



April 26, 2024

Mr. Randy Evans, Operator in Responsible Charge  
Wellington Operating Company  
1590 East County Road 70  
Wellington, Colorado 80549

Subject: Annual Update 2024 – Groundwater Flow Direction  
Wellington Muddy Sandstone Unit, Wellington, Colorado  
Project No.: 1022.006

Dear Mr. Evans:

We understand that the Wellington Operating Company manages and operates the Wellington Muddy Sandstone Unit north of Wellington, Colorado. The company utilizes a water treatment system to handle portions of produced water originating from the oil field. The water handling process includes discharge of treated water to Rapid Infiltration Basins (RIBs) located north and south of CR 70 approximately  $\frac{3}{4}$  mile west of County Road 9. The site location and related features are shown on Figure 1.

A discharge permit is required for the RIBs and is updated as necessary to meet state regulations. The discharge permit is issued by the Colorado Energy and Carbon Management Commission (ECMC) [formerly Colorado Oil and Gas Conservation Commission]. As a condition of Wellington Operating Company's discharge permit renewal, the Commission asked for a conceptual assessment of the shallow groundwater regime and evaluation of the location of the monitoring well network near the RIBs. The initial assessment was completed in 2021 and ongoing assessment requires an annual update of groundwater flow direction.

### ANNUAL UPDATE

To complete the annual update, we reviewed water levels recorded during Wellington Operating Company's routine monthly monitoring events. The data was used to create potentiometric surface contour maps dating from May 2023 to April 2024 (Figures 2A – 2L). The maps depict groundwater contours and flow direction.

As shown on the attached figures, groundwater flow direction near the RIBs and downgradient cropland remains generally southeasterly. Variations in flow direction occur throughout the year in response to pumping from the irrigation wells and seasonal changes.

### GEOLOGY/HYDROGEOLOGY

The RIBs are located within the Boxelder Creek alluvial valley-fill deposit. The deposit consists of intermittent layers of unconsolidated gravels, sands, silts, and clays overlying Pierre Shale bedrock. Along County Road 70, east to west, the river valley is approximately one-mile wide. The generally flat-lying valley is evident on the topographic map (Figure 1) and is bounded by 30' to 40' high river terraces approximately corresponding to County Roads 9 and 11.

A series of groundwater monitoring wells was installed in 2006 and are associated with installation of the original treatment system and RIBs. Well locations are depicted on Figure 2A – 2L. Specific lithology in the immediate area of the RIBs is described in the log for Monitoring Well 050-B, attached. The log describes unconsolidated alternating layers of sand and gravel, silty sand, and clayey sand ranging to a depth of 60 feet below land surface. The material is predominately medium to coarse grain sand and gravel with layers of silty sand and clayey sand; typical of valley-fill alluvial deposits. There are no apparent confining layers which would significantly restrict groundwater flow.

The alluvial material described in the well log overlies Pierre Shale bedrock; encountered at a depth of 60 feet in Monitoring Well 050-B. The bedrock formation was encountered deeper in Wells 050-A (94 feet) and 050-C (85 feet). This is consistent with the generalized sections presented in other reports including: *Groundwater Resources of the Alluvial Aquifers in Northeastern Larimer County, Colorado*, US Geological Survey, Water-Resources Investigations Report 77-7.

In the area of the RIBs, Boxelder Creek is located on the extreme eastern edge of the valley. It has little to no impact on groundwater flow beneath the RIBs. Water levels and gauging of the creek were not considered in this assessment. Likewise, water levels in monitoring well 050-E were not included.

As recorded during regular monthly monitoring events, from May 2023 to April 2024, water levels in Monitoring Well 050-B range from approximately 47 to 52 feet below land surface. This equates to approximate elevations of 5289' to 5284' amsl; consistent with previous data. Specific elevations are presented in Table 1 and on Figures 2A -2L.

## **IRRIGATION WELLS**

There are two irrigation wells owned and operated by Seaworth Farms located approximately 1400 feet east of the RIBs. They are presented as “W-1” and “W-2” on Figure 2A-2L. According to records of the Colorado State Engineer, the wells are 91 feet and 85 feet deep with first beneficial use in 1937 and 1954. The owner (Seaworth Farms) reports that the wells irrigate 475 acres using 1 to 1.5 acre feet per acre from April through October. There are no specific records of pumping rates or schedules.

## **GROUNDWATER FLOW DIRECTION**

Water level data from routine monthly monitoring conducted during May 2023 to April 2024 was used to prepare groundwater table potentiometric surface maps included herein as Figure 2A – 2L. Study focused on wells nearest the RIBs. Monitoring Well 050-E appears to be influenced by Boxelder Creek (located approximately one mile east of the RIBs) and was not included in the evaluation of groundwater flow direction at the RIBs.

Consistent with previous readings, the general groundwater flow direction is southeast. Along County Road 70 and east of the RIBs, there is an easterly flow component which is attributed to pumping from the irrigation wells in August through October. In other times of the year and elsewhere in the study area, the impact of periodic pumping from the irrigation wells upon overall groundwater flow direction appears to be negligible.

A southeasterly flow direction is in regular agreement with surface topography and contour data included in the other more general hydrogeological reports relative to the area.

This report is intended for client use in submittals to COGCC.

If you have any questions or comments relating to this report, please call (970) 231-5696.

Sincerely,

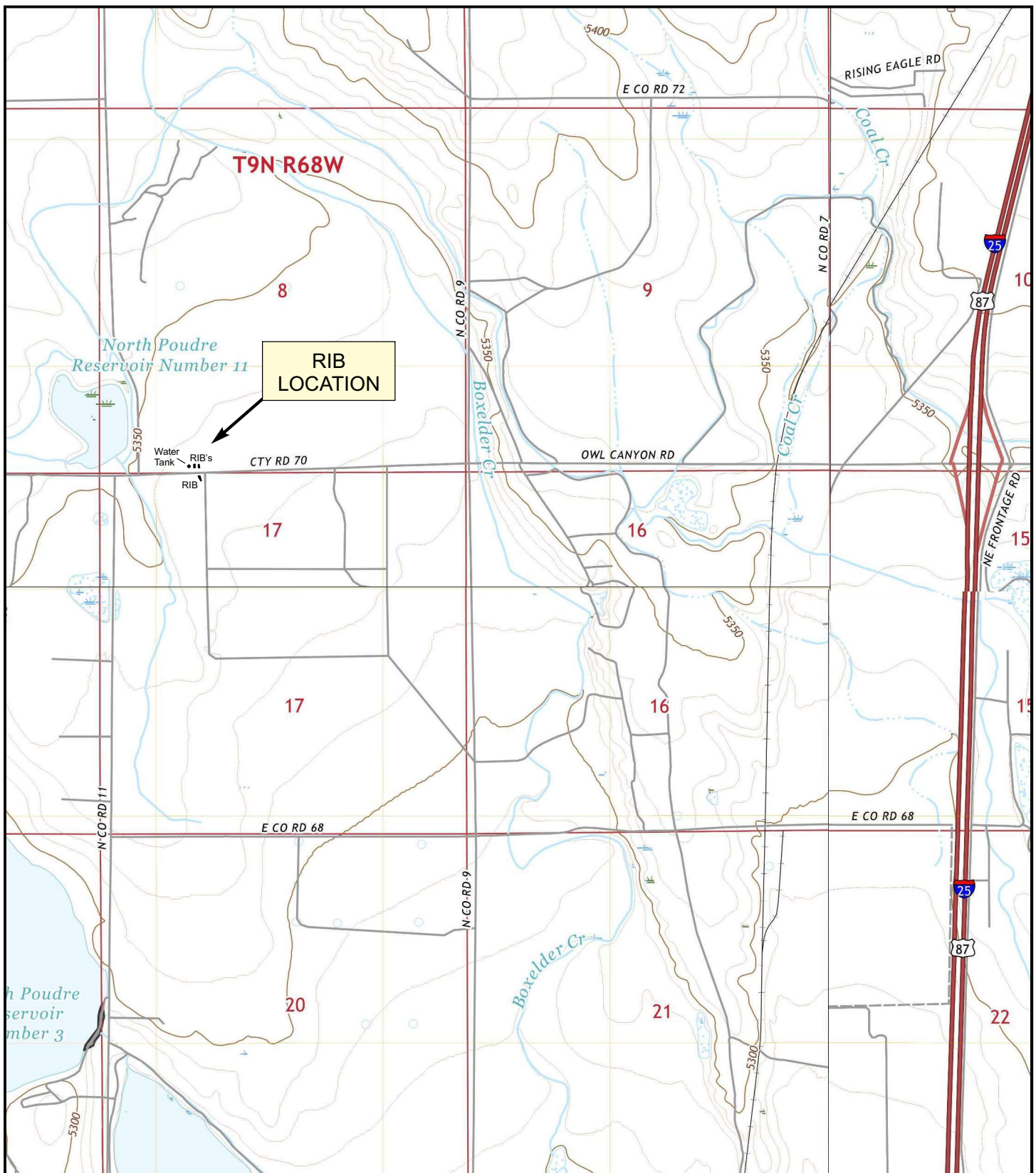
STONEGATE LAND & WATER, LLC

A handwritten signature in black ink, appearing to read "Paul A. Stone". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Paul A. Stone, PG  
Senior Geologist

