RESOURCE
HYDROGEOLOGIC
SERVICES

March 6, 2020

File #: 2020-013-004-2

Ms. Diana Furman
GCC Rio Grande, Inc.
3372 Lime Road
Pueblo, CO 81004

Attn: Diana Furman
Environmental Engineer

Dear Ms. Furman

Re: Response to Preliminary Adequacy Review #2, Technical Revision (TR-07); GCC Pueblo Cement Plant, Permit No. M2002-004

This letter addresses comments from the Division of Reclamation, Mining and Safety (Division) from Mr. Patrick Lennberg, Environmental Protection Specialist, dated February 28, 2020. For ease of review, each Division comment has been restated in italics immediately followed by the corresponding response. Numbers 1 and 9 below are continuation of discussion from the original Adequacy Review dated October 31, 2019, while the remainder are comments specifically from Adequacy Review #2. The corresponding response includes reference to specific incorporation in the final Sampling and Analysis Plan (SAP) subject to approval by the Division as TR-07.

1. ***Original Adequacy Comment (#1) -*** *Please update the map provided in Figure 1 to be appropriately sized and in compliance with the requirements of Rule 6.2.1(2), specifically revise the scale of the map to be no larger than 1 inch = 50 feet nor smaller than 1 inch = 660 feet.*

   GCC Response 2/18/2020 - Figure 1 was previously submitted in a 36" X 48" format which meets Rule 6.2.1(2) with 1 inch = 660 feet, otherwise 1 section width (1 mile) = 8 inches. It is thus interpreted that the Division actually wants a smaller printer-friendly format. Figure 1 has been updated to an 11" X 17" format.

   Division Response 2/28/2020 – *In the hardcopy of the original application the figure was not submitted in a 36" x 48" format, it was submitted on an 8.5" x 11" format and thus does not meet the requirements of Rule 6.2.1(2). Please update the map to be appropriately sized and in compliance with the requirements of Rule 6.2.1(2). Moving the forward if GCC would like to submit responses and maps electronically please seek approval to do so.*

Figure 1 has been restored to 36” X 48” format to meet requirements of Rule 6.2.1(2) for both electronic and printed format submittals.

2. *Please update Figure 1 to show the current extent of mining to be consistent with the Annual Report Map submitted in August 2019.*

   Figure 1 has been updated to show the current extent of mining consistent with the Annual Report Map submitted August 2019.

3. *Please update Figure 1 to show the location of the newly installed monitoring well, MW-8.*

   Figure 1 has been updated to show the location of the newly installed monitoring well, MW-8.

4. *Table 1, please update the table to include the analytical method and the method detection limit for each analyte.*

   Table 1 has been updated to include the analytical method and the method detection limit for each analyte.

5. *Sections 3.3 and 3.4, please remove references to Specific Conductance and replace with Conductivity to be consistent and avoid possible future confusion.*

   In Sections 3.3 and 3.4 the references to “specific conductance” have been replaced with “conductivity”.

6. *Section 3.4, paragraph 5, the response to item #10 in the Preliminary Adequacy Review is inconsistent with what was incorporated into the text. A minor revision (MR) is not part of the Act and Rules that govern hard rock and construction material mine sites only technical revisions (TR) are allowed, please revise.*

   This correction has been made to Section 3.4, paragraph 5.

7. *Section 5, data validation, what is the level of data validation that will be done by the third party? The Division is aware that there are typically 3 tiers of validation that can be done;*

   ***Tier 1** involves a general review of the QC data for the project. This is sometimes referred to as a “Summary Forms” review. At a minimum, all data should receive a Tier 1 review.*

   ***Tier 2** involves a selected validation of a portion of the data. Which aspect of the project is to be reviewed should be defined in the DQO discussion of the project. The focus might be on a specific area within the sampling area, specific analytes or analyses of concern critical to decision making, or some other factor(s). The review may also look at unusual results noted in the Tier 1 review.*

   ***Tier 3** involves validation of all the data collected and reported. This includes a review of the raw data, the laboratory’s standards log books, extractions logs, instrument printouts,* *chromatograms (if applicable), mass spectra (if applicable), etc. Calibration data, sample analysis data, and quality control data are all evaluated. Typically, this is a "third party review" and is based on strict protocols, such as the National Functional Guidelines.*

Currently, there are groundwater exceedances at the site and the Division would like a commitment from the Operator to having a Tier 3 Data Validation done on an annual basis.

GCC Rio Grande commits to having a Tier 3 Data Validation done by a third-party on an annual basis and reported within the Facility's annual groundwater report, and this has been specified in Section 5.

8. ***Original Adequacy Comment (#20) -*** *Section 5.1, please include a discussion about completeness. Completeness is referenced as being specified in this SAP in Section 5.2.1.*

GCC Response - *Reference to "completeness" is acknowledged to have been confusing and reference to the term has been removed from Sections 5.1 Data Quality Objectives and 5.2.1 Data Validation.*

Division Response - *Data Quality Indicators (DQIs) provide a means to evaluate the quality of data and are normally defined in terms of PARCCS (precision, accuracy, representativeness, completeness, comparability, and sensitivity (method detection limits)). Precision, accuracy, and sensitivity are usually covered in method specific criteria. However, the other DQIs (representativeness, completeness, and comparability) should be defined in the plan for the project as a whole. Please revise the text to include a discussion of completeness, or provide a discussion of the other terms referenced in the text (representativeness and comparability).*

A discussion about completeness has been added to Section 5.1 as follows: "Completeness is defined as the percentage of laboratory measurements judged to be valid on a method-by-method basis. Data completeness is expressed as the percent of data meeting the necessary objectives and should be greater than or equal to 90 percent. All laboratory reports shall be reviewed to ensure that all requested analytical procedures were carried out and the following information was present in the analytical record:

- Completed chain-of-custody forms with individual samples and analyses identified
- Laboratory reports include data qualifier flags and definitions of qualifier flags
- Laboratory reports include case narratives, and include all laboratory QA/QC test and results"

9. *Section 5.2.1, Field QA Sample Review, for consistency and to avoid possible future confusion please use the same equation for calculating RPD, compared to the one used in Section 5.1.*

For consistency the RPD equation presented in Section 5.2.1 has been updated to be the same as the RPD equation presented in Section 5.1.

Yours sincerely,

Resource Hydrogeologic Services, Inc.

Landon Beck
Principal Hydrogeologist

Enclosures/Attachments:
Revised SAP (3/6/2020)

cc: None

SAMPLING AND ANALYSIS PLAN
for
ENVIRONMENTAL GROUNDWATER MONITORING

Prepared for:
GCC Rio Grande, Inc.
Pueblo, Colorado

March 2020
Effective Date: Upon approval by DRMS (TR-07)

History of Document Revisions

Revision No	Revision Date	Reason for Revision
1	2/28/2003	Initial Sampling and Analysis Plan developed for the site after permit approval (DRMS Comments 03/17/2003)
2	03/26/2003	Revised in response to DRMS Comments received 03/17/2003 (DRMS approved April 2003)
3	10/18/2019	Revised Draft SAP submitted to DRMS for review as a Technical Revision in response to changes in site wells and sampling protocols approved under Technical Revisions 3 and 6 (DRMS approved TBD) (Close Consulting)
4	2/19/2020	Revised SAP submitted to DRMS as Technical Revision 7 (TR-07) in response to Preliminary Adequacy Review dated October 31, 2019. (DRMS approved TBD). (Resource Hydrogeologic Services)
5	3/13/2020	Revised SAP submitted to DRMS as Technical Revision 7 (TR-07) in response to Preliminary Adequacy Review #2 dated February 28, 2020. (DRMS approved TBD). (Resource Hydrogeologic Services)

