

**NORTH TEXAS
GROUNDWATER
CONSERVATION
DISTRICT**

BOARD MEETING

Pilot Point ISD Administration Office
829 S. Harrison St.
Pilot Point, TX 76258

**TUESDAY
APRIL 11, 2023
10:00 AM**

NOTICE OF PUBLIC MEETING

OF THE
BOARD OF DIRECTORS
of the

NORTH TEXAS GROUNDWATER CONSERVATION DISTRICT
Tuesday, April 11, 2023, at 10:00 a.m.

MEETING LOCATION:
Pilot Point ISD Administration Office
829 S. Harrison St.
Pilot Point, TX 76258

Board Meeting

The regular Board Meeting will begin at 10:00 a.m.

Notice is hereby given that the Board of Directors of the North Texas Groundwater Conservation District (“District”) may discuss, consider, and take all necessary action, including expenditure of funds, regarding each of the agenda items below:

Agenda:

1. Pledge of Allegiance and Invocation.
2. Call to order, establish quorum; declare the meeting open to the public.
3. Public comment.
4. Consider and act upon approval of the minutes from the February 14, 2023, Board meeting.
5. Consider and act upon approval of invoices and reimbursements, Resolution No. 2023-04-11-1.
6. Receive reports from the following Committees*:
 - a. Budget and Finance Committee
 - i. Receive Monthly Financial Information
 - b. Investment Committee
 - i. Receive Quarterly Investment Report
 - c. Management Plan Committee
 - i. Receive Quarterly Report
7. Consider and possibly act upon all matters incident and related to a contract and scope of services with Intera Incorporated for Northern Trinity and Woodbine Aquifers Groundwater Availability Model Update.
8. Consider and act upon all matters incident and related to an Interlocal Agreement regarding Groundwater Management Area 8 Funding for Northern Trinity and Woodbine Aquifers Groundwater Availability Model Update.
9. Receive report on the District’s Well Monitoring Program.
10. Consider and act upon compliance and enforcement activities for violations of District rules.

11. Discussion and possible action related to 88th Texas Legislative Session and Issues.
12. General Manager's Report: The General Manager will update the board on operational, educational and other activities of the District.
 - a. District's Disposal/Injection Well Program
 - b. Well Registration Summary
13. Open forum / discussion of new business for future meeting agendas.
14. Adjourn public meeting.

* Reports from District standing committees will include a briefing by each committee for the Board on the activities of the committee, if any, since the last regular Board meeting.

The above agenda schedule represents an estimate of the order for the indicated items and is subject to change at any time.

These public meetings are available to all persons regardless of disability. If you require special assistance to attend the meeting, please call (855) 426-4433 at least 24 hours in advance of the meeting to coordinate any special physical access arrangements.

For questions regarding this notice, please contact Velma Starks at (855) 426-4433, at ntgcd@northtexasgcd.org, or at 5100 Airport Drive, Denison, TX 75020.

At any time during the meeting or work session and in compliance with the Texas Open Meetings Act, Chapter 551, Government Code, Vernon's Texas Codes, Annotated, the North Texas Groundwater Conservation District Board may meet in executive session on any of the above agenda items or other lawful items for consultation concerning attorney-client matters (§551.071); deliberation regarding real property (§551.072); deliberation regarding prospective gifts (§551.073); deliberation regarding personnel matters (§551.074); deliberation regarding security devices (§551.076); and deliberation regarding cybersecurity (§551.089). Any subject discussed in executive session may be subject to action.

ATTACHMENT 4

**MINUTES OF THE BOARD OF DIRECTORS' BOARD MEETING AND PUBLIC HEARING
NORTH TEXAS GROUNDWATER CONSERVATION DISTRICT**

Tuesday, February 14, 2023, at 10:00 a.m.

**Pilot Point ISD Administration Office
829 S. Harrison St.
Pilot Point, TX 76258**

Please note for in-person attendance that the Board meeting location can only accommodate a limited number of attendees to comply with state requirements related to in-person gatherings. In the event in-person attendance exceeds any state or local requirements, the District may provide an option for virtual participation for any overflow attendees as necessary and authorized by law.

Members Present: Joe Helmberger, David Flusche, Jimmy Arthur, Lee K. Allison, Ronny Young, and Allen Knight

Members Absent: Thomas Smith, Ron Sellman and Greg Peters

Staff: Paul Sigle, Allen Burks, Wayne Parkman, and Velma Starks

Visitors: Kristen Fancher, Law Offices of Kristen Fancher, PLLC

Permit Hearing

Agenda:

1. Call to Order; establish quorum; declare hearing open to the public; introduction of Board.

Board President Joe Helmberger called the Permit Hearing to order at 10:00 a.m.
2. Public Comment on the Production Permit Applications (verbal comments limited to three (3) minutes each).

No public comments.
3. Review the Production Permit Applications of:

New Production Permits

- a. **Applicant:** Horizon Rockhill Heights LLC; 9550 John W Elliot Dr Suite 106, Frisco, Texas 75033
Location of Well: County Road 95, Celina, Texas 75009; Latitude: 33.330422°N, Longitude: -96.782090°W; approximately 1,890 feet south of the CR 95 and Burlington Northern Santa Fe RR intersection, and approximately 2,250 feet west of Highway 289.

Purpose of Use: Landscape Irrigation and Surface Impoundment(s)

Requested Amount of Use: 32,290,000 gallons for 2023 and 17,340,000 gallons per year after 2023.

Production Capacity of Well(s): 195 gallons/minute

Aquifer: Woodbine

General Manager Paul Sigle reviewed the permit with the Board. Brief discussion was held. Board Member Allen Knight made the motion to approve the permit. Board Member Ronny Young seconded the motion. Motion passed unanimously.

4. Consider and act upon the Production Permit Applications, including designation of parties and/or granting or denying the Production Permit Applications in whole or in part, as applicable.
5. Adjourn or continue permit hearing.

Board President Joe Helmberger adjourned the permit hearing at 10:03 a.m.

Board Meeting

Agenda:

1. Pledge of Allegiance and Invocation

Board President Joe Helmberger led the Pledge of Allegiance and Board Member Ronny Young provided the invocation.

2. Call to order, establish quorum; declare meeting open to the public.

Board President Joe Helmberger called the meeting to order at 10:03 a.m., established a quorum was present, and declared the meeting open to the public.

3. Public Comment

There were no public comments.

4. Consider and act upon approval of the minutes from the January 10, 2023, Board meeting.

Board President Joe Helmberger asked for approval of the minutes from the January 10, 2023, meeting. Board Member David Flusche made the motion to approve the minutes. Board Member Allen Knight seconded the motion. Motion passed unanimously.

5. Consider and act upon approval of invoices and reimbursements, Resolution No. 2023-02-14-1.

General Manager Paul Sigle reviewed the liabilities with the Board. Board Member Allen Knight made the motion to approve Resolution No. 2023-02-14-1. Board Member Ronny Young seconded the motion. Motion passed unanimously.

6. Receive reports from the following Committees*:
 - a. Budget and Finance Committee
 - i. Receive Monthly Financial Information

General Manager Paul Sigle reviewed the Financial Report with the Board. Brief discussion was held.

- b. Management Plan Committee
 - i. Receive Quarterly Report

General Manager Paul Sigle reviewed the Quarterly Report with the Board.

- 7. Update and possible action regarding the process for the development of Desired Future Conditions (DFCs).

General Manager Paul Sigle informed the Board that the GMA 8 meeting will be March 7, 2023. GMA 8 districts will consider a contract and scope of services with Intera for the model update. The cost will be divided among the GMA 8 districts. GMA 8 district will also consider an Interlocal Agreement regarding GMA 8 and TWDB for the model update.

Board will convene into Executive Session for Items 8 and 9 after Items 10 and 11 have been reviewed.

- 8. Consider and act upon compliance and enforcement activities for violations of District rules.
 - a Lime Rock Resources.

- 9. Discussion and possible action related to 88th Texas Legislative Session and Issues.

- 10. General Manager’s Report: The General Manager will update the board on operational, educational and other activities of the District.

- a. District’s Disposal/Injection Well Program

No update

- b. Well Registration Summary

General Manager Paul Sigle reviewed the well registration summary with the Board. Fourteen wells were registered in December and sixteen wells were registered in January.

- 11. Open forum/discussion of new business for future meeting agendas.

No requests for future meeting agendas were made.

Board convened into Executive Session at 10:15 a.m.

Board reconvened into Regular Session at 10:35 a.m. No action was taken on either Item 8 or 9.

- 12. Adjourn public meeting

Board President Joe Helmberger declared the meeting adjourned at 10:35 a.m.

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Recording Secretary

Secretary-Treasurer

ATTACHMENT 5

RESOLUTION NO. 2023-04-11-1

A RESOLUTION BY THE BOARD OF DIRECTORS OF THE NORTH TEXAS GROUNDWATER CONSERVATION DISTRICT AUTHORIZING PAYMENT OF ACCRUED LIABILITIES FOR THE MONTHS OF FEBRUARY & MARCH

The following liabilities are hereby presented for payment:

	<u>Amount</u>
<u>Administrative Services</u>	
GTUA - February 2023 monthly expenses	26,729.29
<u>Consultants</u>	
Advanced Groundwater Solutions - General hydrogeo services through 12/21/22	6,300.00
<u>Direct Costs</u>	
NexTraq - March 2023 GPS tracking	34.95
NexTraq - April 2023 GPS tracking	34.95
<u>Legal</u>	
Kristen Fancher PLLC - Legal services through March 2023	5,050.95
<u>Legal- Injection</u>	
Sledge Law - Legal Injection services for January 2023	3,000.00
Sledge Law - Legal Injection services for February 2023	3,000.00
<u>Meetings & Conferences</u>	
Pilot Point ISD - Meeting Room April 2023	75.00
<u>Refunds</u>	
Danny Andino - Driller deposit refund	100.00
<u>Well Injection Monitoring</u>	
Eno Scientific LLC - 10 W Solar Panel Mount kit.	27.00
Statewide Plat Service - January & February 2023	100.00
GRAND TOTAL:	<u>\$ 44,452.14</u>

On motion of _____ and seconded by _____ the foregoing Resolution was passed and approved on this, the 11th day of April, 2023 by the following vote:

AYE:
NAY:

President

Secretary/Treasurer

1000 PM
DECEMBER 12 2023
AMERICA

DEPT OF HEALTH & HUMAN SERVICES
2101 CONSTITUTION AVENUE
WASHINGTON, DC 20037

ATTACHMENT 6 a. - i.