Enc




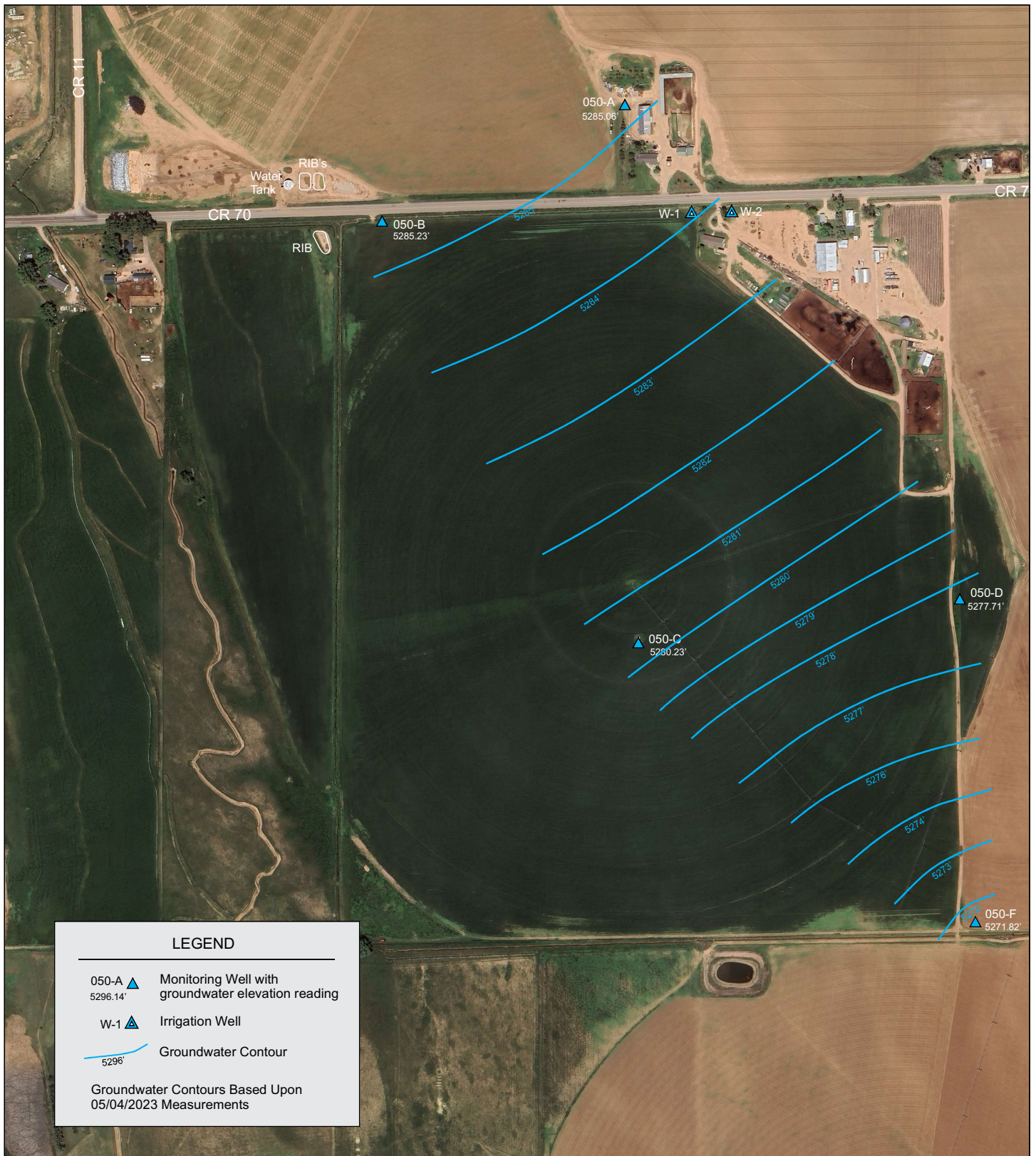


MAP SOURCE: USGS  
 BUCKEYE, CO 2016, CARR, CO 2016  
 COB LAKE, CO 2016, AND WELLINGTON, CO 2016



0 1/2 1 MILE  
 SCALE 1 : 24,000  
 CONTOUR INTERVAL 10 FEET

<div></div> <div>STONEGATE Land &amp; Water, LLC</div>		PROPERTY LOCATION	<div>Wellington Operating Company Wellington Muddy Sandstone Unit Wellington, Colorado</div>	<div>FIGURE 1 SITE LOCATION</div>
PROJECT NUMBER 1022.006	DATE April 2024			



**LEGEND**

050-A ▲ Monitoring Well with groundwater elevation reading  
5296.14'


W-1 ▲ Irrigation Well

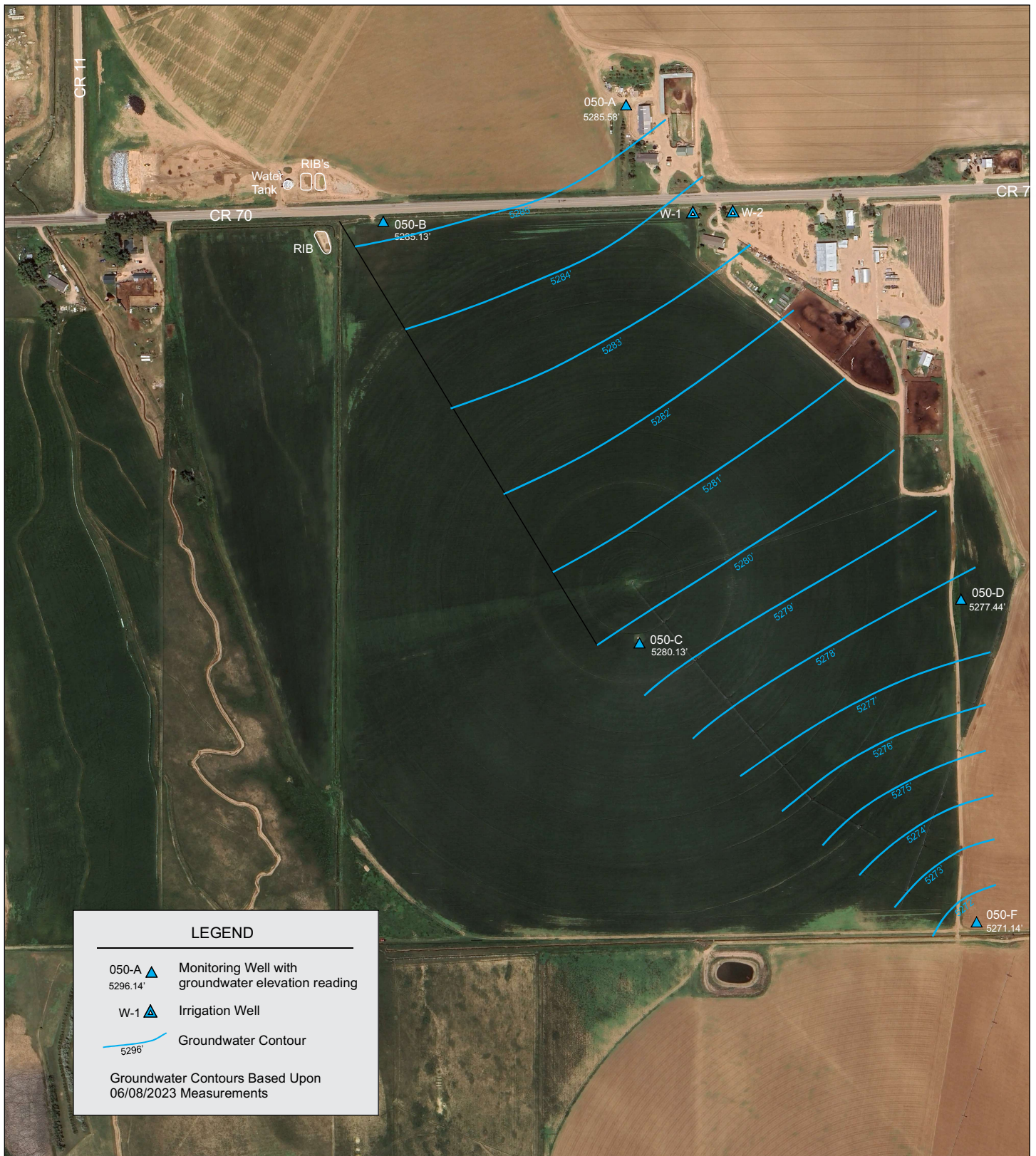
5296' Groundwater Contour

Groundwater Contours Based Upon  
05/04/2023 Measurements

MAP SOURCE:  
GOOGLE EARTH 6/6/23




 <b>STONEGATE</b> Land & Water, LLC		<b>PROPERTY LOCATION</b>  Wellington Operating Company Wellington Muddy Sandstone Unit Wellington, Colorado	<b>FIGURE 2 A</b> GROUNDWATER TABLE CONTOURS 05/04/2023
PROJECT NUMBER 1022.006	DATE April 2024		

