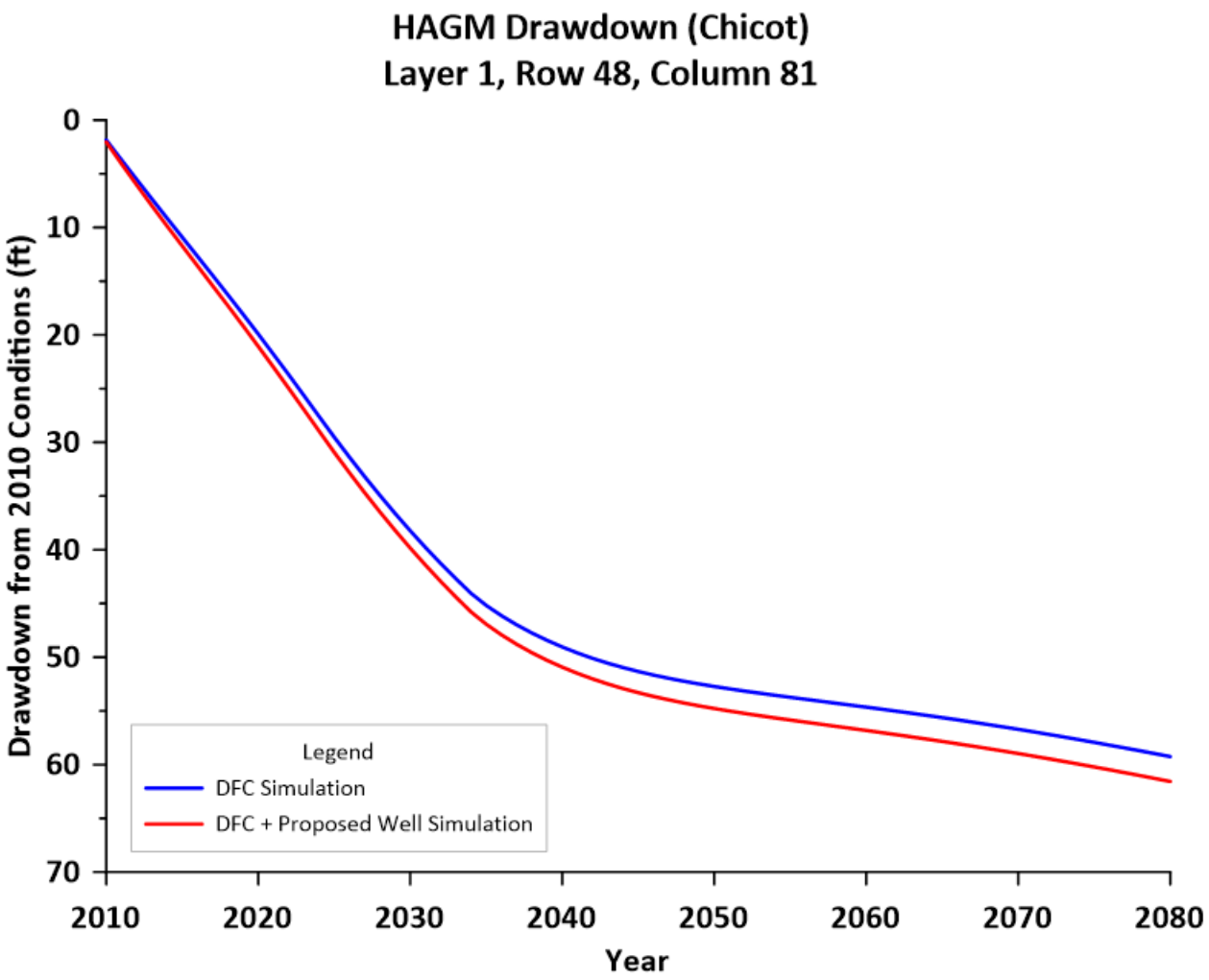
Appendix A

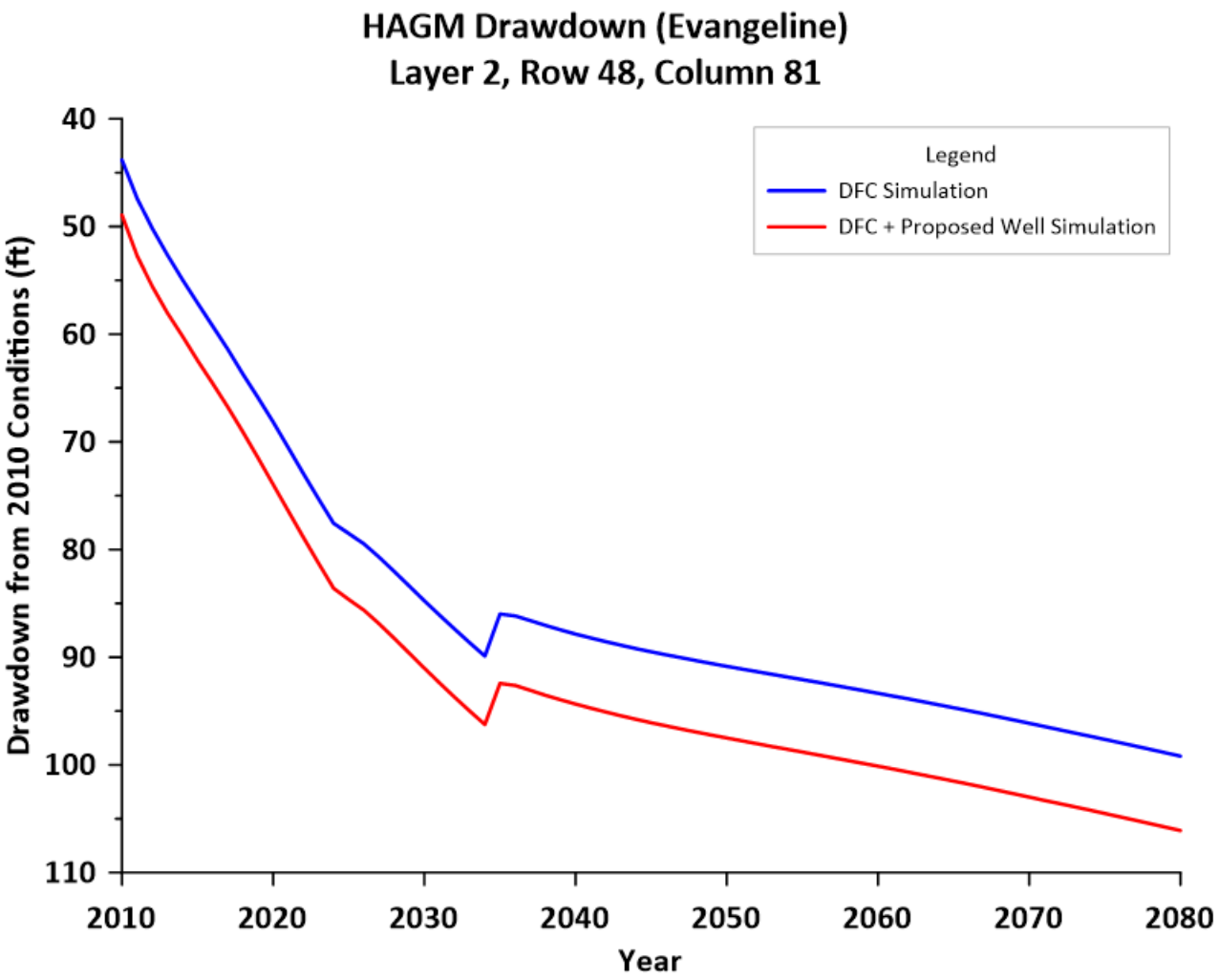
Drawdown Hydrographs

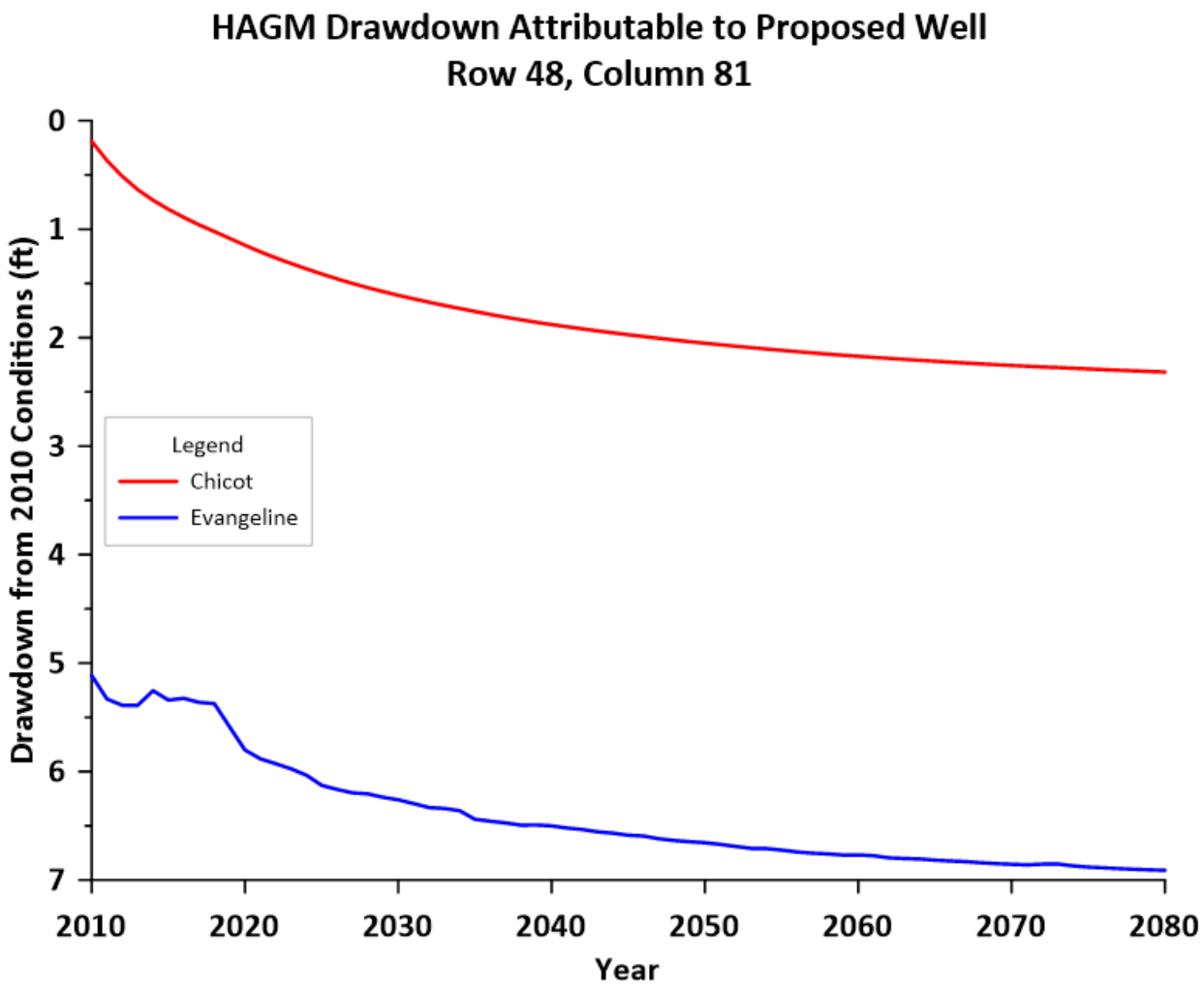

HAGM Drawdown (Chicot)
Layer 1, Row 48, Column 80
Drawdown from 2010 Conditions (ft)
0
10
20
30
40
50
60
70
2010
2020
2030
2040
2050
2060
2070
2080
Year
Legend
DFC Simulation
DFC + Proposed Well Simulation


HAGM Drawdown (Evangeline)
Layer 2, Row 48, Column 80
Legend
DFC Simulation
DFC + Proposed Well Simulation
Drawdown from 2010 Conditions (ft)
50
60
70
80
90
100
110
120
130
2010
2020
2030
2040
2050
2060
2070
2080
Year


HAGM Drawdown Attributable to Proposed Well
Row 48, Column 80
Drawdown from 2010 Conditions (ft)
0
1
2
3
4
5
6
7
8
9
Legend
Chicot
Evangeline
2010
2020
2030
2040
2050
2060
2070
2080
Year