DEPT OF HEALTH & HUMAN SERVICES

DISTRICT
CONSERVATION
CROSSCOUNTRY
BED STAIR

NORTH TEXAS GROUNDWATER

Balance Sheet

As of March 31, 2023

ASSETS

Current Assets

Checking/Savings

10001 Checking Account	290,831.42
10005 Cash-Index Account	20,173.58
10006 Cash - CDARS Legend	1,150,000.00
10008 Cash - Tex Star	156,266.41
10010 Investment	1,763,000.00
10025 Accounts Receivable	9,446.24
10033 A/R Penalties	3,816.76
10035 A/R GMA8 Members	18.25
10070 A/R Liens	14,000.00
10026 Allowance for Uncollectib	-21,300.00
12001 Prepaid Expenses	1,551.23

TOTAL ASSETS 3,387,803.89

LIABILITIES & EQUITY

Liabilities

Current Liabilities

Accounts Payable

23100 Accounts Payable	5,016.00
23150 Well Drillers Deposits	24,237.54

Total Liabilities 29,253.54

Equity

35100 Retained Earnings	3,466,255.27
Net Income	-107,704.92

Total Equity 3,358,550.35

TOTAL LIABILITIES & EQUITY 3,387,803.89

NORTH TEXAS GROUNDWATER
Profit & Loss Budget vs. Actual
March 31, 2023

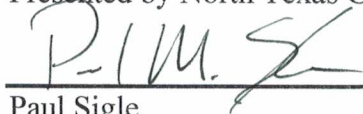
	TOTAL				
	March 23	1 mo. Budget	YTD Actual	Total Budget	% of Budget remaining
Ordinary Income/Expense					
Income					
46003 - Registration Fees	1,000.00	2,166.67	4,100.00	26,000.00	84.23%
46004 - Well Driller Fees	0.00	0.00	0.00	0.00	0.0%
46005 - PRODUCTION FEES	-117.87	0.00	-15,232.18	710,000.00	102.15%
46006 Income GMA8	0.00	366.67	0.00	4,400.00	100.0%
46007 - Penalties	0.00	0.00	0.00	0.00	0.0%
46008 - Online Pay Fees	25.20	416.67	100.80	5,000.00	97.98%
46015 Late Fees	4,805.98	0.00	4,805.98	0.00	0.0%
Total Income	<u>5,713.31</u>	<u>2,950.00</u>	<u>-6,225.40</u>	<u>745,400.00</u>	<u>100.84%</u>
Gross Profit	5,713.31	2,950.00	-6,225.40	745,400.00	100.84%
Expense					
77010 ADMINISTRATIVE					
77013 Admin-Secretarial	208.00	1,833.33	2,171.50	22,000.00	90.13%
77014 Admin-Project Coordinator	0.00	1,333.33	688.50	16,000.00	95.7%
77015 Admin-GM	3,680.00	5,500.00	9,442.00	66,000.00	85.69%
77016 Admin-Clerical	1,789.44	3,554.17	10,631.94	42,650.00	75.07%
77040 ADMIN-MILEAGE	139.93	225.00	294.23	2,700.00	89.1%
77025 ACCOUNTING	2,672.00	2,916.67	7,608.50	35,000.00	78.26%
77027 AUDITING	0.00	485.00	0.00	5,820.00	100.0%
77030 ADVERTISING	0.00	166.67	331.80	2,000.00	83.41%
77050 BANKING FEES	43.59	425.00	192.71	5,100.00	96.22%
77150 CONSULTING-HYDROGEO SVC	0.00	2,833.33	6,300.00	34,000.00	81.47%
77325 DIRECT COSTS-REIMB	702.33	458.33	1,679.58	5,500.00	69.46%
77450 DUES & SUBSCRIPTION	0.00	615.67	0.00	7,388.00	100.0%
77480 EQUIPMENT	756.92	3,791.67	756.92	45,500.00	98.34%
77485 Equipment Database	0.00	1,250.00	0.00	15,000.00	100.0%
77500 FEES-GMA8	68.00	400.00	68.00	4,800.00	98.58%
77550 FIELD TECH	8,924.00	15,166.67	27,295.00	182,000.00	85.0%
77560 Field Permitting/Geologis	5,252.00	6,083.33	13,007.00	73,000.00	82.18%
77650 FUEL/MAINTENANCE	390.35	416.67	811.41	5,000.00	83.77%
77800 INJECTION WELL MONITORING	127.00	58.33	127.00	700.00	81.86%
77810 INSURANCE & BONDING	517.09	386.33	1,770.27	4,636.00	61.81%
77970 LEGAL					
77975 Legal-Injection	3,000.00	833.33	6,000.00	10,000.00	40.0%
77970 LEGAL - Other	5,050.95	3,333.33	7,052.95	40,000.00	82.37%
78010 MEETINGS & CONFERENCES	380.01	666.67	1,612.83	8,000.00	79.84%
78310 Rent	200.00	200.00	600.00	2,400.00	75.0%
78600-SOFTWARE MAINT	0.00	333.33	231.16	4,000.00	94.22%
78610 TELEPHONE	375.43	316.67	1,020.63	3,800.00	73.14%
78780 Well Monitoring/Testing	0.00	450.00	0.00	5,400.00	100.0%
Total Expense	<u>34,277.04</u>	<u>54,032.83</u>	<u>99,693.93</u>	<u>648,394.00</u>	<u>84.62%</u>
Other Income/Expense					
Other Income					
46100 INTEREST INC	0.00	958.33	8,782.80	11,500.00	23.63%
Total Other Income	<u>0.00</u>	<u>958.33</u>	<u>8,782.80</u>	<u>11,500.00</u>	
Net Other Income	0.00	958.33	8,782.80	11,500.00	
Net Income	<u><u>-28,563.73</u></u>	<u><u>-50,124.50</u></u>	<u><u>-97,136.53</u></u>	<u><u>108,506.00</u></u>	

ATTACHMENT 6 b. - i.


North Texas Groundwater Conservation District
Quarterly Investment Report
For the Quarter Ended
March 31, 2023

The investment portfolio of the North Texas Groundwater Conservation District is in compliance with the Public Funds Investment Act and the Investment Policy and Strategies.

Presented by North Texas Groundwater Conservation District Investment Officers:



Paul Sigle
General Manager



Debi Atkins
Finance Officer

Investment Holdings
3/31/2023

Description	Ratings	Coupon/ Discount	Maturity Date	Settlement Date	Face Amount/Par Value	Book Value	Market Price	Market Value	Life (Day)	Yield
Independent (DDA)		0.25%	1/1/2023	12/31/2022	\$ 290,800.15	\$ 290,800.15	1.00	\$ 290,800.15	1	0.25%
Independent (ISS)		0.10%	1/1/2023	12/31/2022	\$ 20,173.58	20,173.58	1.00	20,173.58	1	0.10%
TexStar		3.968%	1/1/2023	12/31/2022	\$ 156,266.41	156,266.41	1.00	156,266.41	1	0.107%
Legend (CDARS)		1.440%	5/11/2023	5/12/2022	1,150,000.00	1,150,000.00	1.00	1,150,000.00	41	1.440%
East West CD		4.790%	6/1/2023	3/1/2023	440,750.00	440,750.00	1.00	440,750.00	62	4.910%
East West CD		5.000%	9/1/2023	3/1/2023	440,750.00	440,750.00	1.00	440,750.00	154	5.130%
East West CD		5.000%	12/1/2023	3/1/2023	440,750.00	440,750.00	1.00	440,750.00	245	5.130%
East West CD		4.990%	3/1/2024	3/1/2023	440,750.00	440,750.00	1.00	440,750.00	336	5.120%
					<u>\$ 2,498,740.14</u>	<u>\$ 2,498,740.14</u>			<u>260</u>	
Weighted Ave Maturity in yrs									(1)	0.16

(1) Weighted average life - For purposes of calculating weighted average life, bank accounts, pools and money market funds are assumed to have an one day maturity.

Book/Market Value Comparison

Description	Coupon/ Discount	Maturity Date	December 31, 2022			March 31, 2023		
			Face Amount/ Par Value	Book/Market Value	Purchases/ Adjustments	Sales/Adjust/ Call Maturity	Face Amount/ Par Value	Book/Market Value
Independent (DDA)	0.25%	12/31/2022	\$ 1,003,635.48	\$ 1,003,635.48	1,261,087.08	1,973,922.41	\$ 290,800.15	\$ 290,800.15
Independent (ISS)	0.10%	12/31/2022	20,170.33	20,170.33	3.25		\$ 20,173.58	\$ 20,173.58
TexStar	3.968%	12/31/2022	1,161,059.56	1,161,059.56	8,206.85	1,013,000.00	\$ 156,266.41	\$ 156,266.41
Legend (CDARS)	1.440%	5/11/2023	1,150,000.00	1,150,000.00			\$ 1,150,000.00	\$ 1,150,000.00
East West CD	4.790%	6/1/2023			440,750.00		\$ 440,750.00	\$ 440,750.00
East West CD	5.000%	9/1/2023			440,750.00		\$ 440,750.00	\$ 440,750.00
East West CD	5.000%	12/1/2023			440,750.00		\$ 440,750.00	\$ 440,750.00
East West CD	4.990%	3/1/2024			440,750.00		\$ 440,750.00	\$ 440,750.00
			\$ 3,334,865.37	\$ 3,334,865.37	\$ 3,032,297.18	\$ 2,986,922.41	\$ 3,380,240.14	\$ 3,380,240.14

ATTACHMENT 6 c. – i.



COLLIN COUNTY - COOKE COUNTY - DENTON COUNTY

General Manager’s Quarterly Report

Date: March 31, 2023

North Texas GCD Management Plan

This quarterly briefing is being provided pursuant to the adopted Management Plan for the quarter ending March 31, 2023.

Well Registration Program:

Current number of wells registered in the District: **3,123**

Aquifers in which the wells have been completed: Trinity and Woodbine

Well Inspection/Audit Program:

**2023
Well Inspections**

Month	Collin	Cooke	Denton	Total
January	0	16	12	28
February	7	21	9	37
March	11	18	31	60
April				0
May				0
June				0
July				0
August				0
September				0
October				0
November				0
December				0
Total	18	55	52	125

Number of Exempt wells inspected (as of March 31, 2023)

County	Number of Wells Inspected (2022)	Total Number of Completed Wells*	%
Collin	5	183	3%
Cooke	33	746	4%
Denton	26	1313	2%
Total	64	2242	3%

Number of Non-Exempt wells inspected (as of March 31, 2023)

County	Number of Wells Inspected (2022)	Total Number of Completed Wells*	%
Collin	13	149	9%
Cooke	22	97	23%
Denton	26	468	6%
Total	61	714	9%

*Plugged wells have been excluded

*Total number of completed wells is estimated.

- Assumptions
 - Wells that have completion dates are assumed to be complete.
 - Wells with application dates through 4/5/2020 are assumed to be complete.
 - Wells that have been inspected are assumed to be complete.

ATTACHMENT 7

MASTER TECHNICAL SERVICES AGREEMENT

THIS AGREEMENT ("Agreement") is made as of 7 March 2023 by **INTERA Incorporated**, ("INTERA") a Texas Corporation, and **North Texas Groundwater Conservation District**, ("Client") a Texas governmental entity. Individually, INTERA and Client are sometimes referred to as a Party and collectively as Parties.

WHEREAS, Client desires INTERA to furnish certain technical, maintenance, construction, installation and/or related services ("Services") and INTERA is willing to do so, subject to the terms and conditions set forth herein.

WHEREAS, in certain situations, Client also desires INTERA to furnish certain equipment, materials and other goods (collectively "Goods") and INTERA is willing to do so, subject to the terms and conditions set forth herein.

NOW, THEREFORE, in consideration of the premises and the mutual covenants and agreements hereinafter set forth, the Parties agree as follows:

ARTICLE 1. SCOPE OF SERVICES

Client desires INTERA to perform the Services and provide the Goods described in the applicable Work Order(s).