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1.0 INTRODUCTION AND SAMPLING OBJECTIVES

This Sampling and Analysis Plan (SAP) provides a protocol for performance of shallow groundwater monitoring at the GCC Rio Grande, Inc. facility in Pueblo, Colorado (the Site). Based on increased knowledge of the groundwater system at the Site, groundwater monitoring locations and requirements have evolved significantly since the previous SAP was prepared in 2003 (Brown and Caldwell, 2003). As a result of subsequent findings, and in accordance with Technical Revision No. 3 (TR-03) approved by the Colorado Division of Reclamation, Mining and Safety (DRMS) in April 2013, all shallow wells subject to prior monitoring were plugged and abandoned except for one (MW-005, hereinafter referred to as MW-5). The plugged wells were either dry, or were located far from the site along the St. Charles River and proven to not be applicable for GCC monitoring. MW-5, located north of the plant, has remained dry since it was installed so no samples have been collected. Pursuant to TR-06, approved by DRMS in July 2017, new wells MW-6 and MW-7 were installed in December 2017 downgradient of the second mine panel to monitor the mined Fort Hays Limestone. MW-8 was installed at that same location in February 2020 in order to monitor the underlying Codell Sandstone. (Figure 1)

This SAP describes groundwater sampling and analysis procedures for obtaining chemical data from existing wells, and future wells installed as mining progresses, to define the baseline groundwater conditions and track any changes in applicable water quality constituents in potentially affected groundwater. Significant changes to the sampling protocol(s) will be submitted to DRMS for approval prior to implementation.

The following sections provide details of the SAP, including sample locations and frequency, sampling methods, laboratory analysis, quality assurance/quality control (QA/QC), and reporting.

2.0 GROUNDWATER SAMPLING LOCATIONS AND FREQUENCY

Figure 1 illustrates the site features and mine plan. GCC quarries the Fort Hayes Limestone Member of the Niobrara Formation, and began extraction and processing in 2007 and 2008, respectively. GCC is permitted to quarry the Fort Hayes Limestone and approximately 5 feet into the Codell Sandstone, which has also been described as hard, brown sandy petroliferous limestone and a platy and shaly sandstone. Figure 2 shows a site stratigraphic section. Site drilling logs indicate that the Codell also contains multiple shale or sandy shale lenses. Initially, GCC planned to remove and process Codell Sandstone, but that was eliminated near the onset of operations when further testing determined the material was not beneficial to process. GCC extracts only the Fort Hayes, leaving the bottom one foot of the limestone.

Regionally, the Juana Lopez Shale Member separates the Fort Hayes and Codell members, but is only about 2 feet thick. Locally, the Juana Lopez Member is largely absent due to an erosional unconformity, such that the Fort Hayes directly overlies the Codell (Collum, 2000). Underlying the Codell is approximately 400 feet of upper Cretaceous members, principally composed of dense shales, which provides an effective hydraulic barrier from the underlying Dakota Sandstone aquifer**.**

2.1 **Sampling Locations**

Groundwater monitoring currently occurs at three monitoring wells (Figure 1). Well MW-5 was installed between the plant site and the Edson Arroyo in July of 2008. The well is completed in claystone (weathered shale) beneath a surficial clayey soil and screened from 9 to 25 feet. The borehole extended to 29 feet, but was terminated in the same claystone. Well MW-5 has been dry since it was installed.

Two other site environmental monitoring wells are MW-6 and MW-7, which were installed in the Fort Hayes Limestone during December 2017 (Close Consulting Group, 2018). These wells were drilled in the area of a suspected fault downgradient of the second mine panel. Prior to drilling these wells, no free water had been encountered in the Fort Hayes or Codell Sandstone during other site drilling and well installations. The fault/fracture system that results in water occurring in these wells transects both the Fort Hayes and Codell.

The fourth groundwater monitoring location is MW-8, which was installed into the Codell Sandstone in February 2020 (Resource Hydrogeologic Services, Inc., March 2020).

As mining progresses or compliance matters arise, additional monitoring wells will be installed. This SAP will also apply to those wells, unless specific modifications are approved by DRMS as part of future Technical Revisions.

2.2 **Monitoring Frequency**

Groundwater monitoring currently is performed semi-annually for dry wells (MW-5) and quarterly for wells that typically produce water (MW-6, MW-7, and MW-8). Quarterly monitoring is typically scheduled for April, June, September and December. Semi-annual monitoring is typically performed in June and December. Unexpected circumstances or adverse weather/site conditions may require that a sampling date be rescheduled or modified, but GCC will strive for overall consistency in the sampling schedule.

3.0 SAMPLING METHODS

This section of the SAP presents a summary of groundwater documentation requirements, water level measurement procedures, field water quality measurement procedures, groundwater sample collection procedures, decontamination procedures, sample handling and custody requirements, and field QA/QC samples.

3.1 Documentation and Records

Documentation during field activities is completed through the use of field sampling forms. The intent of field documentation is to provide complete documentation of the methods of sampling and consistency between sampling events. Examples of field reporting forms that may be used to document a sampling event are included in Appendix A.

3.2 Water Level Measurements

Depth to groundwater generally will be measured with an electronic water-sensing device. The measurement will be made relative to a marked measurement point at the well head (commonly the top of the PVC casing), and will be recorded to the nearest 0.01 foot. The total depth of the well will also be recorded for each well during each monitoring event. These measurements will be used to measure and record the initial static water level and wetted casing volume. Water levels may also be recorded after removal of each wetted casing volume during purging and sampling.

The casing stick-up height will be measured during each monitoring event. Any change in height of the casing above ground surface or concrete pad shall be noted. If the distance changes more than 0.04 feet above a concrete pad, GCC will have the measuring point resurveyed to verify accuracy of static water elevations.

3.3 Field Water Quality Measurements

Field water quality parameters (i.e., temperature, pH, and conductivity) will be measured with a calibrated meter at each sample location (Table 1). These field measurements will be taken after each purge volume and at the time of sample collection and recorded on water quality sampling forms (Appendix A). Separate aliquots of water are used to monitor field parameters (i.e., samples for laboratory analysis will not be used or reopened for field measurements). Field meters will be calibrated at the beginning of each day in accordance with the manufacturer's specifications. Calibration information and results will be documented on the field form or a field notebook each time a field instrument is calibrated for use in the sampling activities.

3.4 Groundwater Sample Collection Procedures

Groundwater sampling procedures, measurements and observations will be recorded on an appropriate field reporting form (Appendix A). The following typical sampling procedures will be followed to ensure that water quality can be reliably compared from well to well and from sampling event to sampling event and that the data are reproducible.

Field water quality parameters (pH, conductivity, and temperature) will be measured at removal of the first wetted casing volume and following removal of each subsequent wetted casing volume. If applicable or practicable, the groundwater sample will be collected following the removal of the third wetted casing volume if field water quality parameters show relative stability (within approximately 10%) and two or more parameters show no significant trend of increasing or decreasing value. If the meter readings for pH, temperature and conductivity do not stabilize, field personnel need only remove five casing volumes before taking a groundwater sample.