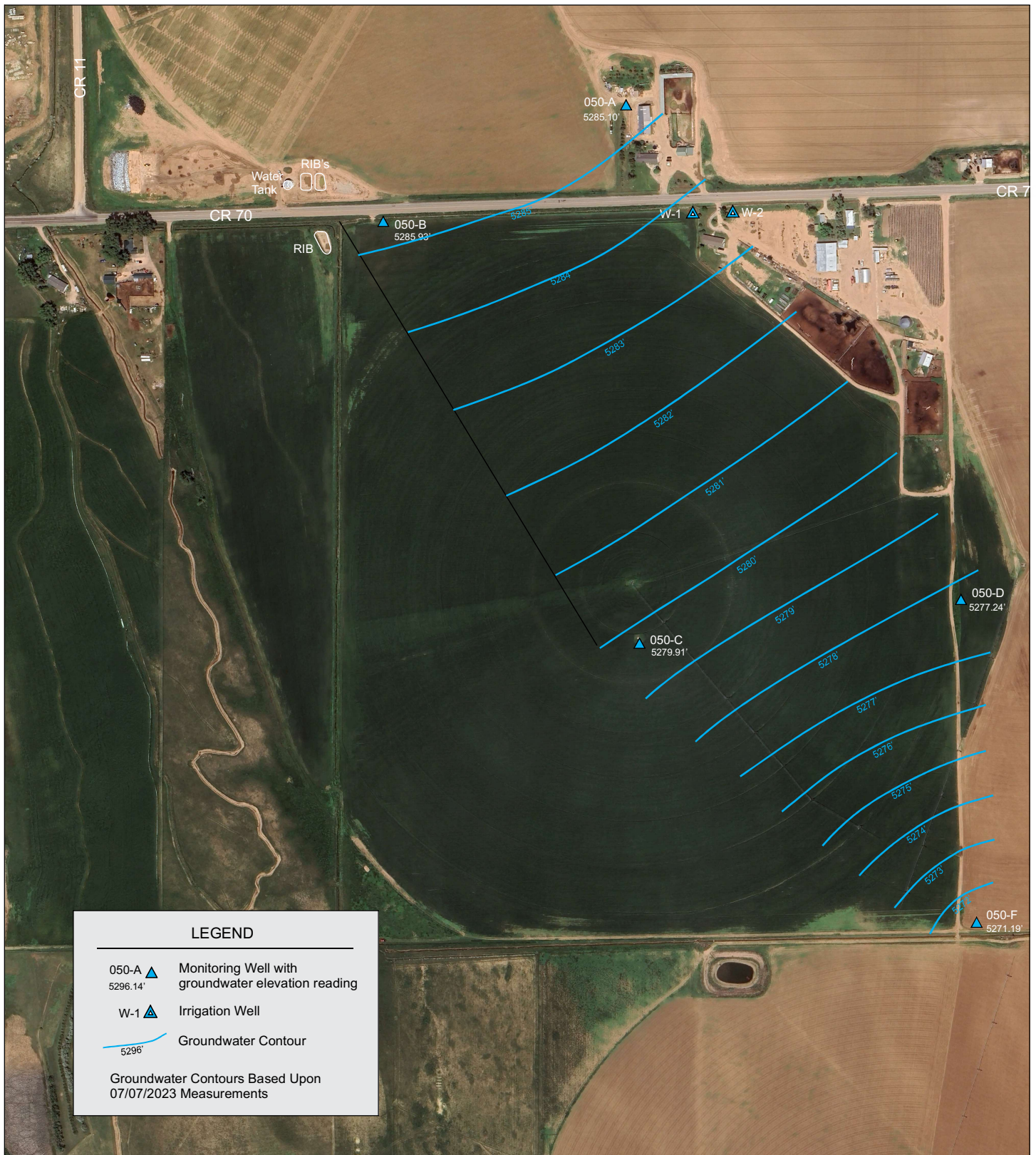


MAP SOURCE:  
GOOGLE EARTH 6/6/23




0 500 1000 1500  
APPROX SCALE IN FEET

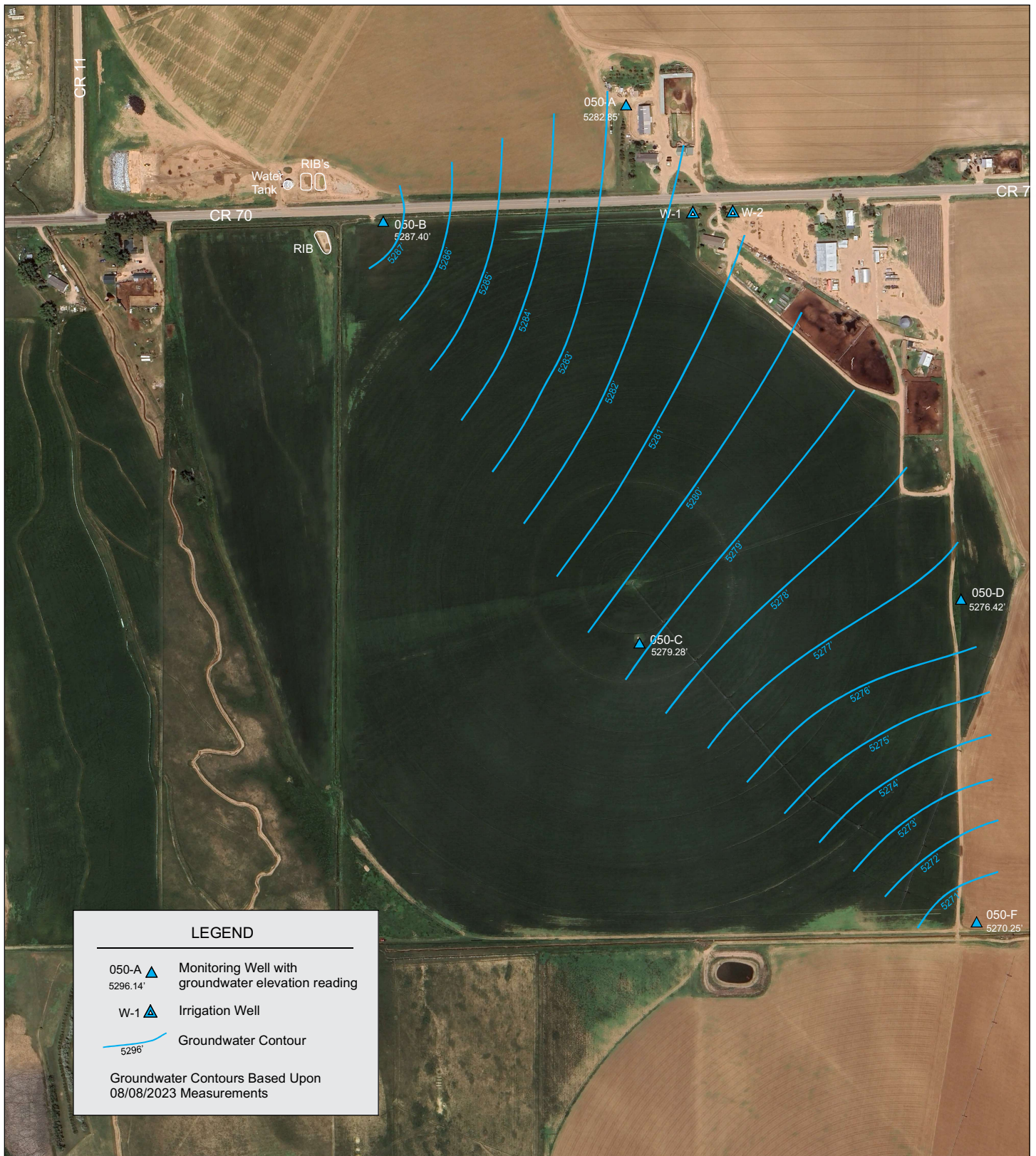
 <b>STONEGATE</b> Land & Water, LLC		PROPERTY LOCATION Wellington Operating Company Wellington Muddy Sandstone Unit Wellington, Colorado	<b>FIGURE 2 B</b> GROUNDWATER TABLE CONTOURS 06/08/2023
PROJECT NUMBER 1022.006	DATE April 2024		



MAP SOURCE:  
GOOGLE EARTH 6/6/23



 <b>STONEGATE</b> Land & Water, LLC		PROPERTY LOCATION Wellington Operating Company Wellington Muddy Sandstone Unit Wellington, Colorado	<b>FIGURE 2 C</b> GROUNDWATER TABLE CONTOURS 07/07/2023
PROJECT NUMBER 1022.006	DATE April 2024		