ARTICLE 2. TERM

The term of this Agreement will commence on 7 March 2023 and will continue until 31 December 2025 unless sooner terminated as provided in this Agreement.

ARTICLE 3. INVOICING AND PAYMENT

For performance of the Services, Client will pay INTERA the compensation specified in each Work Order. This compensation will be invoiced to Client at monthly intervals along with reimbursables and will be due and payable within 30 days following the date of the invoice. In the event that part of an invoice is in dispute, Client agrees to pay the undisputed portion of the invoice according to the payment terms hereunder. If for any reason Client fails to pay INTERA in full within 30 days from the date of an invoice, Client will pay INTERA a late payment charge each month equal to one percent (1%) of any unpaid balance or the highest rate permitted by law, whichever is the lesser. If for any reason Client fails to pay INTERA in full within 60 days from the date of an invoice, INTERA may, at INTERA's sole option, (i) suspend its performance of Services and supply of Goods until all outstanding bills have been paid in full by Client, (ii) terminate this Agreement and any or all Work Orders and/or (iii) engage debt collection services/commence legal proceedings for the collection of unpaid and undisputed invoiced amounts. INTERA shall be entitled to recover, to the extent allowed by law, its costs and expenses, including reasonable attorney's fees, incurred in connection with all actions taken to obtain or enforce payment by Client of Client's obligations under this Agreement. Payment information is included on INTERA's invoice to Client.

ARTICLE 4. REPRESENTATIVES

INTERA will cooperate with the Client and be subject to the direction and control of Client's designated representative. Client will designate a representative who will be the authorized representative of Client regarding this Agreement and Services and will inform INTERA promptly upon discovery of any aspect of the Services or Goods, which does not meet with Client's approval. INTERA will also designate a representative who will be responsible for the execution of the Services and the provision of Goods and will be the authorized representative of INTERA for this Agreement and each Work Order. Each party may designate a different representative for each Work Order or one representative for all Work Orders.

ARTICLE 5. RECORDS

For a period of one year after completion of each Work Order under this Agreement, INTERA will, upon written request of the Client, provide reasonable access to necessary supporting records and documentation.

ARTICLE 6. RELATIONSHIP OF THE PARTIES

6.1. Independent Contractor. INTERA will perform the Services as an independent contractor. INTERA acknowledges and agrees that no employer-employee relationship exists or is intended to be created between INTERA and Client.

6.2. Assumption or Creation of Obligations or Responsibilities. Neither Party will have the right to assume or create obligations or responsibilities of any type in the name of the other Party unless expressly authorized to do so in writing by the Party taking on the obligation.

ARTICLE 7. SUBCONTRACTOR AND SUPPLIERS

INTERA will have the right to retain subcontractors and suppliers to assist INTERA in the performance of the Services and the provision of Goods under each Work Order.

ARTICLE 8. CONFIDENTIALITY AND RIGHTS IN DATA

8.1. Maintenance of Confidentiality. Information disclosed by one Party to the other Party during the performance of a Work Order may include the confidential or proprietary information of the disclosing Party and that Party's agents, subcontractors or suppliers. In the event such information is

expressly identified as proprietary or confidential prior to or at the time of disclosure, the Party receiving such information will keep it in confidence and will not furnish or otherwise disclose it to any third party during or after completion of the applicable Services for a period of three years. Neither Party will be obligated to maintain the confidentiality of any information designated by the other Party as confidential or proprietary if the information:

8.1.1. Was in the receiving Party's possession or was known to the receiving Party prior to its receipt from the other Party and the receiving Party was under no prior legal obligation to protect such information;

8.1.2. Is independently developed by the receiving Party without the utilization of the confidential or proprietary information;

8.1.3. Is or becomes public knowledge without the fault of the receiving Party;

8.1.4. Becomes available to the receiving Party from a source other than the disclosing Party where the receiving Party is not under any legal obligation to protect such information; or

8.1.5. The information is disclosed pursuant to a governmental or legal requirement.

8.2. Provision of Information to INTERA. Client will promptly furnish INTERA with all information necessary for INTERA to perform the Services and supply the Goods. INTERA and its Subcontractors will be entitled to rely upon such information and upon information from generally acceptable reputable sources without independent verification in the performance of the Services or supplying of Goods.

8.3. Intellectual Property. INTERA will have the full title and all rights in and to (including the sole right to obtain patents on) any inventions made or conceived as a result of the performance of the Services. INTERA hereby grants to Client a royalty-free, nonexclusive license for Client to make, have made and use any such invention made or conceived as a result of the performance of the Services or supply of the Goods. All computer programs, applications, methods, mechanized design practices, layouts, and systems developed by INTERA during the term of an applicable Work Order or owned by INTERA on the effective date of this Agreement, will remain the exclusive property of INTERA. Except as otherwise provided in this Article 8, all reports, data, drawings, plans, specifications and other items delivered by INTERA (hereinafter referred to as "Reports") to Client under a Work Order will become the property of Client; however, INTERA is entitled to retain a file copy and utilize such Reports and the material in those Reports in the scope of INTERA's work and/or services for itself and others.

8.4. Report Reuse. Reports delivered by INTERA under a Work Order issued under this Agreement are not intended or represented to be suitable for reuse by Client or others for purposes other than those described in that Work Order, nor are they intended to be used by Client in other materials other than in their complete form. Any such reuse without written verification or modification by INTERA will be at Client's sole risk and without liability or legal exposure to INTERA, and Client shall indemnify and hold harmless INTERA from all claims, damages, losses and expenses including attorney's fees arising out of or resulting therefrom.

ARTICLE 9. TERMINATION

9.1. Client's Right to Terminate. Client may terminate i) one or more Work Orders or ii) this Agreement and All Work Orders upon 30 days prior written notice to INTERA, but such termination will not relieve Client of its obligation to pay INTERA for expenses incurred, Services performed and Goods provided up to the date of termination and all reasonable expenses, which INTERA incurs related to the termination.

9.2. INTERA's Right to Terminate. INTERA may terminate i) one or more Work Orders or ii) this Agreement and All Work Orders upon 30 days prior written notice to Client, but such termination will not relieve INTERA of its

MASTER TECHNICAL SERVICES AGREEMENT

obligation to provide Client with a copy of all Reports prepared up to the date of termination of the Agreement.

ARTICLE 10. INDEMNIFICATION, WARRANTY AND LIMITATION OF LIABILITY

10.1. INTERA's Indemnification of Client. INTERA will indemnify and hold harmless Client, its officers, employees, and agents (the "Client Indemnified Parties") from losses (including, but not limited to, reasonable attorneys' fees and expenses) of the Client Indemnified Parties to the extent caused by the 1) negligent acts or omissions of INTERA, 2) reckless acts or omissions of INTERA, 3) intentional misconduct of INTERA, 4) material misrepresentations of INTERA, 5) material breaches of contract or warranty by INTERA and 6) infringement of United States patents, copyrights and trademarks by INTERA.

10.2. Client's Indemnification of INTERA. Client will indemnify and hold harmless INTERA, its officers, employees, agents, subcontractors and suppliers (the "INTERA Indemnified Parties") from losses (including, but not limited to reasonable attorneys' fees and expenses) of the INTERA Indemnified Parties to the extent caused by the 1) negligent acts or omissions of Client, 2) reckless acts or omissions of Client, 3) intentional misconduct of Client, 4) material misrepresentations of Client, 5) material breaches of contract or warranty by Client and 6) infringement of United States patents, copyrights and trademarks by Client.

10.3. INTERA's Warranty and Limitation of Liability. INTERA warrants that the Services will be performed, within the limits prescribed by Client, with professional thoroughness and competence. Notwithstanding anything to the contrary herein, INTERA's total cumulative liability for claims of any kind whether based in contract, tort (including negligence and strict liability), under any warranty, indemnification or otherwise, for any loss or damage arising out of or related to this Agreement, any Work Order or the performance of the Services or supply of Goods under this Agreement and any Work Order, will in no case exceed the compensation paid to INTERA by Client for the Services under the applicable Work Order.

ARTICLE 11. INSURANCE

11.1. Insurance Coverage. Prior to commencing with the Services and at all times during the term of a Work Order, INTERA will provide and maintain in full force and effect, insurance of the types and with limits not less than those specified as follows:

11.1.1. Workers' Compensation Insurance in accordance with the statutory requirements of the State having jurisdiction over employees who are engaged in the Scope of Services, and Employer's Liability insurance of One Million Dollars (\$1,000,000) each accident; disease-each employee; and disease-policy limit.

11.1.2. Commercial General Liability Insurance with a per occurrence limit of One Million Dollars (\$1,000,000). This policy will include Contractual Liability coverage. This insurance will cover bodily injury to or death of persons, and/or loss of or damage to property.

11.1.3. Automobile (owned, non-owned or hired) Insurance with an each accident limit of One Million Dollars (\$1,000,000) for bodily injury and property damage liability.

11.1.4. Professional Errors and Omissions Insurance of One Million Dollars (\$1,000,000) for each occurrence per claim and in the aggregate.

11.2. Insurance Terms and Conditions. All insurance policies provided and maintained by INTERA will be underwritten by insurers which are rated "A VII" or higher by the most current edition of *Best's Key Rating Guide*, and which are authorized to write insurance in the state or states in which the Services are performed or where the Goods are provided.

ARTICLE 12. DISPUTE RESOLUTION

12.1. Negotiation. The Parties will attempt in good faith to resolve any dispute arising out of or relating to this Agreement or a Work Order promptly by negotiation between executives who have authority to settle the controversy. Any Party may give the other Party written notice of any dispute not resolved in the normal course of business. Within ten days after delivery of the notice, the receiving Party will submit to the other a written response. The notice and response will include (a) a statement of that Party's position and a summary of arguments supporting that position, and (b) the name and title of the executive who will represent that Party and of any other person who will accompany the executive in negotiations. Within 20 days after delivery of the initial notice, the executives of both Parties will meet at a mutually acceptable time and place, and thereafter as often as they reasonably deem necessary, to attempt to resolve the dispute. All reasonable

requests for information made by one Party to the other will be honored. All negotiations pursuant to this clause are confidential and will be treated as compromise and settlement negotiations for purposes of applicable rules of evidence.

12.2. Mediation. If the dispute has not been resolved by negotiation as provided above within 30 days after delivery of the initial notice of negotiation, or if the Parties fail to meet within 20 days, the Parties will endeavor to settle the dispute by mediation under the International Institute for Conflict Prevention & Resolution ("CPR") Mediation Procedure in effect on the date of this Agreement, provided, however, that if one Party fails to participate in the negotiation as provided above, the other Party can initiate mediation prior to the expiration of the 30 days. Unless otherwise agreed, the Parties will select a mediator from the CPR Panel of Distinguished Neutrals.

12.3. Litigation. Any dispute arising out of or relating to this Agreement or a Work Order, including the breach, termination or validity thereof, which has not been resolved by mediation as provided above within 50 days after delivery of the initial notice of negotiation will be finally resolved by litigation.

12.4. The Client agrees to the joinder of any Subcontractor hired by INTERA to any proceeding under this Agreement that involves or may involve a Subcontractor's Services.

