Water Level & Water Quality Monitoring Plan for the R9 Ranch

prepared for

City of Hays, Kansas

City of Russell, Kansas

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BURNS McDONNELL

1.0 INTRODUCTION

Burns & McDonnell, Inc. (Burns & McDonnell) has developed this Water Level and Water Quality Monitoring Plan (Plan) for the R9 Ranch to support the development and operation of the property for municipal water supply. This Plan outlines the standard practices that will be used to monitor the groundwater levels and quality throughout the aquifer underlying the R9 Ranch. Since the water will be used as a public drinking water supply, the Cities of Hays and Russell, KS (Cities) will also be conducting water quality sampling in accordance with the Kansas Department of Health and Environment (KDHE) regulations and the Safe Drinking Water Act (SDWA) requirements.

The purpose of this Plan is to provide a detailed scope of work and methodology for the gathering of water quality and water level information. The primary objectives of the water level and water quality monitoring plan include:

- Establish the locations of observation wells on the R9 Ranch property.
- Describe water level measurement sites, method of measurement, and frequency of measurement.
- Describe water quality sample collection sites, methodology, frequency, and constituents to be sampled for in addition to KDHE and SDWA requirements for the development and operation of a public water supply.

2.0 OBSERVATION WELLS

The R9 Ranch property contains a total of fifteen (15) existing observation wells. These wells were originally installed as part of an initial site evaluation completed by Groundwater Associates in 1995. These observation wells were completed in the aquifer at total depths ranging from 38 to 131 feet. Each well is constructed of 2-inch PVC casing and mill cut PVC screen. The names and coordinates of the observation wells are listed in Table 1, and shown on Figure 1.

3.0 MUNICIPAL WELLS

The municipal well field that will be constructed for municipal water supply at the R9 Ranch is currently anticipated to be constructed in multiple phases. Each municipal well will be constructed with a water level measurement port such that manual measurements can be taken utilizing an electronic measurement tape. The names and coordinates of the currently proposed municipal wells are listed in Table 2, and shown on Figure 1.