Purging of each well will be accomplished with either a dedicated and disposable bailer or a dedicated in-situ pump system. During the purging process, temperature, pH, and conductivity are measured and entered on the field sampling form after each casing volume is removed. At all times, purging and sampling equipment will not be allowed to come into contact with the ground or other potentially contaminated surface.

Water samples to be analyzed for dissolved metals will be collected in a dedicated, disposable plastic intermediate transfer container for filtration in the field which shall be a 1-gallon new, disposable, poly cubitainer or similar appropriate container. Samples will be filtered through a 0.45-micron disposable filter cartridge directly into laboratory-prepared containers, using dedicated, disposable tubing. If a bailer is used to collect the sample, a standard peristaltic pump with appropriate environmental grade tubing shall be used to force the sample from the intermediate transfer container through the filter. If a dedicated in-situ pump system is utilized to collect the sample, the filter shall be connected to the discharge tubing allowing the pump pressure to force the sample through the filter. The new filter cartridge shall be purged with sample water by the method described previously, allowing time to observe proper function of the filter demonstrating clear water production prior to filling the subject sample bottle(s). Sample containers provided by the lab typically contain a nitric acid preservative. If this is not the case, preservatives will be added immediately after the samples are filtered. In the standard case of pre-preserved (pre-acidified) bottle utilization, care must be taken at the time of sample collection to not overflow the bottle which will flush some if not all of the acid from the sample, leaving said sample less than adequately preserved. If a bottle is overflowed, the bottle shall be discarded and an appropriate replacement pre-preserved sample bottle will be substituted from spare bottle set inventory, kept on hand for such occurrences.

The method of sample collection can vary according to how much water a well produces and if a representative water sample can be collected. The following methods for bailer purging and sampling are adapted from Colorado Water Quality Control Division guidance (CDPHE WQCD, undated). Some slight modifications are made so that only produced water (not stagnant purge water) is submitted for laboratory analysis. In order to collect what is believed to be the most representative water sample, the time between purging and sampling low yielding wells may be adjusted given the behavior of a given well and until the response of a given well is observed over time. If dedicated pump systems are installed in any of the monitoring wells at a future date, purging and sampling will be performed using manufacturer's and EPA-approved guidance. The installation of such system(s) in any of the current or future groundwater monitoring wells shall require submittal and Division approval of a technical revision (TR) to the mine permit.

3.4.1 Method A for Groundwater Sample Collection

This method is to be utilized for those wells that produce a sufficient volume of water and have a rapid recovery rate.

- Purge the well water into a clean, dedicated collection container (e.g., emptied distilled water jug) to measure and record temperature, pH, and conductivity. Continue purging until the stagnant water in the casing has been replaced by formation water. This is best determined by logging the readings for temperature, pH, and conductivity. After approximately three casing volumes have been removed from the well and once the most recent reading is within 10% of the previous two readings for each individual field parameter, a groundwater sample will be taken. If the field parameters do not stabilize, a minimum of five casing volumes shall be removed from the well prior to taking a groundwater sample.

- If a bailer is used to purge the well, the bailer is to be lowered into the well to what hereinafter is referred to as the "sample depth". "Sample depth" is determined by lowering the bailer to the bottom of the well. Once the bailer is gently resting on the bottom, the field person is to mark this location on the cable. The mark is to be placed directly across from the measuring point while the cable is held taut. Raise the bailer one-foot above the bottom of the well. Mark the cable or place adhesive tape on the cable to indicate the sample depth for future reference. Taking a purge water sample at this elevation should avoid undue amounts of sediments in the sample and prevent sediment interfering with closure of the bailer valve. Prior to extracting water for field measurement, the well should be purged by bailing from the bottom of the well. Take "throw-away" samples from the sample depth to determine temperature, pH and conductivity after each casing volume and purge as described above.

- When using a bailer to sample the well, lower the bailer slowly through water column until the bottom of the bailer reaches the sample depth. The sample depth is indicated by a mark or adhesive tape on the cable. The bailer should be raised to the surface and the sample transferred to sample containers with minimal agitation and contact with the atmosphere. The sample should be allowed to flow down the side of the receiving container and not allowed to cascade onto the bottom of the container.

3.4.2 Method B for Groundwater Sample Collection

This method describes procedures to be performed when the monitoring well(s) are low yielding. A low yielding well is one that is capable of recharging within approximately three to four hours. Sample handling and transfer is handled the same way as Method A. This sampling procedure includes the following:

- Purge the well and measure field water quality parameters after each wetted casing volume until it is dry.

- If there is sufficient recovery after three to four hours, take another throw away sample to determine temperature, pH and conductivity. Record these values. Collect samples for laboratory analysis in the order indicated in Section 4.2. Sample may not be collected for analysis of all parameters if the well bails dry before completing the suite.

- After the last groundwater sample is taken, again take a throw-away sample to measure and record the pH, temperature and conductivity if sufficient volume can be recovered.

3.4.3 Method C for Groundwater Sample Collection

This method describes procedures to be performed when the monitoring well(s) are very low yielding. A "very low yielding" well is one whose time of recharge for sampling is greater than three to four hours and less than 24 hours. Sample handling and transfer is handled the same way as Method A. This sampling procedure includes the following:

- Purge the well and measure field water quality parameters after each wetted casing volume until it is dry.

- Return to the well in approximately 24 hours. Measure the water level in the well. If sufficient recovery has occurred, pump/bail the water into a bulk sample container. From the bulk sample container determine the temperature, pH and conductivity. Transfer water from the bulk sample container to sample bottles in the order indicated in Section 4.2 until the suite is complete or until the well purges dry.

For all methods, samples will be stored under ice in an ice chest pending delivery to the laboratory.

3.5 Equipment Decontamination Procedures

Dedicated and disposable equipment (e.g., bailers and rope) will be used to the extent possible to eliminate the need for equipment decontamination prior to and between uses, and the preparation and analysis of associated field rinsate blanks. Clean and disposable nitrile gloves will be worn during purging and sampling activities. Due to the use of dedicated equipment and disposable supplies, the only equipment typically requiring decontamination are the water level meter and water quality measurement probes.

Where equipment decontamination is required, the following procedures can be used:

- Spray with Alconox detergent followed by distilled water rinse, or
- Triple water rinse with distilled water, and
- Air dry or paper towel dry the decontaminated equipment and either use it immediately, or wrap and/or store it appropriately for later use.

Sampling equipment will be decontaminated or bagged (if disposable) between each sample location. Disposable sampling equipment and supplies (bailers, bailer cord, gloves, etc.) will be disposed in site waste containers. Purge water will be disposed on the ground near the wells.

3.6 Sample Handling and Custody Requirements

This section describes the methods used to ensure samples are managed in accordance with sampling handling and chain of custody requirements.

3.6.1 Sample Handling

Samples will be packaged and preserved in a manner prescribed by the applicable analytical method. Method-specific holding time requirements will be observed. Table 2 provides the relevant holding times by analyte/method for the GW-Compliance suite.

3.6.2 Sample Custody Documentation

The following describes the proper procedure for labeling and documenting samples once they are collected.

Sample Labeling

Individual sample bottles are labeled by the lab for each respective analytical test or group of tests and grouped into individual clear plastic bags. All sample containers shall be labeled using waterproof ink directly on the bottle or bottle label if such a label is present. Following collection, sample bottles for each sample location ID shall be placed in their respective plastic bags provided by the lab containing each bottle set for protection and grouping and sealed by either twist-tie or Ziploc mechanism. Information provided on each bottle set bag and the individual sample bottles and/or labels shall include:

- Site or project name;
- Sample location ID;
- Sample collection date and time;
- Sampler's name or initials.