ARTICLE 13. NOTICES

Any notice, request, demand or other communication related to this Agreement or Work Order will be in writing and will be considered duly made three calendar days after the date of deposit in the U.S. Mail, by certified mail, return receipt requested, postage prepaid, addressed to the applicable Party at the following address or when delivered, if delivered by hand or transmitted by telecopy to the other Party at the following addresses or facsimile numbers:

If to INTERA: INTERA Incorporated
Attn: George Westbury, Director of Contracts
9600 Great Hills Trail, Suite 300W
Austin, TX 78759
Telephone: 512.425.2000
Email: gwestbury@intera.com

If to Client: North Texas Groundwater Conservation District
Attn: Paul Sigle
5100 Airport Dr.
Denison, TX 75020
Telephone: 855.426.4433
Email: p.sigle@northtexasgcd.org

Either Party may change its address or numbers for receiving notices by giving written notice of the change to the other Party.

ARTICLE 14. MISCELLANEOUS

14.1. Title to Goods. Title to and risk of loss of or damage to Goods will pass to Client upon delivery of the Good to Client.

14.2. Force Majeure. Neither Party will be considered in default in the performance of its obligations hereunder to the extent that the performance of any such obligation is prevented or delayed by any cause, which is beyond the reasonable control of and could not have been anticipated by the affected Party, including, but not limited to, acts of God, storms, floods, fire, strikes, boycotts, other labor disputes, riots, thefts, accidents, acts or failures to act by the other Party; and acts or failures to act by any non-Party government or government agency; provided, however, that any obligation to make payment hereunder will not be extended for any reason. Upon the occurrence of a situation as described above, the time for performance by either Party to this Agreement of its obligations will be extended by a period of time equal to the time lost because of such situation; provided, however, that prompt notice of such a situation will be provided to the other Party and reasonable efforts will be used to mitigate the adverse impact of such a situation.

14.3. Responsibility for Taxes. Client will be responsible for and will pay any taxes due to any agency arising out of or under this Agreement or a Work Order or the Services and Goods provided except for those taxes levied upon the net income, gross receipts, real, or personal property of INTERA.

14.4. Assignment. Neither this Agreement and any Work Orders nor any rights or obligations under this Agreement and any Work Orders will be assigned or otherwise transferred by a Party without the prior written consent of the other Party except that INTERA may assign all or a portion of this the Services or Goods under a Work Order to a subcontractor or supplier without the prior written consent of the Client.

14.5. Waiver. The failure of either Party to exercise any right under this Agreement or any Work Order or to take any action permitted will not be

MASTER TECHNICAL SERVICES AGREEMENT

deemed a waiver of any right in the event of a subsequent breach of a like or different nature.

14.6. Entire Agreement. The terms and conditions set forth in this Agreement and a signed Work Order are intended by both Parties to constitute the final and complete statement of their agreement with respect to the subject matter of this Agreement and Work Order(s), and all prior proposals, communications, negotiations, agreements, understandings and representations relating the subject matter of this Agreement and Work Order(s) are hereby superseded. No modification or amendment of this Agreement or Work Order(s) will be effective unless the same is in writing and signed by both Parties.

14.7. Third Party Beneficiaries. Except as expressly provided to the contrary in this Agreement or Work Order(s) this Agreement does not and is not intended to confer any rights or remedies upon any person other than the Parties.

14.8. Law and Venue. This Agreement and Work Order(s) will be governed by and interpreted in accordance with the laws of the State of Texas and exclusive venue shall be in a court of competent jurisdiction in Travis County, Texas.

14.9. Severability. The invalidity or unenforceability of any provision of this Agreement and any Work Order will not affect the validity or enforceability of any other provision of this Agreement or Work Order(s), each of which will remain in full force and effect.

14.10. Captions. The Articles and Section captions in this Agreement are for convenience of reference only, do not constitute part of this Agreement and will not be deemed to limit or otherwise affect any of the provisions in the Agreement. Similarly, any captions in a Work Order are also for convenience and reference only, do not constitute part of the Work Order and will not be

deemed to limit or otherwise affect any of the provisions in the Work Order.

14.11. Construction. The Parties to this Agreement and any Work Order participated jointly in the negotiation and drafting of this Agreement and any Work Order. Therefore, in the event any ambiguity or question of intent or interpretation arises, this Agreement and any Work Order will be construed as if drafted jointly by the Parties and no presumption or burden of proof will arise favoring or disfavoring any Party by virtue of authorship of any of the provisions of this Agreement or any Work Order.

14.12. Counterparts. This Agreement and any Work Order may be executed in the original, by facsimile, by e-mail or by electronic signature in any number of counterparts, each of which shall be deemed an original and all of which together shall constitute one and the same instrument.

14.13. Professional Materials. INTERA may use these Services and Client's name in its promotional and professional materials. INTERA will not disclose information that is identified by Client as confidential or proprietary according to Article 8.

14.14. Survival. The provisions of Articles 5, 8, 10 and 12 and Sections 14.3, 14.8 and 14.13 of this Agreement will survive the termination or cancellation of this Agreement and the completion of the Scope of Services under any Work Order.

14.15. Priority. To the extent of conflict between the terms of a signed Work Order and the signed Agreement, the terms of the signed Work Order shall govern.

14.16. Attachments. The following attachments are made a part of this Agreement for all purposes:

- Attachment A - Master Rate Schedule
- Attachment B - Work Order Form

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their duly authorized representatives as of the date first above written.

North Texas Groundwater Conservation District

INTERA Incorporated

By: _____

Printed Name: Paul Sigle

Printed Title: General Manager

By: _____

Printed Name: Wade Oliver

Printed Title: Director

Project ID: _____

MASTER TECHNICAL SERVICES AGREEMENT

ATTACHMENT A: MASTER RATE SCHEDULE

INTERA Labor Hourly Billing Rates

Labor Category	Rate (\$USD/hr.)
Principal Engineer/Scientist I	\$280
Principal Engineer/Scientist II	\$250
Principal Engineer/Scientist III	\$235
Senior Engineer/Scientist I	\$220
Senior Engineer/Scientist II	\$200
Senior Engineer Scientist III	\$185
Senior Engineer/Scientist IV	\$175
Engineer/Scientist I	\$165
Engineer/Scientist II	\$155
Engineer/Scientist III	\$135
Engineer/Scientist IV	\$125
Engineer/Scientist Intern	\$85
Senior Technician	\$140
Technician	\$85
Senior Technical Editor	\$140
Technical Editor	\$95
Senior CAD/Graphics Specialist	\$120
CAD/Graphics Specialist	\$95
Project Associate	\$88

There is a 15% mark up on other direct costs such as subcontractors, vendors, travel, and equipment. Mileage is reimbursed at the current IRS standard mileage rate.

MASTER TECHNICAL SERVICES AGREEMENT

ATTACHMENT B: SAMPLE WORK ORDER FORM

CLIENT: _____

PROJECT or CONTRACT ID: _____

WORK ORDER NO: _____

1.0 SCOPE OF SERVICES

2.0 TERM

The term of this Work Order will commence on _____ and will continue until _____ unless sooner terminated by the Client and as provided in the Master Agreement.

3.0 DELIVERABLES AND SCHEDULE

4.0 FEES/COMPENSATION/REIMBURSABLES

INTERA shall be compensated for work performed on either a Time and Materials or a Fixed Price basis as selected below:

TIME AND MATERIALS

FIXED PRICE

FIXED PRICE OR NOT TO EXCEED AMOUNT: _____

Inclusive of any applicable taxes?

YES

NO

5.0 DESIGNATED REPRESENTATIVES

CLIENT:

Printed Name: _____

Phone: _____

Email: _____

INTERA:

Printed Name: _____

Phone: _____

Email: _____

6.0 AUTHORIZATION

The Services and Goods in this Work Order shall be performed in accordance with the terms and conditions set forth in the Master Technical Services Agreement made on _____ between the Client and INTERA.

This Work Order is agreed and entered into on _____.

CLIENT

INTERA Incorporated

Printed Name: _____

Printed Name: _____

MASTER TECHNICAL SERVICES AGREEMENT

WORK ORDER FORM

CLIENT: North Texas Groundwater Conservation District

PROJECT or CONTRACT ID: _____

WORK ORDER NO: 1

1.0 SCOPE OF SERVICES

The first task will be to convert the NTWGAM from MODFLOW-NWT to MODFLOW 6. This is a critical first step in the scope of work because it needs to be demonstrated that MODFLOW 6 can reliably reproduce the results of the 2014 NTWGAM. If the solutions between MODFLOW-NWT and MODFLOW 6 are not baselined, we run the risk of propagating errors in the updated model unrelated to the purposefully implemented modifications to the underlying model. The first subtask of Task A will be migrating the existing NTWGAM packages to MODFLOW 6 format. INTERA has converted many models to MODFLOW 6 over the last two years. We have developed scripts to support this process with error checking logic. To test the conversion and to identify any systematic differences between the codes, we will run the 2014 NTWGAM calibration simulation and the current GMA 8 MAG run. The end of this process represents a significant milestone, and we will meet with GMA 8 to provide a detailed analysis of the comparison of the two simulation codes.

Once we have demonstrated the successful conversion of the current NTWGAM to MODFLOW 6, we will meet with GMA 8 to discuss the objectives of the updated model with emphasis on correcting known errors, adding additional data collected by the GCDs, and improving functionality for groundwater management. For efficiency, this meeting can be combined with the model conversion meeting at the end of Task A. We will have already met with TWDB to discuss their interests in the update of the NTWGAM. Because of the importance of TWDB accepting the updated model, we will request that technical staff from TWDB attend any key model update meetings with GMA 8. Some of the already known key objectives of the model update are to extend the calibration period from 2012 through 2020, incorporate new data on structure and aquifer properties, and use the improved numerical capabilities of MODFLOW 6 to improve model efficiency, accuracy, and applicability to management at the district and GMA level.

In Milam County, the structural update will include evaluation of at least 12 geophysical logs in the Trinity group in addition to the logs used in the development of the previous GAM. We will also use these logs in Milam County to estimate water quality and refine the locations and offsets of faults.

To update the NTWGAM, we will establish an efficient workflow for model construction and calibration that minimizes construction errors and results in a purpose-built model. The applied workflow dictates how a groundwater model is constructed and deployed in a specific resource management context. This workflow deserves specific attention because it ultimately controls the quality and utility of the model. The INTERA Team brings experience applying reproducible modeling workflows built on a foundation of scripting and open-source software tools, so that all decisions and assumptions made during the modeling workflow are transparently and openly documented. The scripting-driven workflow brings significant advancements to improve efficiency, transparency, and ultimately quality, to all facets of the modeling process.