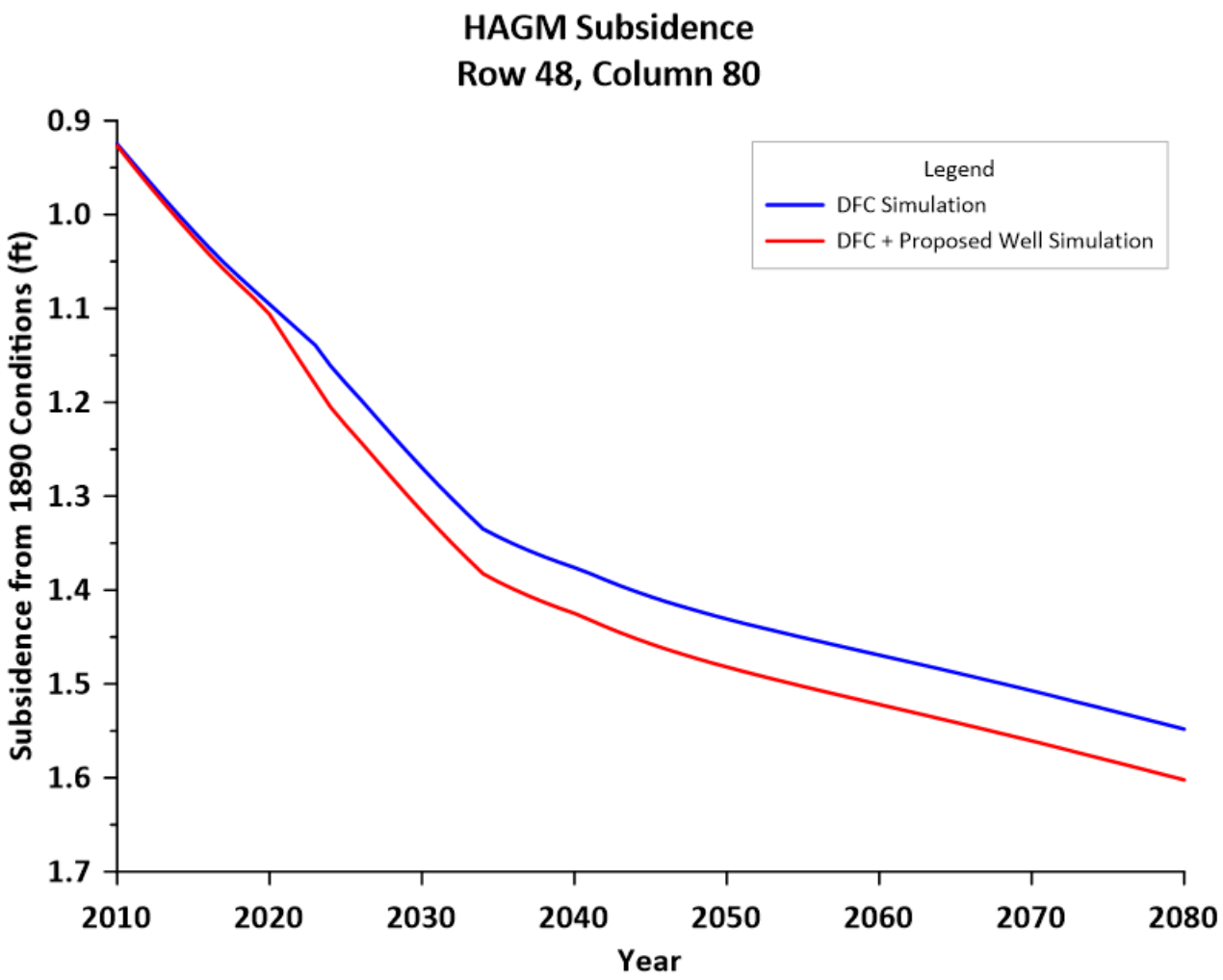

HAGM Drawdown (Chicot)
Layer 1, Row 48, Column 81
Drawdown from 2010 Conditions (ft)
0
10
20
30
40
50
60
70
2010
2020
2030
2040
2050
2060
2070
2080
Year
Legend
DFC Simulation
DFC + Proposed Well Simulation