Chain of Custody Forms

Record all samples chronologically on chain of custody forms. All entries to chain of custody documents will be made in ink. The chain of custody form requires the following information to be accurately written in ink:

- Contact information for report receipt (GCC Rio Grande)
- Contact information for report copy receipt (consultant or other relevant party)
- Contact information for laboratory invoice receipt (GCC Rio Grande)
- Samplers printed name, signature, site information (state, zip code, time zone)
- Designation of analytical suite designation, typically assigned as quote number
- Chronological listing of sample ID, date/time of collection, matrix (groundwater), number of containers, analysis requested (analytical suite – "GW-Compliance")
- Remarks as necessary
- Relinquished by signature and date/time

No scratch-outs are permitted on the chain of custody form. If a minor correction is required, such correction shall be made in ink by a single line through the error and corrected information beside. Initials shall be placed beside the correction. If the error is deemed significant by the sampler and could cause any future question as to the validity of the sample(s), the original chain of custody shall be destroyed and replaced with a new clean, accurate version. The carbon copy shall be retained by the sampler for records. If a carbon copy is not available, a photocopy of the chain of custody shall be made and filed in the sampler's records prior to packaging. The chain of custody document(s) will be placed in a Ziploc-type plastic bag and enclosed in the sample cooler or shipping container. The sample cooler will be custody-sealed as described below.

Custody Seals

Custody seals are used to assure the integrity of samples from the time the samples are collected and logged into the chain of custody system until the samples are received by analytical laboratory personnel. Samples will be shipped to the laboratory in coolers or other appropriate shipping containers. The cooler or shipping container must be custody-sealed in a manner which requires the destruction of the seal at the time of opening whenever a third-party delivery service is used. Such coolers or shipping containers will also be taped shut, with a layer of clear packaging tape placed over the custody seal, signed and dated using an indelible pen, to minimize the likelihood of accidental destruction during shipping and handling.

3.7 Field Quality Assurance/Quality Control (QA/QC) Samples

Field duplicate samples and equipment rinse blanks will be collected during sampling events as described below. Field duplicates are useful in documenting combined field and laboratory precision. Field equipment rinsate blanks serve to evaluate the effectiveness of field decontamination procedures and should be collected as the final sample of the sampling event.

Duplicate Samples

One field duplicate sample will be collected per sampling event. Field duplicate samples are collected at the same location and time, placed in two different bottle sets, and labeled appropriately for separate analysis at the laboratory. Corresponding duplicate sample pair bottles are filled in alternating quarter-bottle increments to maximize sample homogeneity. Duplicate QC samples will be identified in a manner so as to not represent the sample site location, otherwise known as a single-blind naming convention. Designation of the sampling location where the duplicate sample is taken will be recorded in the groundwater sampling record (Appendix 1) for reference when reviewing sample results. Although the laboratory may suspect the sample is a duplicate, it will not know what sample has been duplicated. MW-99 shall be the universal duplicate blank identification for the Facility.

Equipment Rinsate Blanks

In cases where non-dedicated/non-disposable sampling equipment is used, one field equipment rinsate blank sample will be collected. However, use of a water level measuring probe decontaminated in accordance with Section 3.5 will not in and of itself trigger the requirement for a field rinsate blank. A field equipment rinsate blank is prepared by passing distilled water through the sample collection or measuring equipment, transferring it to appropriate sample containers and returning it to the laboratory for analysis. Should an equipment rinsate blank sample be required, MW-98 shall be the single-blind universal equipment rinsate blank identification for the Facility.

4.0 LABORATORY ANALYSIS AND ANALYTICAL PARAMETERS

4.1 Laboratory Analysis

Laboratory analyses will be completed within the scope of each laboratories' quality assurance manual and analytical procedures, sample handling, and preservation techniques. Analyses are conducted following standard laboratory quality assurance (QA) and quality control (QC) procedures as required by the analytical methods. Laboratory QA/QC review procedures are presented in Section 5.2.2. Laboratory analytical reports are provided in either hardcopy or electronic format.

4.2 Laboratory Analytical Parameters

As specified in TR-06, each groundwater sample will be analyzed in the laboratory for the analytes listed in Table 1, which is based on the State of Colorado Water Quality Control Commission (WQCC) Regulation No. 41 – The Basic Standards for Ground Water, Agricultural Standards Table 3 (December 2016). Regulation No. 41 is periodically updated and the most recent Agricultural Standard values will be used during the sampling event. The laboratory will use analytical methods to achieve detection at or below the applicable state groundwater standard.

Initially, MW-5 was to be monitored for field pH, conductivity and temperature, and in the lab for sulfate, TDS, radium-226 and radium-228. This parameter list was developed based on results from the prior St. Charles River monitoring wells, which have since been proven to not be applicable for GCC monitoring and accordingly plugged and abandoned. Potential indicator parameters for groundwater monitoring were evaluated in a report by Close Consulting Group (2016). The parameter list in Table 1 was established in TR-06, and modified by GCC to also analyze samples for Total Dissolved Solids (TDS) to obtain background data. Numeric Protection Levels other than Table Value Standards may be established by DRMS after a sufficient number of samples have been collected and analyzed.

If there is insufficient volume of water for the complete laboratory analytical list, the first priority will be collection of a sample for dissolved metals analysis, followed by nitrate/nitrite, then unfiltered/unpreserved sample(s) for as many remaining analytes as possible.

5.0 DATA QUALITY, VALIDATION, AND USABILITY

This section describes the data quality objectives and validation process used during review of groundwater data collected at the Site. Tier 3 data validation of laboratory results shall be performed by a third-party contractor on an annual basis, with the data validation report incorporated into the Facility's annual groundwater monitoring report.

5.1 Data Quality Objectives

The following section outlines the QA/QC practices employed by sampling personnel and laboratories to ensure the data collected per this SAP are accurate, precise, representative, and comparable between labs (as required). QA/QC terms are described below as well as the steps that GCC will take to ensure these QA/QC practices are met.

GCC achieves QA/QC requirements by ensuring that field meters are properly maintained and calibrated, accurate measurements and notes are recorded, field QA/QC samples are collected, proper sample collection and decontamination field procedures are performed, and a complete data review and validation (as described in Section 5.2) are performed. Analytical laboratories are expected to follow internal SOPs, perform required QA/QC sample analysis (e.g., method blanks, control samples, matrix spikes, and associated duplicates) and include the QA/QC data in the final analytical report.

The following definitions describe terms typically used for data quality.

Completeness

Completeness is defined as the percentage of laboratory measurements judged to be valid on a method-by-method basis. Data completeness is expressed as the percent of data meeting the necessary objectives and should be greater than or equal to 90 percent. All laboratory reports shall be reviewed to ensure that all requested analytical procedures were carried out and the following information was present in the analytical record:

- Completed chain-of-custody forms with individual samples and analyses identified
- Laboratory reports include data qualifier flags and definitions of qualifier flags
- Laboratory reports include case narratives, and include all laboratory QA/QC tests and results

Accuracy

Accuracy is defined as the closeness of agreement between an observed value and an accepted reference value as reported by a laboratory. When applied to a set of observed values (such as field and laboratory QA sample results), accuracy estimates will reflect a combination of random and systematic (i.e., bias) components. In practice, accuracy estimates rely on a determination of the percent recovery measured in spiked samples:

$$\text{Recovery} = \%R = ((Cs - Cu)/Cn)*100$$

where:

Cs = Measured concentration of the spiked sample

Cu = Measured concentration of the unspiked sample

Cn = Nominal (theoretical) concentration increase resulting from spiking the sample, or the nominal concentration of the lab control sample.