MAP SOURCE:  
GOOGLE EARTH 6/6/23



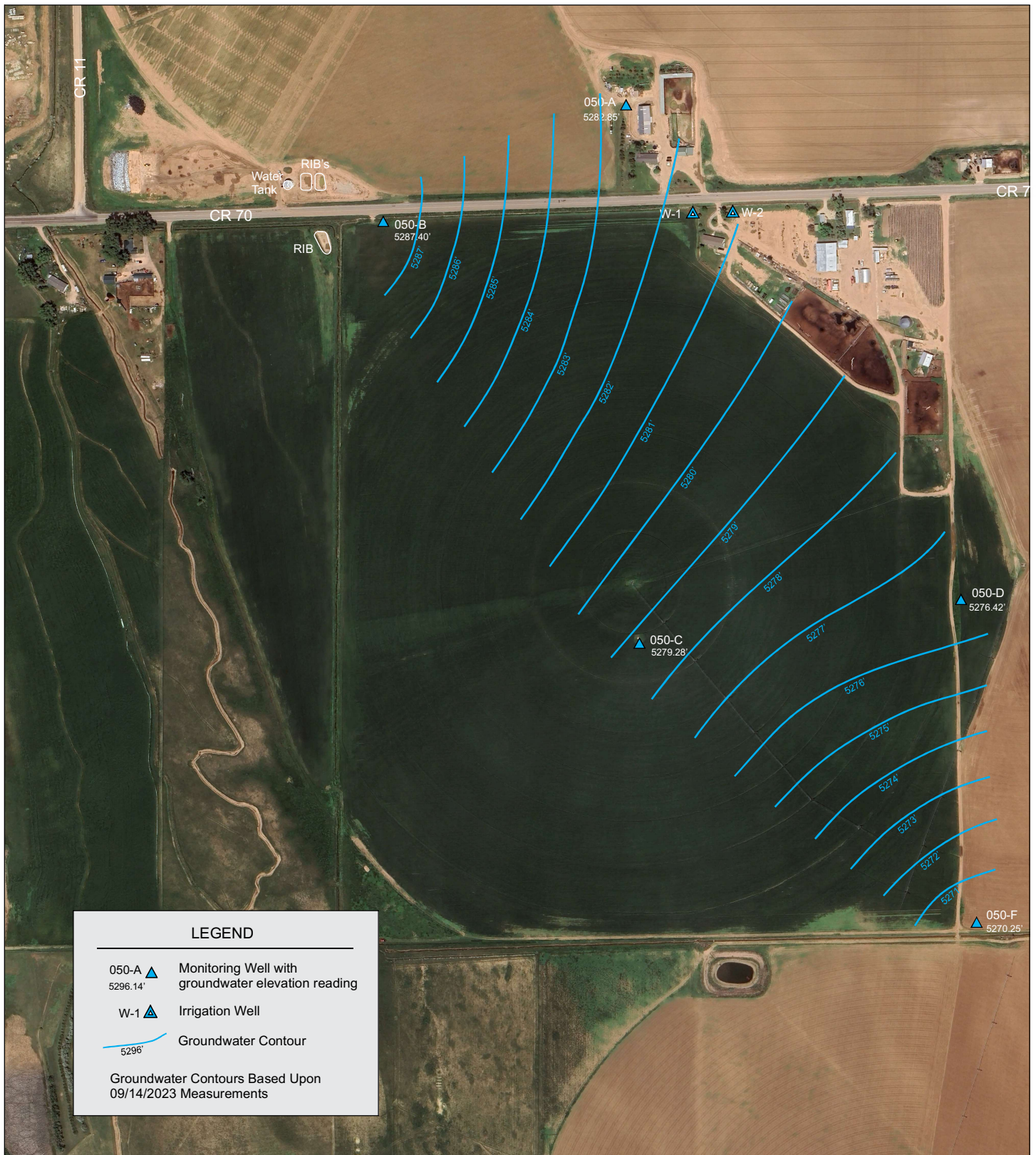
0 500 1000 1500  
APPROX SCALE IN FEET

 <b>STONEGATE</b> Land & Water, LLC	
PROJECT NUMBER 1022.006	DATE April 2024

PROPERTY LOCATION

Wellington Operating Company  
Wellington Muddy Sandstone Unit  
Wellington, Colorado

**FIGURE 2 D**  
**GROUNDWATER TABLE**  
**CONTOURS 08/08/2023**



LEGEND

050-A ▲

5296.14'

Monitoring Well with groundwater elevation reading

W-1 ▲

Irrigation Well

5296'

Groundwater Contour

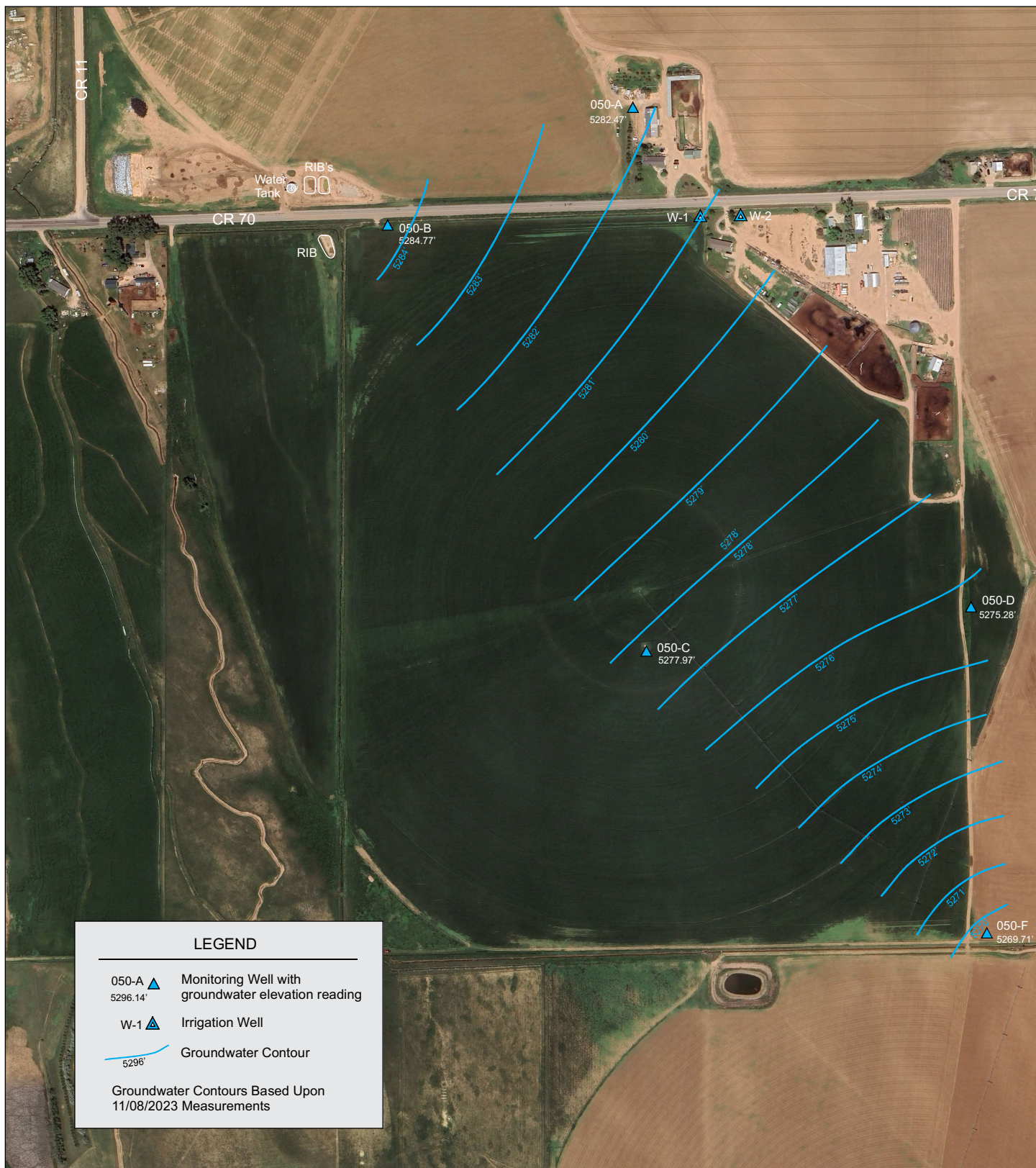
Groundwater Contours Based Upon 09/14/2023 Measurements

MAP SOURCE:  
GOOGLE EARTH 6/6/23



		<div>PROPERTY LOCATION</div> <div>Wellington Operating Company Wellington Muddy Sandstone Unit Wellington, Colorado</div>	<div>FIGURE 2 E</div> <div>GROUNDWATER TABLE CONTOURS 09/14/2023</div>
<div>PROJECT NUMBER</div> <div>1022.006</div>	<div>DATE</div> <div>April 2024</div>		