After we have met with GMA 8 and TWDB, and agreement has been reached on the particulars of the model update, we will start developing the updated model packages. The first subtask will be model discretization which includes horizontal grid size as well as layering. MODFLOW 6 enables revision of the model to an unstructured format, allowing variable grid dimensions as well as pinching and compositing layers that may exist in the current NTWGAM. The current model is difficult to use because of the large number of grid cells and the presence of a pass-through layer that connects the shallow outcrop portions of the aquifer from the deeper portions of the aquifer. We will explore simplifying this formulation for ease of use. We will also meet with GMA 8 and develop a rational for relaxing the ¼-mile grid spacing in portions of the model grid where it is not required. Another place where model layering may be improved is in the handling of the Northern Segment of the Edwards (Balcones Fault Zone [BFZ]) Aquifer. The TWDB is developing an updated Edwards (BFZ) Aquifer GAM, and the integration of layering and properties between this model and the updated NTWGAM will facilitate groundwater management for southern GCDs within GMA 8 through the more accurate evaluation of pumping impacts from the southernmost counties in the aquifer system. Many of the GMA 8 member GCDs have also characterized faulting that is currently not implemented in the 2014 NTWGAM. We will work closely with these GCDs to ensure that this faulting is accurately represented in the updated NTWGAM.

Several transient stress packages will require extension from 2012 through 2020, including pumping, recharge, stream routing, and evapotranspiration (ET). Stream routing will be implemented in a manner consistent with the 2014 NTWGAM. The USGS Soil-Water-Balance (SWB) model (Westenbroek and others, 2010; Westenbroek and others, 2018) can be used for estimating recharge on a grid similar to that used for groundwater availability models. The SWB model code was successfully demonstrated to the TWDB when applied by Mr. Keester during an analysis of changes in soil moisture in four watersheds in the Upper Colorado River Basin (Furnans and others, 2019) and in developing estimates of the temporal and spatial distribution of recharge for aquifers in central and west Texas (Sen and others, 2022). In addition, the USGS applied the SWB model code to develop estimates of recharge to the Gulf Coast Aquifer System as part of the ongoing development of the GULF-2023 model.

The SWB code uses a combination of gridded and tabular data to calculate potential groundwater recharge separately for each grid cell within a model domain. The SWB code evaluates the sources and sinks of water within each grid cell at and near land surface and then calculates recharge as difference between the change in soil moisture and the sources and sinks. Sources for recharge include precipitation and inflow (surface runoff from an adjacent grid cell) while sinks include evapotranspiration, outflow (surface runoff to an adjacent grid cell), and interception (rainfall trapped and used by vegetation and evaporated or transpired from plant surfaces).

Over the past several years, GCDs within GMA 8 have worked with the TWDB TexMesonet group to establish several stations for collecting climate and soil moisture data. These data can now be applied during development of a SWB model to constrain the parameters used for calculating daily evapotranspiration, soil moisture, and potential infiltration. We propose following the approach developed for the TWDB to create a similar ensemble SWB model for GMA 8 including calibration to TexMesonet data using PESTPP-IES (White and others, 2020) and results processing for watersheds and aquifer outcrops. Drawing upon our previous experience with the code and data we will also apply lessons learned to improve efficiency in model development and application.

Results from the SWB model will be used in conjunction with analyses of recharge and evapotranspiration documented for the current NTWGAM (Kelley and others, 2014). The proposed SWB model will serve to increase our understanding of the sources of aquifer inflow and outflow in the outcrop area. Development of the SWB model will allow GMA 8 to apply TexMesonet data to further inform the conceptual model of potential recharge to the Edwards, Woodbine, and Trinity aquifers.

MASTER TECHNICAL SERVICES AGREEMENT

WORK ORDER FORM

Pumping will be updated from 2012 through 2020, using techniques for collection and allocation within the model domain consistent with the current NTWGAM with two exceptions. First, as part of collecting data from GCDs in GMA 8, we will obtain available data and analyses of groundwater use to compare to the water use data available through the TWDB. We will discuss major differences with both the GCDs and the TWDB to resolve any discrepancies in the new calibration period pumping data. Secondly, we will ensure that the transition in pumping between the last historical period of the current NTWGAM (2012) and 2013 is consistent with climatological changes or known water use trends.

The GCDs within GMA 8 have been collecting a significant amount of data on aquifer properties, including hydraulic conductivity, transmissivity and storativity. For the 2014 NTWGAM, hydraulic conductivity was scaled to the model scale through development of a geohydrostratigraphic model that correlated aquifer test derived values of hydraulic conductivity with formation, lithology, and depositional environments. Using the geohydrostratigraphic approach for the NTWGAM update, aquifer parameters could be assigned to the model grid based on known geological factors and the model being constrained by the available aquifer test data. We will compare new aquifer test parameters based on aquifer tests to the calibrated values at a given grid cell. Next, we will develop an averaging scheme that allows integration of the new data into the existing model parameter fields. Prior to calibration, we will develop a comparison of the frequency distribution of aquifer properties from the current NTWGAM and the updated initial parameter field to ensure that constraints on parameter perturbation during calibration are still consistent with those originally used. This will allow consistency with the 2014 NTWGAM while honoring new values that are significantly different than those used in the current model.

We will update calibration targets for the extended calibration period from 2012 through 2020. These targets will include water levels, stream baseflow estimates, and spring flows. Water levels will be collected from TWDB's Groundwater Database and from monitoring data from GCDs. We will request information from each GCD on their DFC compliance monitoring network. Because of the importance of model fit at compliance monitoring wells, we will investigate weighting options for compliance network water levels in the calibration task (Task C). Because surface water interaction is becoming a more important management objective, we will query GCDs on key spring flows that are managed to and make sure they are being appropriately included in the updated NTWGAM. Once the model packages are updated, we will meet with GMA 8 to present implementation of the new packages from 2012 through 2020. TWDB staff will also attend this meeting. After addressing any comments, re-calibration of the model will begin.

At the end of Task A, we will have demonstrated that the converted MODFLOW 6 NTWGAM meets the original calibration criteria documented in the report, Kelley and others 2014. In Task C, we will extend the calibration period from 2012 to 2020. Because the updated model will be incorporating additional data on properties, structure, and discretization, we will calibrate the updated model from 1890 through 2020. The key calibration metrics for the updated NTWGAM will be similar to the current model and will include water levels (heads), estimates of baseflow to streams, and springflow. The current NTWGAM calibration was also guided by a conceptual flow balance which will be used as a constraint in updating the model. As part of a pre-calibration activities, we will review model bias (misfit) with observed water levels and rates of water level change to focus calibration on improving historical water level misfit in the existing NTWGAM. We will achieve this through the calibration metric weighting discussed below.

We propose to use this approach in parameter estimation as well as in model construction. This extension is facilitated by use of the Python package pyEMU to programmatically undertake parameter estimation, and the iterative ensemble smoother PESTPP-IES, which greatly reduces the computational demand of nonlinear, high-dimensional parameter estimation. PESTPP-IES was developed by INTERA's Dr. Jeremy White and was recently used in the calibration of the GULF 2023 GAM for the northern Gulf Coast Aquifer and has been accepted by the TWDB for use on the Cross-Timbers Aquifer GAM, currently under development by INTERA. During parameter estimation, PESTPP-IES also performs an uncertainty analysis, effectively combining the calibration and uncertainty analysis workflows. As was done in the 2014 NTWGAM, calibration metrics will be weighted to reproduce the aspects of the historical dataset that are most aligned with the model objectives during the calibration process. Likewise, parameters adjusted during calibration, such as aquifer hydraulic conductivity, will have prior distributions defined to constrain parameter perturbation and prevent non-sensical parameterization while honoring field measurements. We will provide regular monthly updates to GMA 8 and the TWDB on progress during calibration. The updated and recalibrated NTWGAM model files will be provided to GMA 8 and TWDB for review before advancing to Task D – Predictive Simulations.

After the NTWGAM is successfully re-calibrated, we will perform a series of three predictive simulations, as defined by GMA 8. In 2014 and 2015, INTERA performed similar predictive simulations as part of developing the revised 2014 NTWGAM and under a separate contract with GMA 8. The three simulations to be performed as part of Task D are:

- Run 1 - Determine the amount of production that can occur in order to achieve the current GMA 8 DFC
- Run 2 - Determine what the GMA 8 DFCs would be assuming the current MAG values
- Run 3 - Determine the sustainable amount of production from the Trinity and Woodbine Aquifers

Run 1 will use the updated NTWGAM to produce a simulation with the right balance of pumping per aquifer and county to match the current DFC. To perform this simulation, we will keep pumping locations consistent with the current MAG run and optimally adjust pumping to close the misfit on DFCs per county per aquifer. We will use PEST to perform the optimization. Run 2 will use the updated NTWGAM to produce a simulation that predicts pumping (MAG equivalent) using the constraint of the current county/aquifer DFCs which are expressed in terms of drawdown. For this simulation, we will use PEST to optimize pumping on a county/aquifer basis that recreates the average county/aquifer drawdown equal to the current DFC. Again, pumping will be aggregated from model cells where pumping occurs in the current MAG run. This simulation is less unique than Run 1 and we will adopt a normalized methodology to modify county aquifer pumping. Run 3 will require discussion with GMA 8 member GCDs to define sustainable production in the context of GMA 8. The USGS defines sustainable groundwater development as the development and use of groundwater in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences (Alley and others). In 2014, INTERA simulated a run termed the "conservation run" which examined the amount of pumping that could occur per aquifer per county from 2025 to 2070 that would bring water levels back to 2010 levels (140,000 AFY in Trinity and 18,700 AFY Woodbine). After completing the model runs, we will present results to GMA 8 and document the simulations in a technical memorandum with all model files.

2.0 TERM

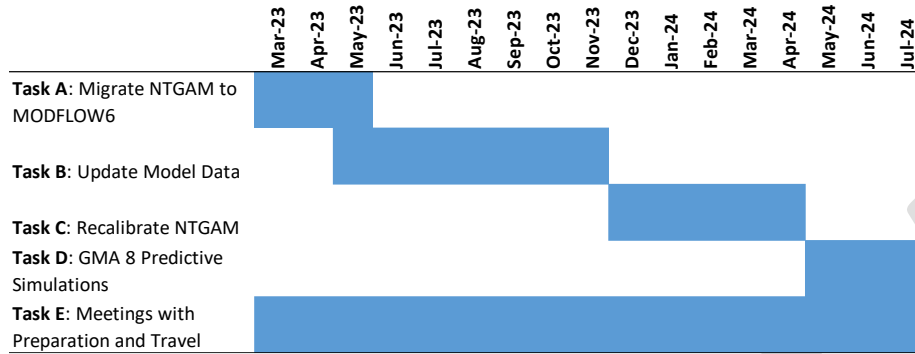
The term of this Work Order will commence on 7 March 2023 and will continue until 1 July 2025 unless sooner terminated by the Client and as provided in the Master Agreement.

MASTER TECHNICAL SERVICES AGREEMENT

WORK ORDER FORM

3.0 DELIVERABLES AND SCHEDULE

The table below shows our proposed 17-month schedule for completing each of the tasks described above. This schedule includes eight meetings of the GMA 8 GCDs over the period as well as the three virtual meetings with TWDB. This schedule is designed to provide sufficient time for the GMA 8 GCDs to review the model update and predictive simulations in Task D leading into the 2026 round of joint planning.