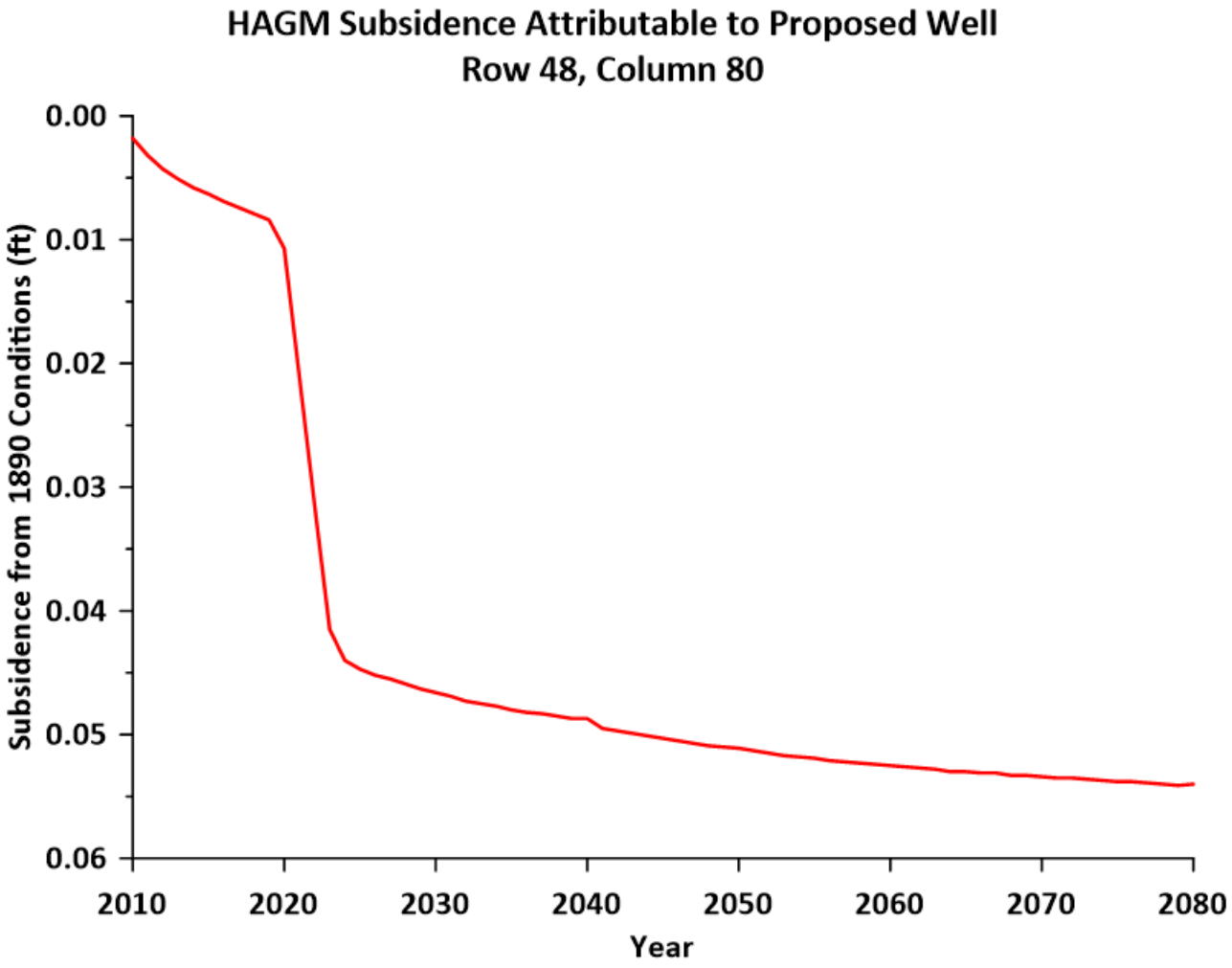

HAGM Drawdown (Evangeline)
Layer 2, Row 48, Column 81
Legend
DFC Simulation
DFC + Proposed Well Simulation
Drawdown from 2010 Conditions (ft)
40
50
60
70
80
90
100
110
2010
2020
2030
2040
2050
2060
2070
2080
Year