MAP SOURCE:  
GOOGLE EARTH 6/6/23



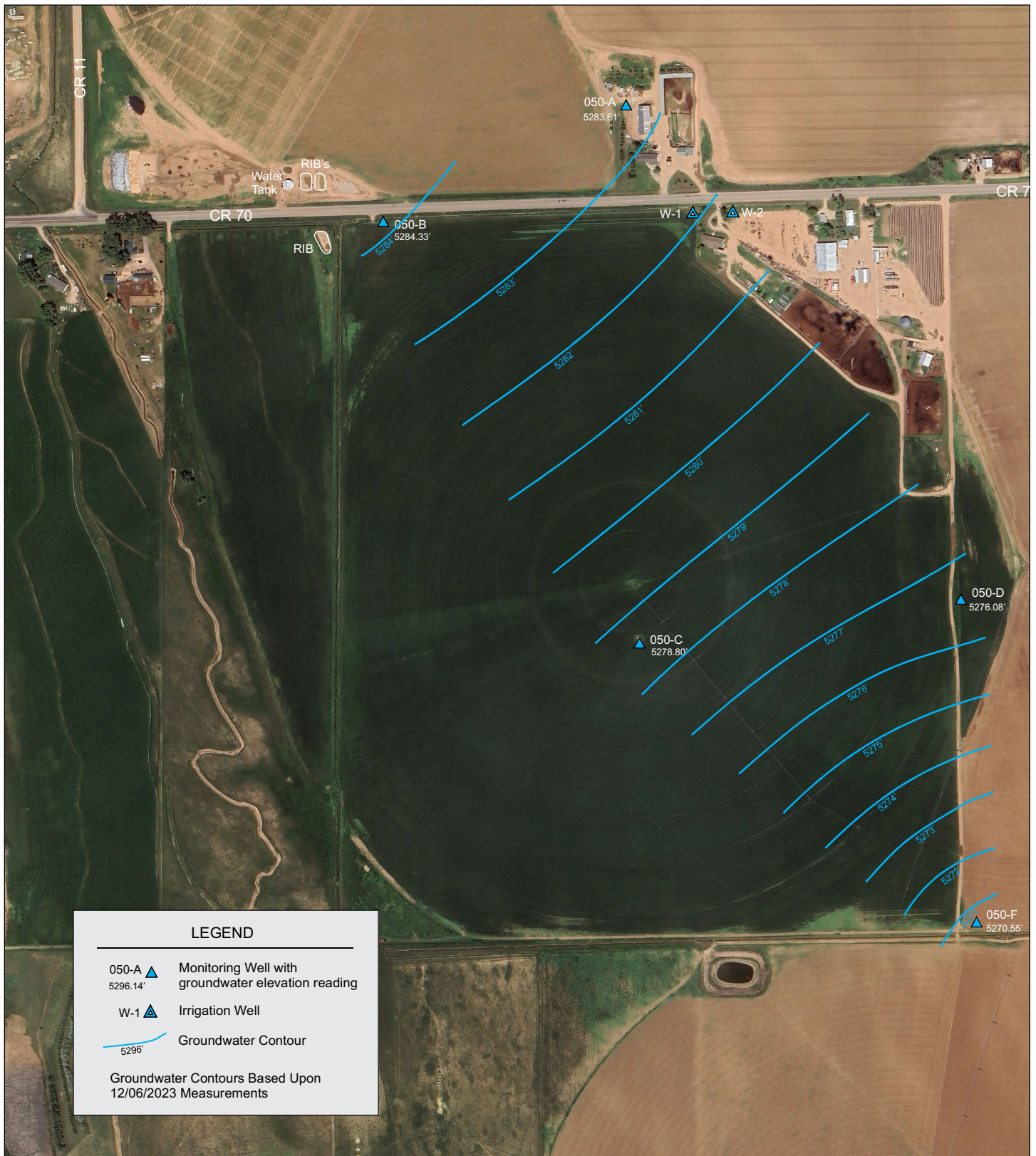
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APPROX SCALE IN FEET

 <b>STONEGATE</b> Land & Water, LLC	
PROJECT NUMBER 1022.006	DATE April 2024

PROPERTY LOCATION

Wellington Operating Company  
Wellington Muddy Sandstone Unit  
Wellington, Colorado

**FIGURE 2 G**  
**GROUNDWATER TABLE**  
**CONTOURS 11/08/2023**



MAP SOURCE:  
GOOGLE EARTH 6/6/23



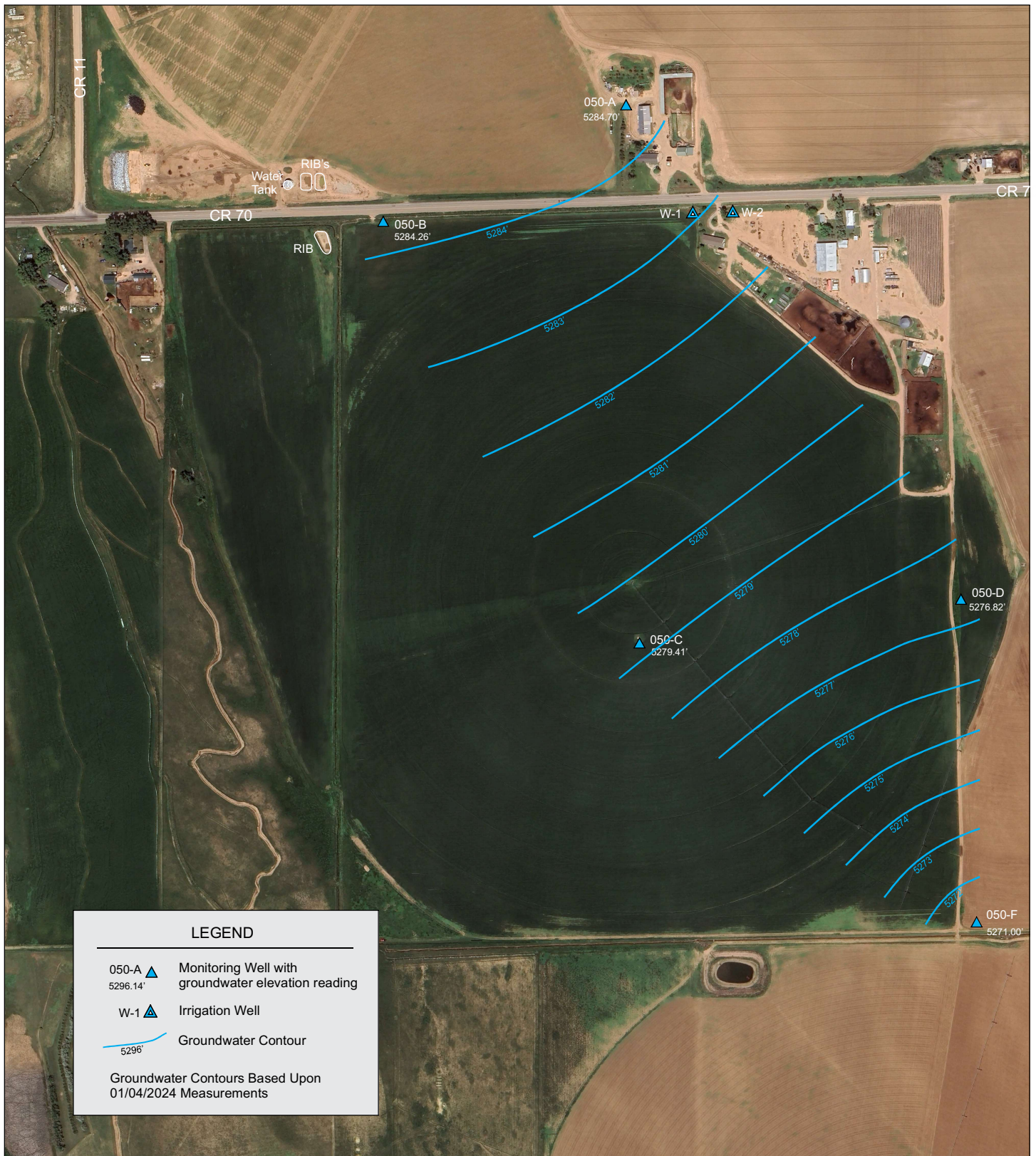
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APPROX SCALE IN FEET

 <b>STONEGATE</b> Land & Water, LLC	
PROJECT NUMBER 1022.006	DATE April 2024

PROPERTY LOCATION

Wellington Operating Company  
Wellington Muddy Sandstone Unit  
Wellington, Colorado