The purpose of reviewing accuracy is to ensure that the laboratories used to analyze samples collected pursuant to this SAP are accurate and meet data quality objectives.

Precision

Precision is defined as the agreement among a set of replicate measurements without assumption or knowledge of the true value. Precision is determined by taking the difference between two measured values and dividing by the average of the two samples to get what is known as the relative percent difference (RPD). The samples used for this assessment should contain concentrations of analyte above the laboratory's reporting limit, and may involve the use of matrix spikes. A quantifiable estimate of precision is made based on the RPD:

$$\text{RPD (\%)} = ((C1 - C2)/C_{Avg})*100$$

where:

C1 = Measured concentration of the first sample

C2 = Measured concentration of the sample duplicate/replicate

C_{Avg} = Average of the two concentrations.

RPD and comparison criteria are described in Section 5.2.1.

5.2 Data Review, Validation and Verification Requirements

Field and laboratory results are reviewed and validated in accordance with the specifications presented in this section. Analytical results are electronically entered into the database or data tables when possible to eliminate transcription errors. Hand entered results are proofed, as necessary, by data validation personnel to address the potential for transcription errors.

5.2.1 Data Validation

Analytical data are validated and verified to assess how well the data satisfy data quality objectives for accuracy, precision and completeness specified by this SAP and the analytical laboratory. Conditions requiring the invalidation of analytical data are rare, as noted in the following sections. However, conditions necessitating qualifying (flagging) data in the data transmittal are more common and will be evaluated based on the following criteria. Qualified data are valid and usable in every way, but are flagged to alert the user that special care may apply to their use in interpretations.

Two types of data qualifiers are recognized for environmental samples, including: 1) flags placed on results by the laboratory to denote problems with associated blanks, spikes, etc. (i.e., laboratory flags), and 2) flags placed by data validation personnel to denote problems or issues associated with sample collection, site conditions or documentation (i.e., validation flags).

Documentation Reviews

Samples are analyzed within the required holding time limits specified in the analytical method or the appropriate reference. Samples are preserved in accordance with applicable method specifications. Samples not analyzed within specified holding time limits, and/or not appropriately preserved, are invalidated unless professional judgment dictates that flagging would be more appropriate (e.g., consistent with historic observations).

Field QA Sample Review

The preparation of an equipment rinsate blank is required when sampling groundwater with reusable sampling equipment. However, use of a water level measuring probe decontaminated in accordance with Section 3.5 will not in and of itself trigger the requirement for a field rinsate blank. Flagging is not required when fewer field blanks than required are collected, but a QA memo will be included with the data. However, sample results associated with contaminated equipment rinsate blanks (i.e., samples collected prior to the equipment blank's preparation) are flagged if the sample blank concentration exceeds 10% of the sample concentration. Further, sample results may be invalidated if the blank concentration exceeds 50% of the sample concentration. Data are not flagged if the sample concentration is below the reporting limit, regardless of the blank concentration, because the sample is not cross-contaminated. Sample concentrations are not corrected by subtracting blank concentrations.

Field duplicates are samples intended to assess variations due to sample collection, handling or analysis. It is recognized that natural variations in the environment can cause variations in concentrations. Field duplicate concentrations should agree with one another as described below:

Relative Concentration Relationship	Criterion
Concentrations < 5 Times the Reporting Limit	± Reporting Limit
Concentrations > 5 Times the Reporting Limit	RPD (± 50% for metals, ±20% for other analytes)

The RPD (Relative Percent Difference) is calculated with the following equation:

$$RPD (\%) = ((C1 - C2)/C_{Avg})*100$$

where:

C1 = Measured concentration of the first sample

C2 = Measured concentration of the sample duplicate/replicate

C_{Avg} = Average of the two concentrations.

Duplicated sample results that do not meet the above criteria and are not consistent with historical results are flagged. Flagging is not required when fewer field duplicates than required are collected, but a QA memo is filed with the data and the incident is noted in the data transmittal for the sampling event.

5.2.2 Laboratory Data Verification

Laboratory data reports are reviewed for appropriate QA/QC procedures and data qualifiers. Applicable U.S. Environmental Protection Agency (EPA) analytical methods encourage laboratories to develop in-house QA/QC limits, and require adherence to in-house limits for data reporting, qualifying and corrective actions. Verification of appropriate laboratory flagging is conducted during data validation.

Although it is the laboratory's responsibility to ensure that its results meet minimum internal QA/QC standards and are properly flagged, the data validation process also includes the following checks:

- Confirm that all sample sites and constituents are reported and that there is an explanation for a missing data point.

- Review the data report and confirm that titles, labels, column headings, and footnotes are accurate and complete. Confirm that constituents are reported in proper units.
- Review values reported as Non-Detected. Confirm that the analytical detection limits are low enough to accomplish project goals. Confirm that all values are either reported as values or less than the detection limit. Confirm that the detection limit is used consistently on all samples.
- Ensure that the required quality control tests (i.e., preparation and calibration blanks, laboratory control standards, matrix spikes and duplicate samples) were performed at the required frequency. If quality control results cannot be obtained from the laboratory, all associated data are qualified or invalidated.
- Ensure that initial calibration verification and reference sample test results were within laboratory specified control limits. Any data reported with associated initial calibration verification or reference standards that are outside of control limits are invalidated.
- Confirm that the laboratory properly qualified (flagged) the data.
- Review data for internal consistency. Confirm that values have a logical relationship to one another. Confirm that values are within the historical range of data for a given well and constituent. Confirm that values vary logically according to known geologic conditions.

6.0 REPORTING

For data evaluation and storage, the data collected, including recorded field parameters, will be transferred to a computerized database after being validated. This will facilitate data evaluation, reporting, graphic demonstration, and statistical analysis.

After the results are reviewed internally for QA/QC, quarterly and semi-annual data will be made available to the DRMS. An annual report will be prepared and submitted to DRMS by January 31of the following year. The annual report will summarize data and findings for the year, as well as include the annual data validation report.

DRMS requires a written report with five (5) working days when there is evidence of an exceedance of applicable groundwater standards (following data validation for the subject analytes). Current groundwater standards applicable to the GCC facility are Colorado Table Value Standards (TVS) for agricultural use, some of which are specific to a particular use or application of the water. Therefore, GCC will coordinate with DRMS on whether or not levels of certain analytes constitute an exceedance requiring reporting. After a sufficient number of samples have been analyzed for a particular well, DRMS may establish Numeric Protection Levels that differ from the TVS.

7.0 REFERENCES

Brown and Caldwell, Inc., 2003. Condition #1 Groundwater Sampling Plan, GCC Rio Grande, Inc. Red Rock Plant and Limestone Mine, February 2003.

Close Consulting Group LLC, 2016. Groundwater Monitoring Evaluation for the GCC Pueblo Plant and Quarry, Letter Report to LRRC, March 17.

Close Consulting Group LLC, 2018. Groundwater Monitoring Well Installation and Baseline Sampling: MW-6 and MW-7, Letter Report to GCC, February 8.

Collom, C.J., 2000. Geologic Considerations Pertaining to the Mining of Fort Hays Limestone for the Manufacturing of Portland Cement in Pueblo County, Colorado. Prepared for Rio Grande Portland Cement, August, 14 p.