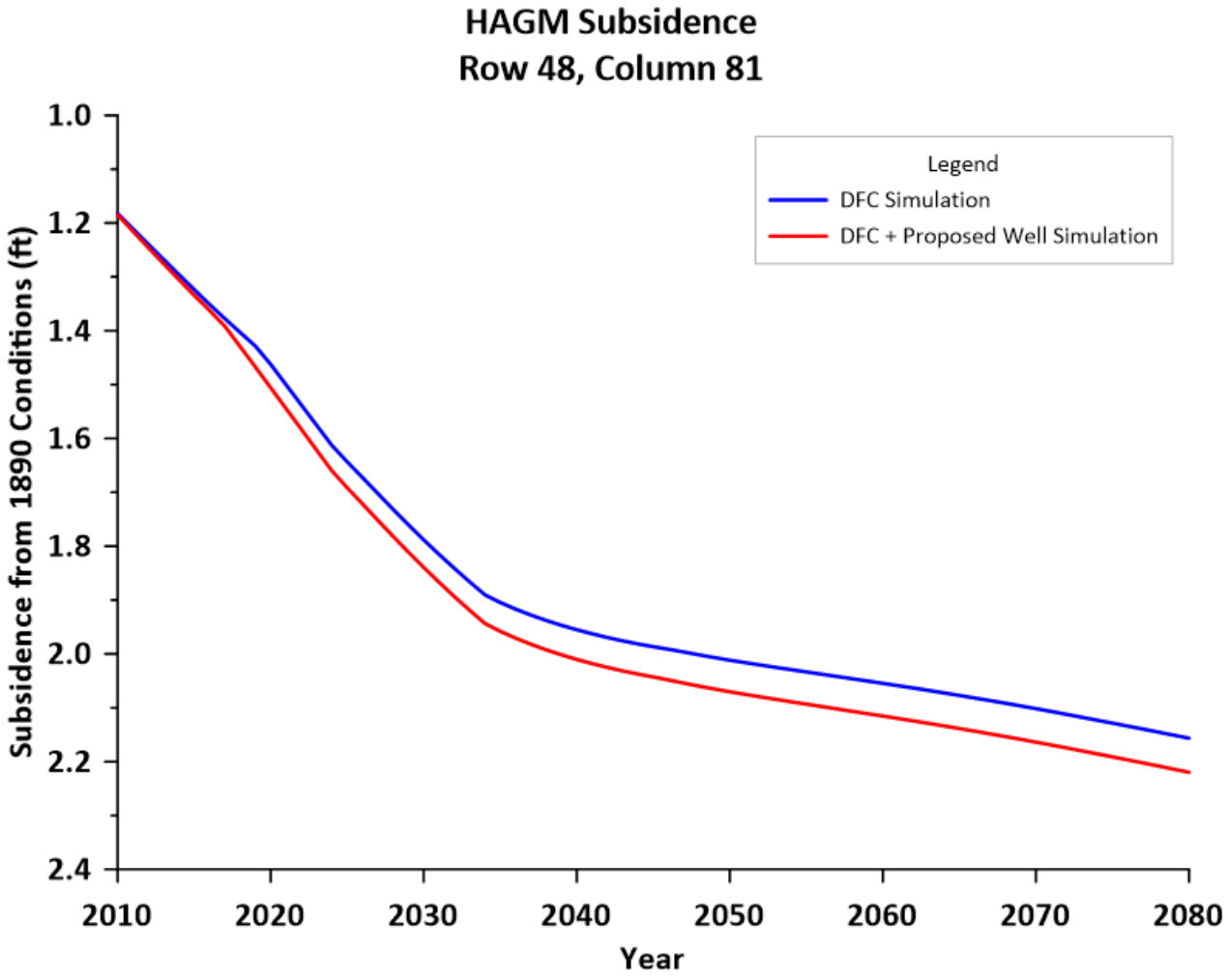

HAGM Drawdown Attributable to Proposed Well
Row 48, Column 81
Drawdown from 2010 Conditions (ft)
0
1
2
3
4
5
6
7
Legend
Chicot
Evangeline
2010
2020
2030
2040
2050
2060
2070
2080
Year