**FIGURE 2 H**  
**GROUNDWATER TABLE**  
**CONTOURS 12/06/2023**

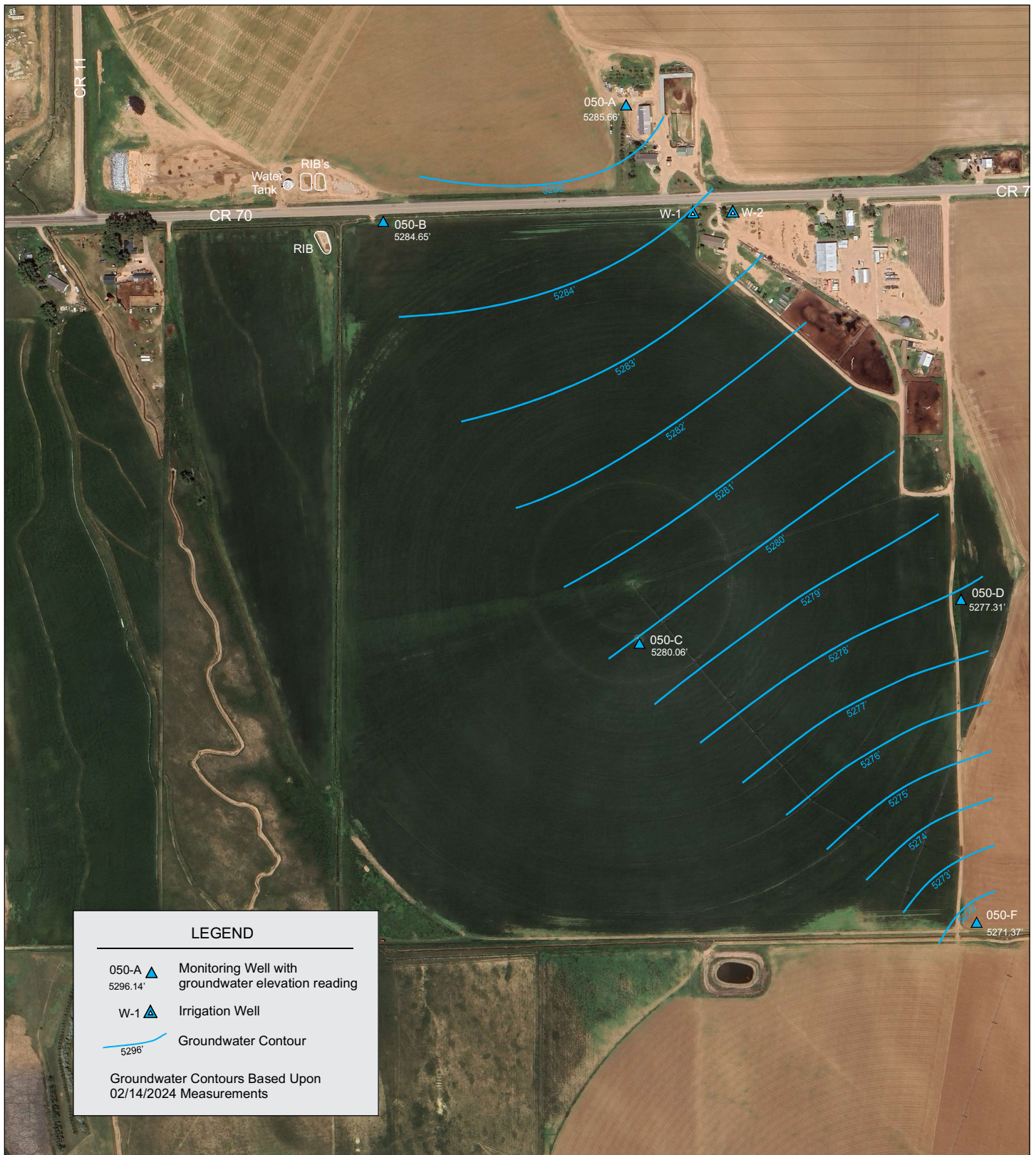


MAP SOURCE:  
GOOGLE EARTH 6/6/23



0 500 1000 1500  
APPROX SCALE IN FEET


 <b>STONEGATE</b> Land & Water, LLC		PROPERTY LOCATION Wellington Operating Company Wellington Muddy Sandstone Unit Wellington, Colorado	<b>FIGURE 2 I</b> GROUNDWATER TABLE CONTOURS 01/04/2024
PROJECT NUMBER 1022.006	DATE April 2024		

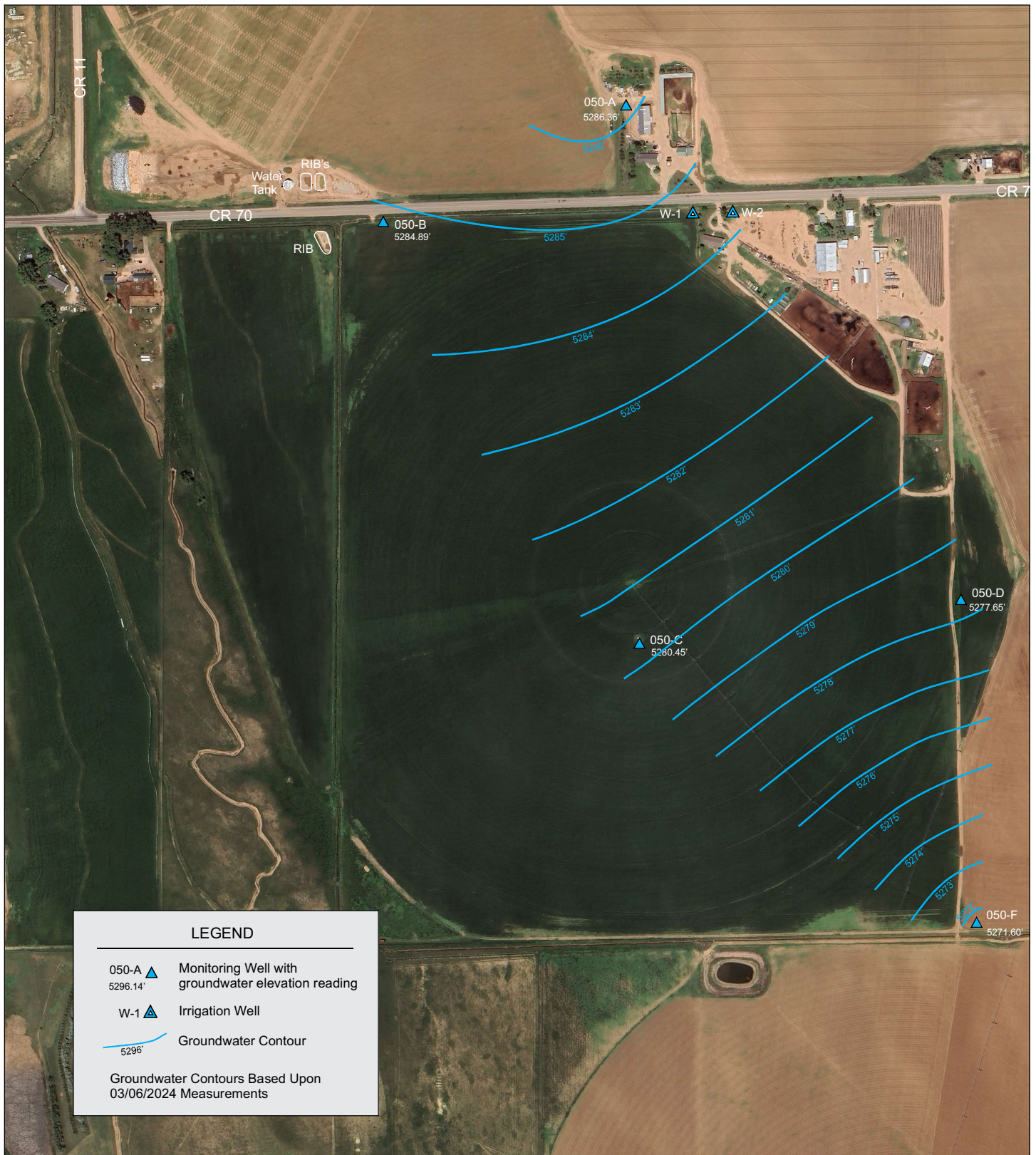


MAP SOURCE:  
GOOGLE EARTH 6/6/23



0 500 1000 1500  
APPROX SCALE IN FEET

 <b>STONEGATE</b> Land & Water, LLC		PROPERTY LOCATION Wellington Operating Company Wellington Muddy Sandstone Unit Wellington, Colorado	<b>FIGURE 2 J</b> GROUNDWATER TABLE CONTOURS 02/14/2024
PROJECT NUMBER 1022.006	DATE April 2024		