Contour Consulting Engineering LLC, 2013. Geologic Report and Submittal, Response to DRMS Letter dated 29 November 2012 regarding: Pueblo Cement Plant and Limestone Quarry, Permit No. M-2002-004, Exceedance of Groundwater Numeric Protection Levels.

Colorado Department of Public Health and Environment, Water Quality Control Commission, 2016. Regulation No. 41, The Basic Standards for Ground Water (5 CCR 1002-41), December 30.

Colorado Department of Public Health and Environment, Water Quality Control Division, Undated. Suggested Sampling Protocol for Ground Water Monitoring Wells.

Resource Hydrogeologic Services, Inc., Technical Memorandum – GCC Rio Grande, Inc. Pueblo Cement Plant MW-8 Installation, March 2020.

TABLES

Table 1. GCC Rio Grande Pueblo Plant Groundwater Analytical Parameters

Parameter[1]	Standard[2]	Method Detection Limit	Analytical Method
Laboratory			
Aluminum (Al)	5 mg/l	0.03 mg/l	M200.7 ICP
Arsenic (As)	0.1 mg/l	0.04 mg/l	M200.7 ICP
Beryllium (Be)	0.1 mg/l	0.01 mg/l	M200.7 ICP
Boron (B)	0.75 mg/l	0.01 mg/l	M200.7 ICP
Cadmium (Cd)	0.01 mg/l	0.005 mg/l	M200.7 ICP
Chromium (Cr)	0.1 mg/l	0.01 mg/l	M200.7 ICP
Cobalt (Co)	0.05 mg/l	0.01 mg/l	M200.7 ICP
Copper (Cu)	0.2 mg/l	0.01 mg/l	M200.7 ICP
Fluoride (F)	2 mg/l	0.05 mg/l	SM4500F-C
Iron (Fe)	5 mg/l	0.02 mg/l	M200.7 ICP
Lead (Pb)	0.1 mg/l	0.03 mg/l	M200.7 ICP
Lithium (Li)	2.5 mg/l	0.008 mg/l	M200.7 ICP
Manganese (Mn)[4]	0.2 mg/l	0.005 mg/l	M200.7 ICP
Mercury (Hg)	0.01 mg/l	0.0002 mg/l	M245.1 CVAA
Nickel (Ni)	0.2 mg/l	0.008 mg/l	M200.7 ICP
Nitrite (NO_2 -N)	10 mg/l	0.01 mg/l	M353.2
Nitrite & Nitrate (NO_2 +NO_3 -N)	100 mg/l	0.02 mg/l	M353.2
Selenium (Se)	0.02 mg/l	0.0001 mg/l	M200.8 ICP-MS
Vanadium (V)	0.1 mg/l	0.005 mg/l	M200.7 ICP
Zinc (Zn)	2 mg/l	0.01 mg/l	M200.7 ICP
pH[3]	6.5 - 8.5	--	SM4500H^+B
Total Dissolved Solids	--	10 mg/l	SM2540C
Field			
pH	6.5 - 8.5	--	--
Conductivity	--	--	--
Temperature	--	--	--

Notes:

1. **Laboratory analyses are dissolved concentrations**
2. **State of Colorado Water Quality Control Commission (WQCC) Regulation No. 41 – The Basic Standards for Ground Water, Agricultural Standards Table 3 (December 2016).**
3. **Only if field pH is not measured**
4. **This standard is only applicable where acidic soils exist**

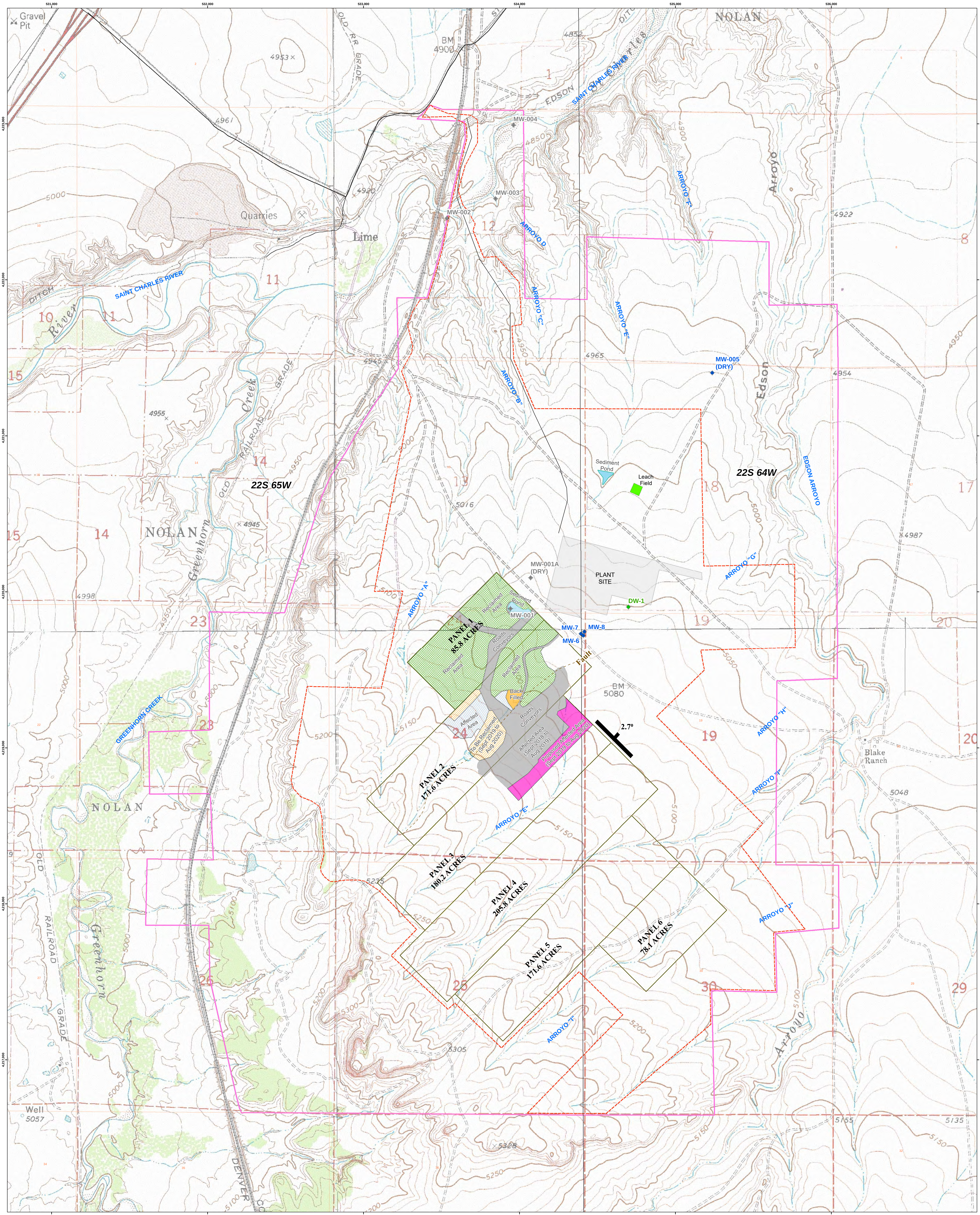
Table 2. Water sample hold times by analytical method, GCC Rio Grande Pueblo Plant GW-Compliance Suite.