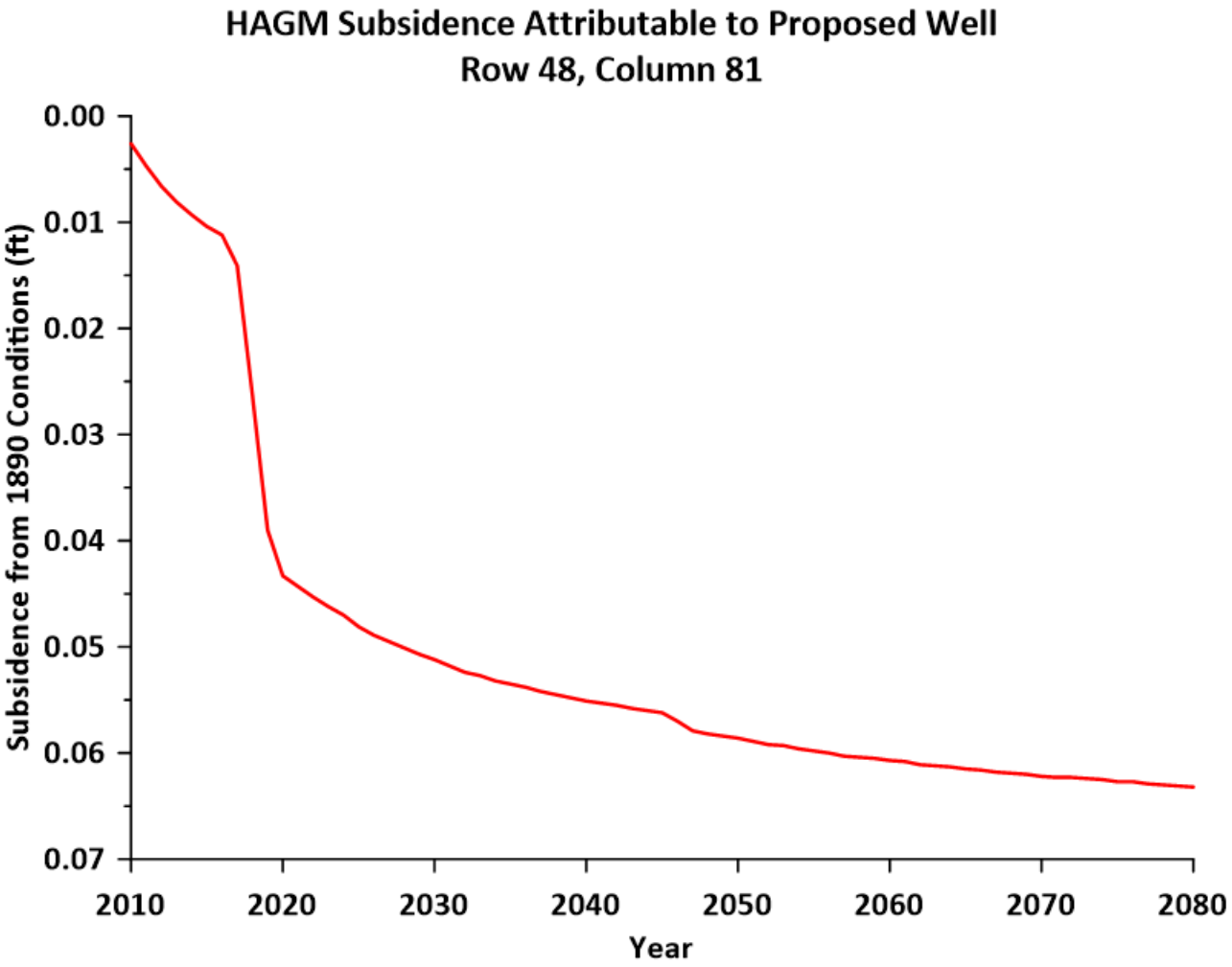
Appendix B

Subsidence Hydrographs


HAGM Subsidence
Row 48, Column 80
Legend
DFC Simulation
DFC + Proposed Well Simulation
Subsidence from 1890 Conditions (ft)
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
2010
2020
2030
2040
2050
2060
2070
2080
Year


HAGM Subsidence Attributable to Proposed Well
Row 48, Column 80
Subsidence from 1890 Conditions (ft)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
2010
2020
2030
2040
2050
2060
2070
2080
Year


HAGM Subsidence
Row 48, Column 81
Legend
DFC Simulation
DFC + Proposed Well Simulation
Subsidence from 1890 Conditions (ft)
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2010
2020
2030
2040
2050
2060
2070
2080
Year


HAGM Subsidence Attributable to Proposed Well
Row 48, Column 81
Subsidence from 1890 Conditions (ft)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
2010
2020
2030
2040
2050
2060
2070
2080
Year