MAP SOURCE:  
GOOGLE EARTH 6/6/23

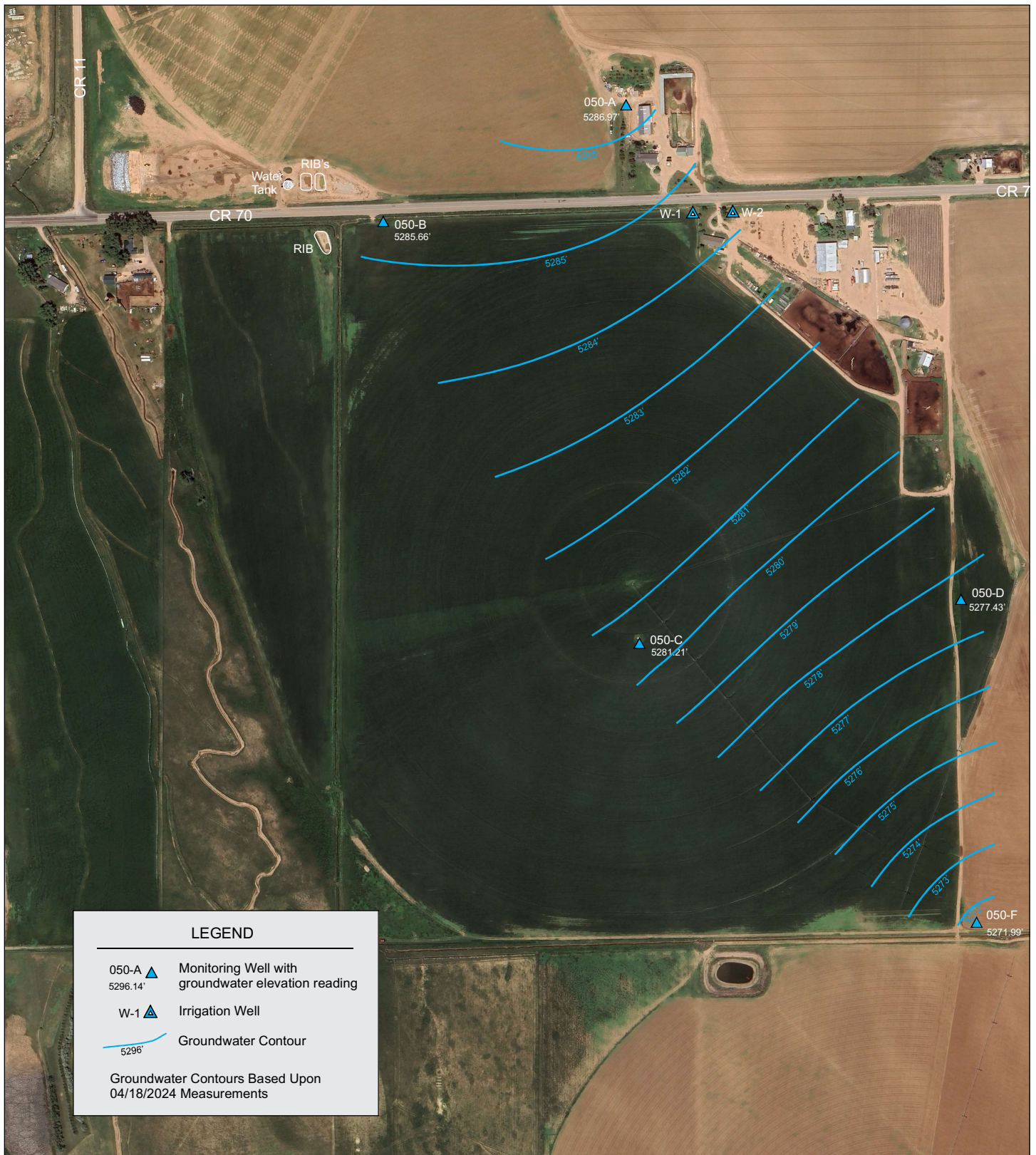


 <b>STONEGATE</b> Land & Water, LLC	
PROJECT NUMBER 1022.006	DATE April 2024

PROPERTY LOCATION

Wellington Operating Company  
Wellington Muddy Sandstone Unit  
Wellington, Colorado

FIGURE 2 K  
GROUNDWATER TABLE  
CONTOURS 03/06/2024



LEGEND

050-A ▲

Monitoring Well with groundwater elevation reading

5296.14'

W-1 ▲

Irrigation Well

Groundwater Contour


5296'

Groundwater Contours Based Upon

04/18/2024 Measurements

MAP SOURCE:  
GOOGLE EARTH 6/6/23



 <div> <div>STONEGATE</div> <div>Land &amp; Water, LLC</div> </div>		<div>PROPERTY LOCATION</div> <div>Wellington Operating Company</div> <div>Wellington Muddy Sandstone Unit</div> <div>Wellington, Colorado</div>		<div>FIGURE 2 L</div> <div>GROUNDWATER TABLE</div> <div>CONTOURS 04/18/2024</div>	
PROJECT NUMBER	DATE				
1022.006	April 2024				