4.0 FEES/COMPENSATION/REIMBURSABLES

INTERA shall be compensated for work performed on either a Time and Materials or a Fixed Price basis as selected below:

TIME AND MATERIALS

FIXED PRICE

FIXED PRICE OR NOT TO EXCEED AMOUNT: \$591,100 **Inclusive of any applicable taxes?** YES NO

5.0 DESIGNATED REPRESENTATIVES

CLIENT:

Printed Name: Paul Sigle
Phone: 855-426-4433
Email: p.sigle@northtexasgcd.org

INTERA:

Printed Name: Wade Oliver
Phone: 832-535-5763
Email: woliver@intera.com

6.0 AUTHORIZATION

The Services and Goods in this Work Order shall be performed in accordance with the terms and conditions set forth in the Master Technical Services Agreement made on 7 March 2023 between the Client and INTERA.

This Work Order is agreed to and entered into on 7 March 2023.

CLIENT

INTERA Incorporated

Printed Name: _____

Printed Name: Wade Oliver

MASTER TECHNICAL SERVICES AGREEMENT

WORK ORDER FORM

CONFIDENTIAL

ATTACHMENT 8

**INTERLOCAL AGREEMENT REGARDING
GROUNDWATER MANAGEMENT AREA 8 FUNDING FOR UPDATE TO
GROUNDWATER AVAILABILITY MODEL**

THIS INTERLOCAL AGREEMENT REGARDING GROUNDWATER MANAGEMENT AREA 8 FUNDING FOR UPDATE TO GROUNDWATER AVAILABILITY MODEL (the “*Agreement*”) is entered into between the Central Texas Groundwater Conservation District, Clearwater Underground Water Conservation District, Middle Trinity Groundwater Conservation District, North Texas Groundwater Conservation District, Northern Trinity Groundwater Conservation District, Post Oak Savannah Groundwater Conservation District, Prairielands Groundwater Conservation District, Red River Groundwater Conservation District, Saratoga Underground Water Conservation District, Southern Trinity Groundwater Conservation District, and the Upper Trinity Groundwater Conservation District (collectively, the “*GMA 8 Districts*” or “*Parties*” and individually a “*GMA 8 District*” or “*Party*”), pursuant to the provisions of the Interlocal Cooperation Act, Chapter 791, Texas Government Code.

WHEREAS, each Party is a political subdivision of the State of Texas created under the authority of Article XVI, Section 59, of the Texas Constitution, and operates pursuant to the provisions of Chapter 36 of the Texas Water Code, and each Party’s respective enabling act; and

WHEREAS, each Party’s boundaries are wholly or partially within Groundwater Management Area 8 (“*GMA 8*”), as delineated by the Texas Water Development Board (the “*TWDB*”) pursuant to Section 356.21 of TWDB Rules, Title 31 Texas Administrative Code § 356.21, as amended; and

WHEREAS, the GMA 8 Districts selected a consultant to update the Groundwater Availability Model for the Northern Trinity and Woodbine Aquifers (“*GAM*”) for use in developing Desired Future Conditions for the relevant aquifers within GMA 8; and

WHEREAS, each Party has the authority provided in Chapter 791, Texas Government Code, its respective enabling act, Chapter 36 of the Texas Water Code, including, but not limited to, Sections 36.1086, 36.205, and 36.207 of the Texas Water Code, as amended, to enter into any and all such contracts as necessary to achieve the intent and purposes set forth herein; and

WHEREAS, the Parties desire to contract with each other in support of updating the GAM;
and

WHEREAS, the governing body of each GMA 8 District has authorized this Agreement.

NOW, THEREFORE, in consideration of the foregoing premises and the mutual promises, obligations, and agreements of the Parties contained in this Agreement, the Parties agree as follows:

I. SCOPE AND FUNDING

1.1 **Scope of Services.** The GMA 8 Districts have selected INTERA Incorporated and R.W. Harden & Associates (“*Consultant*”) in accordance with the Professional Services Procurement Act, Chapter 2254, Texas Government Code (“*Act*”), to perform the professional services necessary to update the GAM (the “*Project*”). The scope of work to be provided by Consultant is set forth in Exhibit A, attached hereto and incorporated herein for all purposes.

1.2 **Funding of Consultant Services.**

(a) The GMA 8 Districts have negotiated a contract price pursuant to the Act for Consultant to perform the services of the Project in the amount of five-hundred and ninety-one thousand and one hundred dollars (\$591,100.00) (“*Contract Price*”), as set forth in Exhibit A. The North Texas Groundwater Conservation District (“*NTGCD*”) has been appointed by the groundwater conservation districts in GMA 8 as the administrative district for GMA 8, and NTGCD shall serve as the entity that will contract with Consultant to perform the services of the Project under Section 1.1 of this Agreement; provided, however that each GMA 8 District has the same obligations and interest under the Consultant contract and right to the data and information prepared by Consultant for the Project by virtue of funding the work performed. The contract between NTGCD and Consultant is entered into on behalf of all of the GMA 8 Districts in the interest of efficiency, and shall at a minimum include terms related to Force Majeure, remedies for breach, and any applicable representations and warranties to ensure timely delivery of the work product set forth in Exhibit A.

(b) The GMA 8 Districts agree to each fund a portion of the Contract Price for the performance of Consultant services pursuant to the schedule set forth in Exhibit B, attached hereto and incorporated herein for all purposes. Any additional costs beyond the Contract Price must be agreed to in writing by all GMA 8 Districts prior to the cost being incurred. Nothing in this section or the Agreement shall be construed to require a Party to fund any additional cost beyond each Party’s portion of the Contract Price to which that Party does not agree to fund. Similarly, nothing in this section or this Agreement shall be construed as limiting a Party hereto, individually or in conjunction with any other Party/Parties comprising the GMA 8 Districts, from separately funding any other services beyond the Contract Price.

(c) In the event an entity that is not a GMA 8 District approved by the GMA 8 Districts desires to contribute funding to the Contract Price and/or approved additional costs, such contribution shall thereby reduce each Party’s share of the funding on a pro rata basis.

1.3 **Payment of Consultant Services Costs.**

(a) Upon receipt of an invoice from Consultant, NTGCD shall send an email to each GMA 8 District with the following: (a) a copy of the Consultant invoice; and (ii) a separate invoice from NTGCD reflecting the amount due from each GMA 8 District. Payment is

due from each GMA 8 District by check mailed to NTGCD not later than thirty (30) days from the date of the NTGCD invoice. NTGCD shall tender one payment to Consultant on behalf of the GMA 8 Districts, and has the discretion whether to do so prior to or after receipt of payment from some or all of the GMA 8 Districts. The GMA 8 Districts agree to provide payment to NTGCD as set forth herein under all circumstances, unless the GMA 8 Districts agree to halt or refuse payment on a particular Consultant invoice due to a dispute over services performed.

- (b) In the event a GMA 8 District is unable to timely render payment in accordance with Section 1.3(a) for any reason whatsoever (the “***Breaching District***”), such inability to pay does not relieve the GMA 8 District of the funding obligations hereunder, but shall require the other GMA 8 Districts to equally absorb the pro rata share of the Breaching District’s amounts owed to NTGCD. The GMA 8 Districts reserve the right to exercise all of the legal rights and remedies available under law and equity against any GMA 8 District that breaches this Agreement.
- (c) Any funding received from a third party under Section 1.2(c) towards payment of a Consultant invoice or total previously paid by the GMA 8 Districts shall serve as a credit on any future payments owed by the GMA 8 Districts. Any such credit shall be reflected on the following NTGCD invoices delivered to the GMA 8 Districts under Subsection (a) of this section.

II. GENERAL PROVISIONS

- 2.1 **Recitals**. The above recitals in this Agreement are true and correct and are incorporated into this Agreement for all purposes.
- 2.2 **Cooperation**. During the Term of this Agreement, the Parties agree to cooperate at all times in good faith to effectuate the purposes and intent of this Agreement.
- 2.3 **Compliance with Laws**. All activities of the Parties under this Agreement shall be in compliance with all applicable Federal, State, and Local rules, laws, and regulations.
- 2.4 **Authority**. This Agreement is made in part under the authority conferred in Chapter 791, Texas Government Code and Sections 36.1086, 36.205, and 36.207 of the Texas Water Code, as amended. Each Party represents and warrants that it has the full right, power and authority to execute this Agreement.
- 2.5 **Severability**. The provisions of this Agreement are severable and, if any provision of this Agreement is held to be invalid for any reason by a court or agency of competent jurisdiction, the remainder of this Agreement will not be affected, and this Agreement will be construed as if the invalid portion had never been contained herein.
- 2.6 **Assignment**. The assignment of this Agreement by any Party is prohibited without the prior written consent of all of the other Parties. All of the respective covenants, undertakings, and successors or assigns of that Party.

- 2.7 **Source of Payment; Pledge to Secure Payment.** The Parties represent and covenant that payments to be made by it under this Agreement shall constitute funds from the current fiscal year's revenues, as appropriated by each Party's Board of Directors through each Party's annual budget adopted in accordance with the applicable procedures of each Party.
- 2.8 **Third Party Beneficiaries.** Except as expressly provided for herein with regard to Consultant, nothing in this Agreement, express or implied, is intended to confer upon any person or entity, other than the Parties, any rights, benefits, or remedies under or by reason of this Agreement.
- 2.9 **Entire Agreement.** This Agreement contains the entire agreement of the Parties regarding the subject matter hereof and supersedes all prior or contemporaneous understandings or representations, whether oral or written, regarding the subject matter.
- 2.10 **Interpretation and Reliance.** No presumption will apply in favor of any Party in the interpretation of this Agreement or in the resolution of any ambiguity of any provisions hereof. Headings and captions used in this Agreement are for reference purposes only, and shall have no bearing on the interpretation of this Agreement.
- 2.11 **Relationship of Parties.** This Agreement is based upon the active participation of the Parties. Neither the execution nor the delivery of this Agreement shall create or constitute a partnership, joint venture, or any other form of business organization or arrangement between the Parties, except for the contractual arrangements specifically set forth in this Agreement. No Party shall have any power to assume or create any obligation on behalf of the other Party.
- 2.12 **Amendments.** Any amendment of this Agreement must be in writing and will be effective if it is signed by the authorized representatives of each the Parties.
- 2.13 **Applicable Law; Venue.** This Agreement will be construed in accordance with Texas laws. Venue for any action arising hereunder will be in a court of competent jurisdiction.
- 2.14 **Notices.** Any notices given under this Agreement will be effective if (i) forwarded to a Party by hand-delivery; (ii) transmitted to a Party by confirmed telecopy or electronic mail; or (iii) deposited with the U.S. Postal Service, postage prepaid, certified, to the official business address of a Party.
- 2.15 **Counterparts; Effect of Partial Execution.** This Agreement may be executed simultaneously in multiple counterparts, each of which will be deemed an original, but all of which will constitute the same instrument.
- 2.16 **No Waiver.** The failure of a Party or the Parties to require strict performance of any provision, term, or condition of this Agreement or to exercise any right or remedy shall not constitute or be construed as a waiver of the provision, term, or condition breached or any other provision, term or condition of this Agreement.

2.17 **Effective Date.** The effective date of this Agreement shall be the last date of execution of the Parties in the signature pages below.