Parameter	Analytical Method	Holding Times (days)
Aluminum (d)	M200.7 ICP	180
Arsenic (d)	M200.7 ICP	180
Beryllium (d)	M200.7 ICP	180
Boron (d)	M200.7 ICP	180
Cadmium (d)	M200.7 ICP	180
Chromium (d)	M200.7 ICP	180
Cobalt (d)	M200.7 ICP	180
Copper (d)	M200.7 ICP	180
Iron (d)	M200.7 ICP	180
Lead (d)	M200.7 ICP	180
Lithium (d)	M200.7 ICP	180
Manganese (d)	M200.7 ICP	180
Mercury (d)	M245.1 CVAA	28
Nickel (d)	M200.7 ICP	180
Selenium (d)	M200.8 ICP-MS	180
Vanadium (d)	M200.7 ICP	180
Zinc (d)	M200.7 ICP	180
Total Dissolved Solids	SM2540C	7
Fluoride (d)	SM4500F-C	28
Nitrite (d)	M353.2	2
Nitrite & Nitrate as N (d)	M353.2	28

Notes:

1. **(d) = dissolved concentrations**

FIGURES



- ◆ Existing Monitoring Well
- ✦ Abandoned Monitoring Well
- ✦ Dakota Formation Production Well
- Fault
- Local roads
- Major roads
- Railroads
- 🟩 Leach Field
- ☐ Property Boundary
- ☐ Permit Boundary
- ☐ Mine Panels
- ☐ Plant Site
- ☐ Township
- ☐ Section
- Strike and Degree Dip (Base of Fort Hayes)
- ▨ Affected
- ■ Affected Area (Sept 2018 to Aug 2019)
- 🟧 Back Filled
- ■ Proposed Affected Area (Sept 2019 to Aug 2020)
- ▨ Reclaimed
- ■ Detention Pond
- ▨ To Be Reclaimed (Sept 2019 to Aug 2020)

Project Information:
Coordinate System: NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
Datum: North American 1983
Units: Meter