## Table

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Wellington Water Works Ground Water Monitoring Well - Water Levels & Survey Data													
Monitoring Well ID	MH-45868 050-A	MH-45868 050-B	MH-45868 050-C	MH-45868 050-D	MH-45868 050-E	MH-45868 050-F	Comments						
Longitude	105° 01' 45.64156° W -105.0293449	105° 01' 56.76100° W -105.0324336	105° 01' 45.02851° W -105.0291746	105° 01' 29.75915° W -105.0249331	105° 01' 09.57944° W -105.0193276	105° 01' 29.51526° W -105.0248654	Latest data provided by Northern Engineering on 04/16/2021						
Latitude	40° 45' 20.91494° N 40.75580971	40° 45' 16.57015° N 40.75460282	40° 45' 01.72858° N 40.75048016	40° 45' 02.02822° N 40.75056339	40° 45' 01.84472° N 40.75051242	40° 44' 51.99713° N 40.74777698							
Location	SESW Sec8 T9 R68 PM6	NENW Sec17 T9 R68 PM6	SENW Sec17 T9 R68 PM6	SWNE Sec17 T9 R68 PM6	SENE Sec17 T9 R68 PM6	SWNE Sec17 T9 R68 PM6							
Top of Pipe	5335.4226	5336.6102	5322.6319	5319.1419	5311.7207	5316.6081							
Surface Elevation	5335.7944	5336.7384	5322.8856	5319.3343	5311.9169	5314.0131							
Installed Depth, Ft	95.0	60.5	85.0	66.5	37.5	88.0							
Measured Depth, Ft 12/18/2017	90.70	60.25	74.70	66.00	36.37	Not Measured							
	12/18/2017	39.28	5296.51	41.37	5295.37	32.54	5290.35	31.75	5287.58	15.10	5296.82	32.70	5281.31
	3/29/2018	37.38	5298.41	39.60	5297.14	31.23	5291.66	30.57	5288.76	13.50	5298.42	31.70	5282.31
	6/27/2018	35.62	5300.17	37.50	5299.24	29.78	5293.11	29.19	5290.14	14.11	5297.81	30.63	5283.38
	9/25/2018	39.63	5296.16	40.73	5296.01	32.82	5290.07	32.36	5286.97	15.17	5296.75	33.67	5280.34
	12/13/2018	38.72	5297.07	40.58	5296.16	31.72	5291.17	30.75	5288.58	14.91	5297.01	31.62	5282.39
	3/26/2019	39.70	5296.09	41.78	5294.96	32.80	5290.09	31.84	5287.49	15.18	5296.74	32.76	5281.25
	6/20/2019	39.60	5296.19	41.68	5295.06	32.93	5289.96	32.06	5287.27	14.46	5297.46	33.01	5281.00
	9/26/2019	47.27	5288.52	46.37	5290.37	37.87	5285.02	38.10	5281.23	15.10	5296.82	38.90	5275.11
	12/15/2019	39.00	5296.79	40.98	5295.76	32.13	5290.76	31.25	5288.08	15.01	5296.91	32.16	5281.85
	3/15/2020	38.54	5297.25	40.69	5296.05	32.02	5290.87	31.21	5288.12	14.34	5297.58	32.23	5281.78
	6/24/2020	45.40	5290.39	46.70	5290.04	37.70	5285.19	36.60	5282.73	15.85	5296.07	37.20	5276.81
	9/28/2020	51.90	5283.89	50.30	5286.44	43.75	5279.14	43.05	5276.28	16.25	5295.67	41.50	5272.51
	12/14/2020	48.80	5286.99	50.15	5286.59	41.46	5281.43	41.10	5278.23	15.10	5296.82	40.36	5273.65
	3/25/2021	47.58	5288.21	50.05	5286.69	40.26	5282.63	39.29	5280.04	13.78	5298.14	39.90	5274.11
	6/29/2021	48.46	5287.33	46.92	5289.82	39.85	5283.04	38.62	5280.71	13.68	5298.24	39.02	5274.99
	9/16/2021	53.43	5282.36	50.02	5286.72	44.77	5278.12	43.85	5275.48	14.56	5297.36	44.47	5269.54
	11/19/2021	49.75	5286.04	50.25	5286.49	42.00	5280.89	40.95	5278.38	15.00	5296.92	41.35	5272.66
	12/19/2021	48.53	5287.26	49.51	5287.23	41.03	5281.86	40.02	5279.31	15.16	5296.76	40.48	5273.53
	1/12/2022	48.70	5287.09	49.20	5287.54	40.47	5282.42	39.53	5279.80	15.32	5296.60	40.03	5273.98
	2/11/2022	47.05	5288.74	48.87	5287.87	39.50	5283.39	39.10	5280.23	15.38	5296.54	39.83	5274.18
	3/11/2022	46.51	5289.28	48.60	5288.14	39.62	5283.27	38.85	5280.48	15.40	5296.52	39.65	5274.36
	4/24/2022	46.85	5288.94	48.75	5287.99	39.82	5283.07	39.02	5280.31	15.68	5296.24	39.80	5274.21
	5/17/2022	46.50	5289.29	48.85	5287.89	39.67	5283.22	38.97	5280.36	15.45	5296.47	39.67	5274.34
	6/8/2022	46.75	5289.04	48.87	5287.87	39.94	5282.95	39.34	5279.99	14.53	5297.39	40.50	5273.51
	6/23/2022			50.07	5286.67								
	7/10/2022	52.83	5282.96	51.10	5285.64	43.90	5278.99	42.50	5276.83	14.57	5297.35	43.02	5270.99
	8/1/2022	54.34	5281.45	51.37	5285.37	45.85	5277.04	44.83	5274.50	14.86	5297.06	45.28	5268.73
	8/15/2022			51.02	5285.72								
	9/7/2022	57.39	5278.40	50.51	5286.23	48.22	5274.67	47.39	5271.94	15.18	5296.74	48.02	5265.99
	9/20/2022			51.65	5285.09								
	10/10/2022	56.93	5278.86	52.59	5284.15	47.80	5275.09	47.04	5272.29	15.28	5296.64	47.83	5266.18
	10/18/2022			53.01	5283.73								
	11/7/2022	54.41	5281.38	53.14	5283.60	46.68	5276.21	45.97	5273.36	15.66	5296.26	46.56	5267.45
	11/22/2022			53.49	5283.25								
	12/5/2022	53.02	5282.77	52.67	5284.07	45.51	5277.38	44.77	5274.56	15.12	5296.80	45.34	5268.67
	12/20/2022			53.29	5283.45								
	1/16/2023	51.68	5284.11	52.18	5284.56	44.32	5278.57	43.47	5275.86	16.38	5295.54	44.01	5270.00
	1/26/2023			52.22	5284.52								
	2/4/2023	51.29	5284.50	52.38	5284.36	44.43	5278.46	43.04	5276.29	14.32	5297.60	44.88	5269.13
	2/13/2023			53.29	5283.45								
	3/2/2023	50.64	5285.15	52.01	5284.73	44.96	5277.93	42.28	5277.05	14.21	5297.71	42.87	5271.14
	3/20/2023			51.71	5285.03								
	4/10/2023	49.89	5285.90	51.55	5285.19	42.77	5280.12	41.51	5277.82	14.91	5297.01	42.27	5271.74
	4/20/2023			51.68	5285.06								
	5/4/2023	50.73	5285.06	51.51	5285.23	42.66	5280.23	41.62	5277.71	15.42	5296.50	42.19	5271.82
	5/22/2023			51.68	5285.06								
	6/8/2023	50.21	5285.58	51.61	5285.13	42.76	5280.13	41.89	5277.44	15.88	5296.04	42.87	5271.14
	6/20/2023			51.13	5285.61								
	7/7/2023	50.69	5285.10	50.81	5285.93	42.98	5279.91	42.09	5277.24	16.34	5295.58	42.82	5271.19
	7/18/2023			50.12	5286.62								
	8/8/2023	52.94	5282.85	47.34	5289.40	43.61	5279.28	42.91	5276.42	16.69	5295.23	43.76	5270.25
	8/23/2023			48.13	5288.61								
	9/14/2023	54.86	5280.93	50.47	5286.27	45.87	5277.02	45.11	5274.22	16.88	5295.04	45.73	5268.28
	9/21/2023			51.27	5285.47								
	10/5/2023	54.51	5281.28	51.68	5285.06	45.96	5276.93	45.13	5274.20	17.20	5294.72	45.64	5268.37
	10/18/2023			51.13	5285.61								
	11/8/2023	53.32	5282.47	51.97	5284.77	44.92	5277.97	44.05	5275.28	17.32	5294.60	44.30	5269.71
	11/20/2023			52.08	5284.66								
	12/6/2023	52.18	5283.61	52.41	5284.33	44.09	5278.80	43.25	5276.08	17.49	5294.43	43.46	5270.55
	12/19/2023			52.36	5284.38								
	1/4/2024	51.09	5284.70	52.48	5284.26	43.48	5279.41	42.51	5276.82	17.99	5293.93	43.01	5271.00
	1/23/2024			52.23	5284.51								
	2/14/2024	50.13	5285.66	52.09	5284.65	42.83	5280.06	42.02	5277.31	16.61	5295.31	42.64	5271.37
	2/20/2024			51.86	5284.88								
	3/6/2024	49.43	5286.36	51.85	5284.89	42.44	5280.45	41.68	5277.65	16.58	5295.34	42.41	5271.60
	3/27/2024			52.25	5284.49								
	4/18/2024	48.82	5286.97	51.08	5285.66	41.68	5281.21	41.90	5277.43	15.92	5296.00	42.02	5271.99
	4/25/2024			50.99	5285.75								

# Well Log

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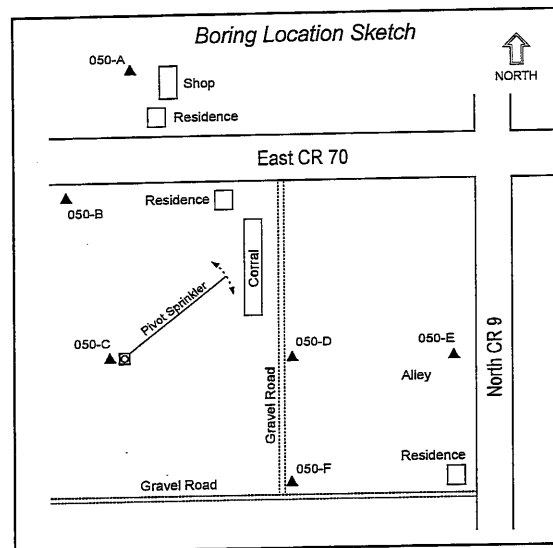
# SOIL BORING LOG

BORING NUMBER

**050-B**

PROJECT NUMBER <b>3470-001 (15)</b>	SOIL LOGGED BY <i>Paul Stone</i>	SCREEN TYPE AND SLOT SIZE <i>PVC 0.010"</i>	HOLLOW STEM AUGER INSIDE DIAMETER <b>4.25"</b>
CLIENT <i>Wellington Water Works</i>	DATE STARTED <b>01/19/06</b>	SAND SIZE <b>10/20</b>	BOREHOLE DIAMETER <b>8 inches</b>
DRILLING COMPANY <i>Spectrum Exploration, Inc.</i>	DATE COMPLETED <b>01/19/06</b>	RISER TYPE AND SIZE <i>PVC 2-inch</i>	SAMPLING METHOD <b>Cuttings</b>
DRILLING RIG TYPE <b>CME 75</b>	TOTAL DRILLED DEPTH <b>~ 60.5 ft. bgs</b>	INITIAL GROUNDWATER DEPTH <b>53.5 ft. bgs</b>	GROUND ELEVATION (top of casing) <b>~ 5331 ft amsl</b>
DRILLER(S) <i>Todd and Terry</i>	CONVERTED TO MONITORING WELL (Y/N) <b>Yes</b>	RELATIVE LOCATION OF BORING <i>See Sketch Below</i>	

DEPTH (FT)	SAMPLES LAB ANALYZED	RECOVERY (INCHES)	HEADSPACE PID TESTING (PPM)	WELL GRAPHIC	SOIL GRAPHIC LOG	GEOLOGIC DESCRIPTION
			VALUE 0 10 100 1000			
0						Top Soil, tilled earth Red-Brown Sand and Gravel, coarse sand and gravel to 1.5", poorly sorted, dry
						Red-Brown Sand and Gravel, coarse sand and gravel to 1.5", poorly sorted, dry auger chatters on gravel
						Red-Brown Sand and Gravel, coarse sand and pea gravel, poorly sorted, dry
						Same as above Fining downward
						Red-Brown silty SAND, minor gravel, loose, very slightly moist
						Red-Brown clayey SAND, minor gravel, slightly moist
						Same as above, small signs of water at 35' - possible water?
						Red-Brown Sand and Gravel, moist
						Same as above, moist
						Red-Brown Sand and Gravel, moist
						Red-Brown Sand and Gravel?, no return of cuttings
						Same as above, soft drilling, wet Same as above, tag top of bedrock at 60' T.D. at 60.5' -gray weathered sandy SHALE, Pierre Shale
60						



01/19/06 01/23/06



**STEWART ENVIRONMENTAL CONSULTANTS, INC.**  
Consulting Engineers and Scientists

PROJECT <i>Wellington Water Works</i>	COUNTY <i>Larimer</i>	BORING NUMBER <b>050-B</b>
ADDRESS <b>3218 East CR 70</b>	CITY/STATE <i>Wellington, Colorado</i>	PAGE OF <b>1 1</b>