(Signature Pages Follow)

(Signature page of Central Texas Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

CENTRAL TEXAS GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Clearwater Underground Water Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

CLEARWATER UNDERGROUND WATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Middle Trinity Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

MIDDLE TRINITY GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of North Texas Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

NORTH TEXAS GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Northern Trinity Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

NORTHERN TRINITY GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Post Oak Savannah Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Prairielands Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

PRAIRIELANDS GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Red River Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

RED RIVER GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Saratoga Underground Water Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

SARATOGA UNDERGROUND WATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Southern Trinity Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

SOUTHERN TRINITY GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

(Signature page of Upper Trinity Groundwater Conservation District to Interlocal Agreement Regarding Groundwater Management Area 8 Funding for Development of Desired Future Conditions Joint Planning)

UPPER TRINITY GROUNDWATER CONSERVATION DISTRICT:

By: _____

Printed Name: _____

Title: _____

Date: _____

Exhibit A

Scope of Services



January 5, 2023

Paul Sigle
General Manager
North Texas Groundwater Conservation District
5100 Airport Drive
Denison, Texas 75020

RE: Scope of Work and Cost Estimate for Updating the Groundwater Availability Model for the Trinity and Woodbine Aquifers in Groundwater Management Area 8

Dear Mr. Sigle,

On behalf of INTERA and R.W. Harden & Associates, thank you for the opportunity to submit this scope of work and cost estimate for updating the groundwater availability model (GAM) for the Trinity and Woodbine aquifers in Groundwater Management Area 8 (GMA 8). We enjoyed the opportunity to meet with you and the other members of the Selection Committee for GMA 8 and are very pleased to have this opportunity to work with you and the group on this project.

Below you will find our proposed scope of work and cost estimate. This scope is very consistent with the technical approach we presented in our Statement of Qualifications to the Committee.

Background

The joint-planning process is an adaptive management framework that recognizes the management of resources within a GMA can evolve with increased understanding, aquifer conditions, and the collection of additional data to inform management decisions. The GCDs that comprise GMA 8 have determined that the current NTWGAM developed in 2014 should be updated with newly available hydrogeologic data and the calibration period should be extended through 2020. GAMs play a critical role for GCDs because they are central to developing modeled available groundwater (MAG) which is a regional analysis. These models also serve as operational tools for local GCD management.

INTERA has led the construction of 13 GAMs and has helped over 30 GCDs and eight GMAs use these and other models to support the planning and management of groundwater resources. Through our interactions with stakeholders and TWDB staff, we are keenly aware of the importance of balancing model complexity and usability. Our modelers have developed specific tools for construction and calibration of models using MODFLOW 6. INTERA's Jeremy White, PhD is an expert on calibration and calibration workflows built on a foundation of scripting and open-source software tools, so that the numerous decisions and assumptions made during the modeling workflow are transparently and openly documented. During the NTWGAM re-calibration phase, we are proposing to use the Python package pyEMU to programmatically undertake parameter estimation, and the iterative ensemble smoother PESTPP-IES, which greatly reduces the computational demand of nonlinear, high-dimensional parameter estimation. INTERA recently presented a webinar on these techniques for the TWDB GAM group. Ultimately, the updated NTWGAM must meet the needs of the GMA and the member GCDs while also

meeting the standards and requirements for approval by the TWDB. INTERA's experience developing more TWDB-approved GAMs than any other firm in Texas will ensure these needs and requirements are met.

Scope of Work

The first task will be to convert the NTWGAM from MODFLOW-NWT to MODFLOW 6. This is a critical first step in the scope of work because it needs to be demonstrated that MODFLOW 6 can reliably reproduce the results of the 2014 NTWGAM. If the solutions between MODFLOW-NWT and MODFLOW 6 are not baselined, we run the risk of propagating errors in the updated model unrelated to the purposefully implemented modifications to the underlying model. The first subtask of Task A will be migrating the existing NTWGAM packages to MODFLOW 6 format. INTERA has converted many models to MODFLOW 6 over the last two years. We have developed scripts to support this process with error checking logic. To test the conversion and to identify any systematic differences between the codes, we will run the 2014 NTWGAM calibration simulation and the current GMA 8 MAG run. The end of this process represents a significant milestone, and we will meet with GMA 8 to provide a detailed analysis of the comparison of the two simulation codes.

Once we have demonstrated the successful conversion of the current NTWGAM to MODFLOW 6, we will meet with GMA 8 to discuss the objectives of the updated model with emphasis on correcting known errors, adding additional data collected by the GCDs, and improving functionality for groundwater management. For efficiency, this meeting can be combined with the model conversion meeting at the end of Task A. We will have already met with TWDB to discuss their interests in the update of the NTWGAM. Because of the importance of TWDB accepting the updated model, we will request that technical staff from TWDB attend any key model update meetings with GMA 8. Some of the already known key objectives of the model update are to extend the calibration period from 2012 through 2020, incorporate new data on structure and aquifer properties, and use the improved numerical capabilities of MODFLOW 6 to improve model efficiency, accuracy, and applicability to management at the district and GMA level.

To update the NTWGAM, we will establish an efficient workflow for model construction and calibration that minimizes construction errors and results in a purpose-built model. The applied workflow dictates how a groundwater model is constructed and deployed in a specific resource management context. This workflow deserves specific attention because it ultimately controls the quality and utility of the model. The INTERA Team brings experience applying reproducible modeling workflows built on a foundation of scripting and open-source software tools, so that all decisions and assumptions made during the modeling workflow are transparently and openly documented. The scripting-driven workflow brings significant advancements to improve efficiency, transparency, and ultimately quality, to all facets of the modeling process.

After we have met with GMA 8 and TWDB, and agreement has been reached on the particulars of the model update, we will start developing the updated model packages. The first subtask will be model discretization which includes horizontal grid size as well as layering. MODFLOW 6 enables revision of the model to an unstructured format, allowing variable grid dimensions as well as pinching and compositing layers that may exist in the current NTWGAM. The current model is difficult to use because of the large number of grid cells and the presence of a pass-through layer that connects the shallow outcrop portions of the aquifer from the deeper portions of the aquifer. We will explore simplifying this formulation for ease of use. We will also meet with GMA 8 and develop a rationale for relaxing the ¼-mile grid spacing in portions of the model grid where it is not required. Another place where model layering may be improved

is in the handling of the Northern Segment of the Edwards (Balcones Fault Zone [BFZ]) Aquifer. The TWDB is developing an updated Edwards (BFZ) Aquifer GAM, and the integration of layering and properties between this model and the updated NTWGAM will facilitate groundwater management for southern GCDs within GMA 8 through the more accurate evaluation of pumping impacts from the southernmost counties in the aquifer system. Many of the GMA 8 member GCDs have also characterized faulting that is currently not implemented in the 2014 NTWGAM. We will work closely with these GCDs to ensure that this faulting is accurately represented in the updated NTWGAM.

Several transient stress packages will require extension from 2012 through 2020, including pumping, recharge, stream routing, and evapotranspiration (ET). Stream routing will be implemented in a manner consistent with the 2014 NTWGAM. The USGS Soil-Water-Balance (SWB) model (Westenbroek and others, 2010; Westenbroek and others, 2018) can be used for estimating recharge on a grid similar to that used for groundwater availability models. The SWB model code was successfully demonstrated to the TWDB when applied by Mr. Keester during an analysis of changes in soil moisture in four watersheds in the Upper Colorado River Basin (Furnans and others, 2019) and in developing estimates of the temporal and spatial distribution of recharge for aquifers in central and west Texas (Sen and others, 2022). In addition, the USGS applied the SWB model code to develop estimates of recharge to the Gulf Coast Aquifer System as part of the ongoing development of the GULF-2023 model.

The SWB code uses a combination of gridded and tabular data to calculate potential groundwater recharge separately for each grid cell within a model domain. The SWB code evaluates the sources and sinks of water within each grid cell at and near land surface and then calculates recharge as difference between the change in soil moisture and the sources and sinks. Sources for recharge include precipitation and inflow (surface runoff from an adjacent grid cell) while sinks include evapotranspiration, outflow (surface runoff to an adjacent grid cell), and interception (rainfall trapped and used by vegetation and evaporated or transpired from plant surfaces).

Over the past several years, GCDs within GMA 8 have worked with the TWDB TexMesonet group to establish several stations for collecting climate and soil moisture data. These data can now be applied during development of a SWB model to constrain the parameters used for calculating daily evapotranspiration, soil moisture, and potential infiltration. We propose following the approach developed for the TWDB to create a similar ensemble SWB model for GMA 8 including calibration to TexMesonet data using PESTPP-IES (White and others, 2020) and results processing for watersheds and aquifer outcrops. Drawing upon our previous experience with the code and data we will also apply lessons learned to improve efficiency in model development and application.

Results from the SWB model will be used in conjunction with analyses of recharge and evapotranspiration documented for the current NTWGAM (Kelley and others, 2014). The proposed SWB model will serve to increase our understanding of the sources of aquifer inflow and outflow in the outcrop area. Development of the SWB model will allow GMA 8 to apply TexMesonet data to further inform the conceptual model of potential recharge to the Edwards, Woodbine, and Trinity aquifers.

Pumping will be updated from 2012 through 2020, using techniques for collection and allocation within the model domain consistent with the current NTWGAM with two exceptions. First, as part of collecting data from GCDs in GMA 8, we will obtain available data and analyses of groundwater use to compare to the water use data available through the TWDB. We will discuss major differences with both the GCDs and the TWDB to resolve any discrepancies in the new calibration period pumping data. Secondly, we will

ensure that the transition in pumping between the last historical period of the current NTWGAM (2012) and 2013 is consistent with climatological changes or known water use trends.

The GCDs within GMA 8 have been collecting a significant amount of data on aquifer properties, including hydraulic conductivity, transmissivity and storativity. For the 2014 NTWGAM, hydraulic conductivity was scaled to the model scale through development of a geohydrostratigraphic model that correlated aquifer test derived values of hydraulic conductivity with formation, lithology, and depositional environments. Using the geohydrostratigraphic approach for the NTWGAM update, aquifer parameters could be assigned to the model grid based on known geological factors and the model being constrained by the available aquifer test data. We will compare new aquifer test parameters based on aquifer tests to the calibrated values at a given grid cell. Next, we will develop an averaging scheme that allows integration of the new data into the existing model parameter fields. Prior to calibration, we will develop a comparison of the frequency distribution of aquifer properties from the current NTWGAM and the updated initial parameter field to ensure that constraints on parameter perturbation during calibration are still consistent with those originally used. This will allow consistency with the 2014 NTWGAM while honoring new values that are significantly different than those used in the current model.

We will update calibration targets for the extended calibration period from 2012 through 2020. These targets will include water levels, stream baseflow estimates, and spring flows. Water levels will be collected from TWDB's Groundwater Database and from monitoring data from GCDs. We will request information from each GCD on their DFC compliance monitoring network. Because of the importance of model fit at compliance monitoring wells, we will investigate weighting options for compliance network water levels in the calibration task (Task C). Because surface water interaction is becoming a more important management objective, we will query GCDs on key spring flows that are managed to and make sure they are being appropriately included in the updated NTWGAM. Once the model packages are updated, we will meet with GMA 8 to present implementation of the new packages from 2012 through 2020. TWDB staff will also attend this meeting. After addressing any comments, re-calibration of the model will begin.