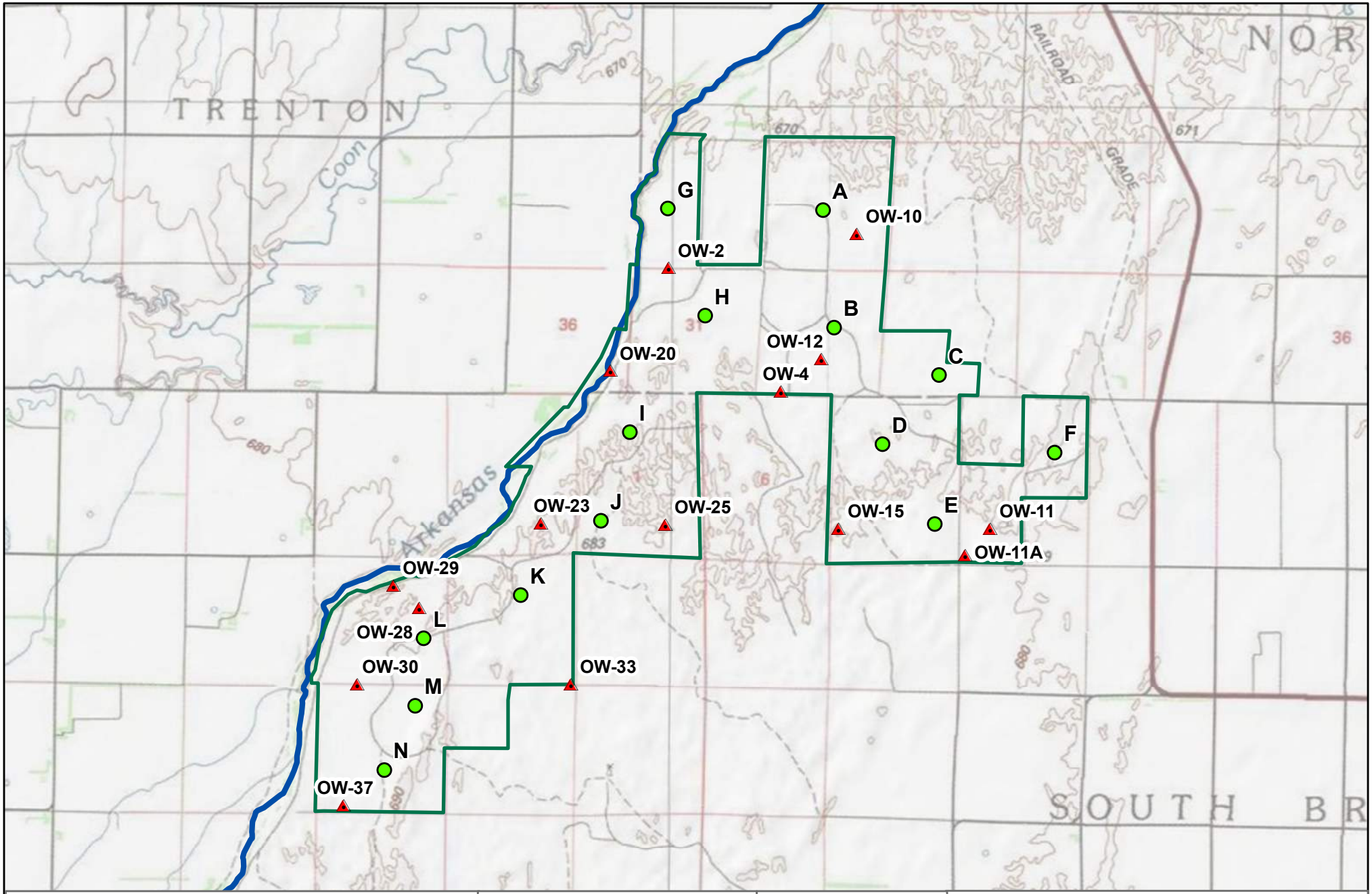

Figure 1

R9 Ranch Site Map

Table 1

R9 Ranch Observation Well Locations

Observation Well Name	UTM NAD83 Easting	UTM NAD83 Northing	Legal Description
OW-2	459934	4188151	30FT NE OF PIVOT
OW-4	461346	4186613	SE OF CIRCLE 4
OW-10	462281	4188587	22FT NE OF PIVOT
OW-11	463663	4184572	30FT NE OF PIVOT
OW-11A	463973	4184906	SW OF CIRCLE 11
OW-12	461850	4187020	24FT SW OF PIVOT
OW-15	462074	4184897	SW OF CIRCLE 15
OW-20	459211	4186856	N OF CIRCLE 20
OW-23	458351	4184946	30FT N OF PIVOT
OW-25	459908	4184937	30 FT N OF PIVOT
OW-28	456834	4183880	30FT N OF PIVOT
OW-29	456512	4184154	NE OF CIRCLE 29
OW-30	456063	4182921	29FT W OF PIVOT
OW-33	458736	4182935	SE OF CIRCLE 33
OW-37	455904	4181403	SW OF CIRCLE 37
Future OW	To Be Determined	To Be Determined	East of Municipal Well F

Table 2

R9 Ranch Municipal Well Locations

Municipal Well Name	UTM NAD83 Easting	UTM NAD83 Northing
A	461875	4188879
B	462020	4187410
C	463337	4186824
D	462635	4185953
E	463292	4184960
F	464785	4185861
G	459934	4188890
H	460406	4187550
I	459473	4186087
J	459116	4184975
K	458120	4184039
L	456908	4183492
M	456804	4182650
N	456422	4181844

3.0 WATER LEVEL MONITORING

Water levels will be collected from the observation wells identified in Table 1 and each of the municipal wells once they are constructed. Once Municipal Well F is constructed, an Observation Well will be installed between it and the property boundary and added to the monitoring schedule. Water level measurement procedures and water level measurement frequency are described below.

3.1 Measurement Procedures

Water levels will be collected manually from the observation wells identified in Table 1 and each municipal well at the R9 Ranch after they are constructed using a calibrated electronic or steel measurement tape. The following items shall be recorded at each site during a manual measurement of water levels:

- Well Name, Time of Day, Date, and Personnel completing the measurement.
- Depth to Water to the nearest hundredth of an inch from an established static measuring point.
- Where possible, the total depth of the well shall be verified with a weighted tape to check for signs of casing failure or sedimentation.

The municipal wells may be constructed with water level transducers that provide feedback to a central City Supervisory Control and Data Acquisition (SCADA) system. This system may also facilitate additional digital logging and trending of water level information.

3.2 Measurement Frequency

Manual water level measurements will be collected quarterly. The quarterly water level measurement frequency is ideal for capturing water level changes and responses over a range of varying groundwater demand and hydrologic conditions. To achieve consistent annual trending of static water level conditions, the first quarterly measurement will be taken during January. Water level measurements will be collected at the times described below:

- Quarterly Measurement 1 (Static Conditions Q1) - January
- Quarterly Measurement 2 (Q2) - March/April
- Quarterly Measurement 3 (Q3) - July/August
- Quarterly Measurement 4 (Q4) - September/October

If water level transducers and a SCADA system are implemented at the municipal wells, the digital recording of water levels will occur on a monthly basis at a minimum. Quarterly manual

water level measurements can be compared to SCADA equipment recordings for verification of SCADA equipment and transducer accuracy.

4.0 WATER QUALITY MONITORING

There are several key parameters in the groundwater at the R9 Ranch with the potential to impact the development and operation of the property as a public water supply. These parameters mainly include nitrate and elevated sulfate concentrations. Additionally, chloride and hardness have also been detected at elevated levels on the R9 Ranch property.

To monitor the groundwater quality on the R9 Ranch, the Cities will complete a full water quality analysis as required to meet the KDHE and SDWA water quality testing parameters for development and testing of public water supply sources. In addition, water quality monitoring will be completed for the following constituents at each of the observation wells identified in Table 1 :

Nitrate	Chloride	Potassium	Sodium
Fluoride	Sulfate	Iron	Manganese
Alkalinity	Bicarbonate	pH	Total Dissolved Solids (TDS)
Calcium	Magnesium	Hardness	

4.1 Sampling Procedures

Samples will be collected from the observation wells identified in Table 1 in accordance with the standard methods defined in the United States Environmental Protection Agency (EPA) Handbook for Sampling and Sample Preservation of Water and Wastewater. Samples will be collected in containers prepared by the lab contracted for completion of the analysis as well as packaged and delivered in a manner consistent with lab requirements. Field measurements of temperature, pH, and conductivity will be recorded for each sample.

4.2 Sampling Frequency

Water quality samples will be collected semi-annually from the observation wells identified in Table 1. This monitoring frequency is ideal for capturing any changes in the groundwater chemistry over a range of varying groundwater demand and hydrologic conditions. Semi-annual sampling of the observation wells will be completed according to the following schedule:

- Observation wells will be sampled once during the during the month of January
- Observation wells be sampled once during the month of either July or August

4.3 Laboratory Analysis

Water quality samples from the observation wells identified in Table 1 will be sent to a KDHE certified laboratory for analysis.

5.0 Reporting & Data Analysis

Water level and water quality information will be evaluated, and a report generated annually and submitted to DWR and GMD5. The DWR Chief Engineer may periodically review the results of the report and authorize a reduction in the scope of the monitoring plan or reporting requirements if appropriate.

The report will include:

- an evaluation of the analytical results,
- a groundwater surface elevation contour map,
- a map showing the areal distribution of nitrate concentrations,
- a map showing the areal distribution of sulfate concentrations,
- a map showing the areal distribution of chloride concentrations,
- a map showing the areal distribution of TDS concentrations,
- hydrographs of the observation well water levels illustrating the historical water level trends with time, and
- tables containing the analytical data results.