At the end of Task A, we will have demonstrated that the converted MODFLOW 6 NTWGAM meets the original calibration criteria documented in the report, Kelley and others 2014. In Task C, we will extend the calibration period from 2012 to 2020. Because the updated model will be incorporating additional data on properties, structure, and discretization, we will calibrate the updated model from 1890 through 2020. The key calibration metrics for the updated NTWGAM will be similar to the current model and will include water levels (heads), estimates of baseflow to streams, and springflow. The current NTWGAM calibration was also guided by a conceptual flow balance which will be used as a constraint in updating the model. As part of a pre-calibration activities, we will review model bias (misfit) with observed water levels and rates of water level change to focus calibration on improving historical water level misfit in the existing NTWGAM. We will achieve this through the calibration metric weighting discussed below.

We propose to use this approach in parameter estimation as well as in model construction. This extension is facilitated by use of the Python package pyEMU to programmatically undertake parameter estimation, and the iterative ensemble smoother PESTPP-IES, which greatly reduces the computational demand of nonlinear, high-dimensional parameter estimation. PESTPP-IES was developed by INTERA's Dr. Jeremy White and was recently used in the calibration of the GULF 2023 GAM for the northern Gulf Coast Aquifer and has been accepted by the TWDB for use on the Cross-Timbers Aquifer GAM, currently under development by INTERA. During parameter estimation, PESTPP-IES also performs an uncertainty analysis,

effectively combining the calibration and uncertainty analysis workflows. As was done in the 2014 NTWGAM, calibration metrics will be weighted to reproduce the aspects of the historical dataset that are most aligned with the model objectives during the calibration process. Likewise, parameters adjusted during calibration, such as aquifer hydraulic conductivity, will have prior distributions defined to constrain parameter perturbation and prevent non-sensical parameterization while honoring field measurements. We will provide regular monthly updates to GMA 8 and the TWDB on progress during calibration. The updated and recalibrated NTWGAM model files will be provided to GMA 8 and TWDB for review before advancing to Task D – Predictive Simulations.

After the NTWGAM is successfully re-calibrated, we will perform a series of three predictive simulations, as defined by GMA 8. In 2014 and 2015, INTERA performed similar predictive simulations as part of developing the revised 2014 NTWGAM and under a separate contract with GMA 8. The three simulations to be performed as part of Task D are:

- Run 1 - Determine the amount of production that can occur in order to achieve the current GMA 8 DFC
- Run 2 - Determine what the GMA 8 DFCs would be assuming the current MAG values
- Run 3 - Determine the sustainable amount of production from the Trinity and Woodbine Aquifers

Run 1 will use the updated NTWGAM to produce a simulation with the right balance of pumping per aquifer and county to match the current DFC. To perform this simulation, we will keep pumping locations consistent with the current MAG run and optimally adjust pumping to close the misfit on DFCs per county per aquifer. We will use PEST to perform the optimization. Run 2 will use the updated NTWGAM to produce a simulation that predicts pumping (MAG equivalent) using the constraint of the current county/aquifer DFCs which are expressed in terms of drawdown. For this simulation, we will use PEST to optimize pumping on a county/aquifer basis that recreates the average county/aquifer drawdown equal to the current DFC. Again, pumping will be aggregated from model cells where pumping occurs in the current MAG run. This simulation is less unique than Run 1 and we will adopt a normalized methodology to modify county aquifer pumping. Run 3 will require discussion with GMA 8 member GCDs to define sustainable production in the context of GMA 8. The USGS defines sustainable groundwater development as the development and use of groundwater in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences (Alley and others). In 2014, INTERA simulated a run termed the “conservation run” which examined the amount of pumping that could occur per aquifer per county from 2025 to 2070 that would bring water levels back to 2010 levels (140,000 AFY in Trinity and 18,700 AFY Woodbine). After completing the model runs, we will present results to GMA 8 and document the simulations in a technical memorandum with all model files.

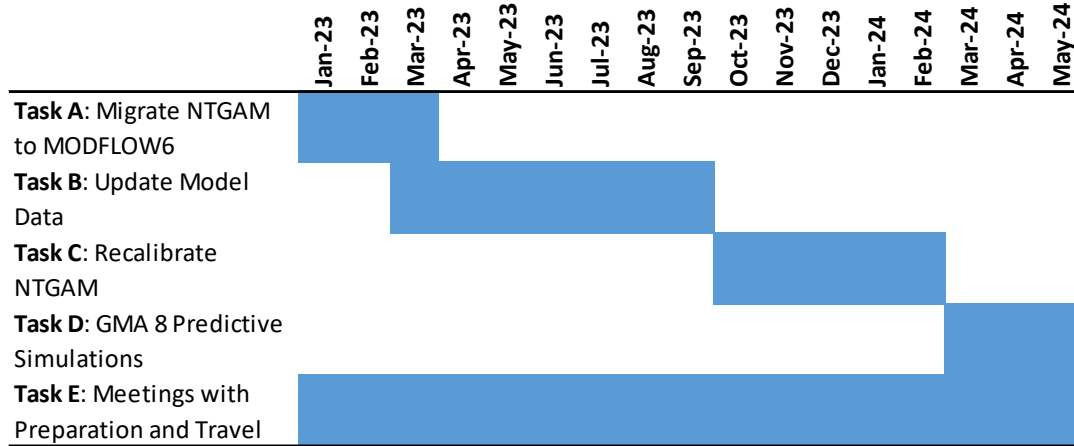
Cost Estimate

The table below summarizes each of the tasks described above and details the estimated costs for each task. We propose to complete the work for the GCDs in GMA 8 on a time and materials basis.

Task	Subtask	Estimated Costs by Task
Task A: Migrate NTGAM to	Migrate original packages Validate conversion by running base calibration and current MAG run	\$ 32,440
Task B: Update Model Data	Collect new data from GMA 8 GCDs and discuss model issues Collect new data from TWDB and discuss model issues Update Structure/Faults/Layering Recharge through SWB Model Pumping Stream Routing ET through SWB Model Update model properties Update head and flow calibration targets (2012-2020) QA Documentation	\$ 265,720
Task C: Recalibrate NTGAM	Recalibration QA Documentation	\$ 160,120
Task D: GMA 8 Predictive Simulations	Run 1 - MAG that achieves the DFC Run 2 - DFC that acheives the MAG Run 3 - Sustainable Production QA Documentation	\$ 59,500
Task E: Meetings with Preparation and Travel	GMA 8 + Stakeholders: Kickoff Meeting GMA 8 + Stakeholders: MODFLOW 6 Migration Results and Data Request TWDB: Model Issues Discussion and Data Request (virtual) GMA 8 + Stakeholders: Model Update Results Meeting GMA 8 + Stakeholders: Recalibration Update Meeting TWDB: Recalibration Update Workshop Meeting (virtual) GMA 8 + Stakeholders: Recalibration Results TWDB: Recalibration Results (virtual) GMA 8: Predictive Simulations Kickoff GMA 8: Predictive Simulations Results GMA 8: Project Wrap Up Meeting	\$ 73,320
Total for All Tasks		\$ 591,100

Proposed Schedule

The table below shows our proposed 17-month schedule for completing each of the tasks described above. This schedule includes eight meetings of the GMA 8 GCDs over the period as well as the three virtual meetings with TWDB. This schedule is designed to provide sufficient time for the GMA 8 GCDs to review the model update and predictive simulations in Task D leading into the 2026 round of joint planning.



If you have any questions, please don't hesitate to reach out to me at woliver@intera.com or 832-535-5763. Thank you again for the opportunity to submit this scope of work and cost estimate. The INTERA Team is excited to work with each of the GMA 8 GCDs on this important project.

Sincerely,



Wade Oliver, P.G.
 INTERA Inc.

EXHIBIT B

GMA 8 Districts Total Funding of Contract Price

<i>District Funding at an Equal Share</i>	<i>Share</i>	<i>%</i>
Central Texas Groundwater Conservation District	\$ 66,387.50	11.23%
Clearwater Underground Water Conservation District	\$ 66,387.50	11.23%
Middle Trinity Groundwater Conservation District	\$ 66,387.50	11.23%
North Texas Groundwater Conservation District	\$ 66,387.50	11.23%
Northern Trinity Groundwater Conservation District	\$ 66,387.50	11.23%
Prairielands Groundwater Conservation District	\$ 66,387.50	11.23%
Red River Groundwater Conservation District	\$ 66,387.50	11.23%
Upper Trinity Groundwater Conservation District	\$ 66,387.50	11.23%
<i>Total for Equal Share</i>	<i>\$ 531,100.00</i>	<i>89.85%</i>
<i>District Funding at a Committed Amount</i>	<i>Share</i>	<i>%</i>
Post Oak Savannah Groundwater Conservation District	\$ 40,000.00	6.77%
Saratoga Underground Water Conservation District	\$ -	0.00%
Southern Trinity Groundwater Conservation District	\$ 20,000.00	3.38%
<i>Total for Committed Amount</i>	<i>\$ 60,000.00</i>	<i>10.15%</i>
<i>Project Total</i>	<i>\$ 591,100.00</i>	<i>100.00%</i>

CHIEF OF POLICE

COMMUNICATIONS SECTION

1000 15TH AVENUE

MEMPHIS, TENNESSEE 38103

MEMPHIS, TENNESSEE

38103

MEMPHIS, TENNESSEE

100

ATTACHMENT 12 b.

MEMPHIS, TENNESSEE

MEMPHIS, TENNESSEE

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MEMPHIS, TENNESSEE

NORTH TEXAS GROUNDWATER CONSERVATION DISTRICT

Well Registration Summary

(as of 2/28/2023)

Well Type	Collin	Cooke	Denton	Total NTGCD	New Registrations February 2023
Domestic	91	663	1037	1791	10
Public Water System	32	76	225	333	0
Irrigation	107	7	211	325	0
Surface Impoundment	62	18	127	207	0
Livestock	7	90	68	165	0
Oil / Gas	1	6	64	71	0
Agriculture	11	13	42	66	0
Commercial	6	9	44	59	1
Golf Course Irrigation	15	2	21	38	0
Industrial / Manufacturing	11	11	9	31	0
*Other	6	5	12	23	0
Monitoring	0	0	3	3	0
TOTALS	349	900	1863	3112	11

NOTE: Plugged wells have been excluded

***Examples of "Other" uses: Closed Loop Geothermal, Construction, and Fire Suppression**

NORTH TEXAS GROUNDWATER CONSERVATION DISTRICT

Well Registration Summary

(as of 3/31/2023)

Well Type	Collin	Cooke	Denton	Total NTGCD	New Registrations March 2023
Domestic	91	665	1043	1799	8
Public Water System	32	76	225	333	0
Irrigation	107	7	212	326	1
Surface Impoundment	62	18	127	207	0
Livestock	7	90	68	165	0
Oil / Gas	1	6	64	71	0
Agriculture	11	13	42	66	0
Commercial	6	9	46	61	2
Golf Course Irrigation	15	2	21	38	0
Industrial / Manufacturing	11	11	9	31	0
*Other	6	5	12	23	0
Monitoring	0	0	3	3	0
TOTALS	349	902	1872	3123	11

NOTE: Plugged wells have been excluded

***Examples of "Other" uses: Closed Loop Geothermal, Construction, and Fire Suppression**

ADJOURN