Data Source:
GCC, NHD

Scale:
1 inch = 600 feet

N

0 1,000 2,000 3,000
Feet

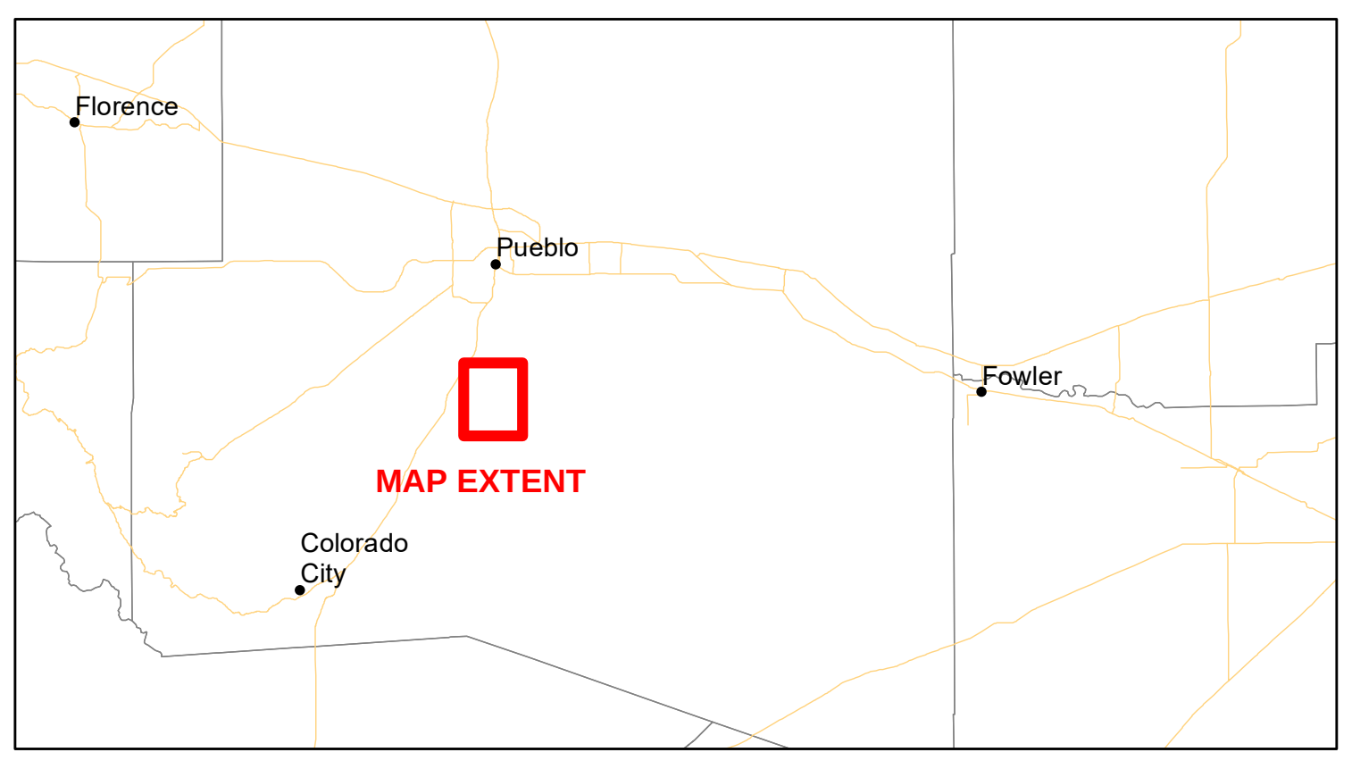


FIGURE 1

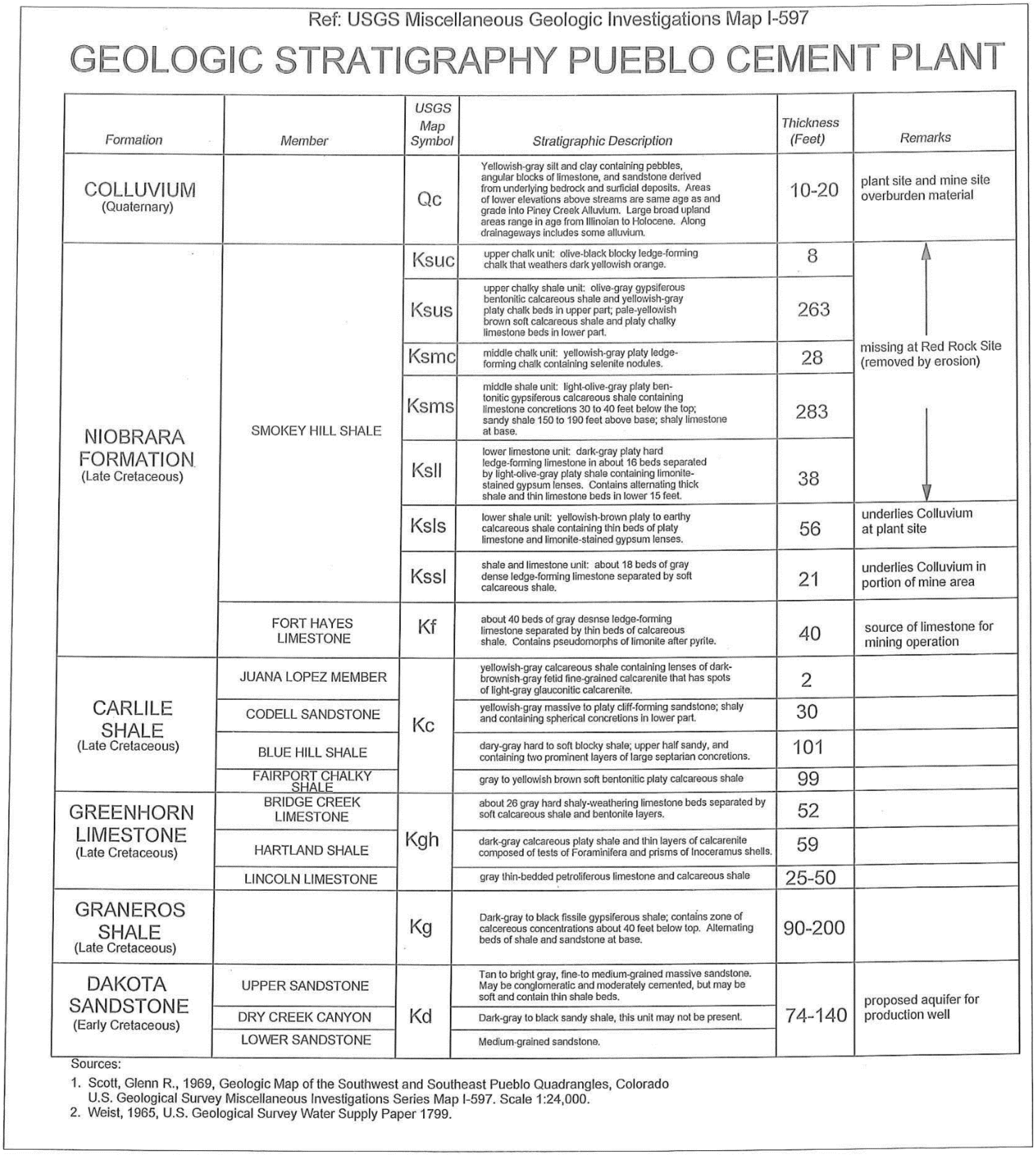
GCC Rio Grande

GCC Rio Grande Pueblo Plant
Pueblo County, CO

DATE: 3/6/2020
BY: MDK
CHECKED: LJB

RESOURCE HYDROGEOLOGIC SERVICES

Figure 2. Site stratigraphic section (from Contour Consulting Engineering LLC Geologic Report and Submittal, January 25, 2013) (2013-01-28_HYDROLOGY – M2002004)



Ref: USGS Miscellaneous Geologic Investigations Map I-597

GEOLOGIC STRATIGRAPHY PUEBLO CEMENT PLANT

Formation	*Member*	*USGS Map Symbol*	*Stratigraphic Description*	*Thickness (Feet)*	*Remarks*
COLLUVIUM (Quaternary)		Qc	Yellowish-gray silt and clay containing pebbles, angular blocks of limestone, and sandstone derived from underlying bedrock and surficial deposits. Areas of lower elevations above streams are same age as and grade into Piney Creek Alluvium. Large broad upland areas range in age from Illinoian to Holocene. Along drainageways includes some alluvium.	10-20	plant site and mine site overburden material
NIOBRARA FORMATION (Late Cretaceous)	SMOKEY HILL SHALE	Ksuc	upper chalk unit: olive-black blocky ledge-forming chalk that weathers dark yellowish orange.	8	missing at Red Rock Site (removed by erosion)
		Ksus	upper chalky shale unit: olive-gray gypsiferous bentonitic calcareous shale and yellowish-gray platy chalk beds in upper part; pale-yellowish brown soft calcareous shale and platy chalky limestone beds in lower part.	263	
		Ksmc	middle chalk unit: yellowish-gray platy ledge-forming chalk containing selenite nodules.	28	
		Ksms	middle shale unit: light-olive-gray platy bentonitic gypsiferous calcareous shale containing limestone concretions 30 to 40 feet below the top; sandy shale 150 to 190 feet above base; shaly limestone at base.	283	
		Ksll	lower limestone unit: dark-gray platy hard ledge-forming limestone in about 16 beds separated by light-olive-gray platy shale containing limonite-stained gypsum lenses. Contains alternating thick shale and thin limestone beds in lower 15 feet.	38	
		Ksls	lower shale unit: yellowish-brown platy to earthy calcareous shale containing thin beds of platy limestone and limonite-stained gypsum lenses.	56	underlies Colluvium at plant site
		Kssl	shale and limestone unit: about 18 beds of gray dense ledge-forming limestone separated by soft calcareous shale.	21	underlies Colluvium in portion of mine area
	FORT HAYES LIMESTONE	Kf	about 40 beds of gray desnse ledge-forming limestone separated by thin beds of calcareous shale. Contains pseudomorphs of limonite after pyrite.	40	source of limestone for mining operation
CARLILE SHALE (Late Cretaceous)	JUANA LOPEZ MEMBER	Kc	yellowish-gray calcareous shale containing lenses of dark-brownish-gray fetid fine-grained calcarenite that has spots of light-gray glauconitic calcarenite.	2	
	CODELL SANDSTONE		yellowish-gray massive to platy cliff-forming sandstone; shaly and containing spherical concretions in lower part.	30	
	BLUE HILL SHALE		dary-gray hard to soft blocky shale; upper half sandy, and containing two prominent layers of large septarian concretions.	101	
	FAIRPORT CHALKY SHALE		gray to yellowish brown soft bentonitic platy calcareous shale	99	
GREENHORN LIMESTONE (Late Cretaceous)	BRIDGE CREEK LIMESTONE	Kgh	about 26 gray hard shaly-weathering limestone beds separated by soft calcareous shale and bentonite layers.	52	
	HARTLAND SHALE		dark-gray calcareous platy shale and thin layers of calcarenite composed of tests of Foraminifera and prisms of Inoceramus shells.	59	
	LINCOLN LIMESTONE		gray thin-bedded petroliferous limestone and calcareous shale	25-50	
GRANEROS SHALE (Late Cretaceous)		Kg	Dark-gray to black fissile gypsiferous shale; contains zone of calcereous concentrations about 40 feet below top. Alternating beds of shale and sandstone at base.	90-200	
DAKOTA SANDSTONE (Early Cretaceous)	UPPER SANDSTONE	Kd	Tan to bright gray, fine-to medium-grained massive sandstone. May be conglomeratic and moderately cemented, but may be soft and contain thin shale beds.	74-140	proposed aquifer for production well
	DRY CREEK CANYON		Dark-gray to black sandy shale, this unit may not be present.		
	LOWER SANDSTONE		Medium-grained sandstone.		

Sources:

1. Scott, Glenn R., 1969, Geologic Map of the Southwest and Southeast Pueblo Quadrangles, Colorado U.S. Geological Survey Miscellaneous Investigations Series Map I-597. Scale 1:24,000.
2. Weist, 1965, U.S. Geological Survey Water Supply Paper 1799.

APPENDICES

GROUNDWATER SAMPLING RECORD

SAMPLE No.

Project No:

Location:

Page of

Date:

Weather Conditions:

Personnel:

Comments:

INSTRUMENTS USED

Instrument	Manufacturer/Model	Serial No.	Calibration	
Water Level Probe				
pH Meter			Std: 4 7 10 @________°C Reading ____________	Slope:
pH Meter			Std: 4 7 10 @________°C Reading ____________	
Conductivity Meter			Std: ____________uS @ 25 °C Reading ____________	
Conductivity Meter			Std: ____________uS @ 25 °C Reading ____________	
Temperature				
Other:				

Filtration 0.45 micron in-line high capacity disposable filter.

WELL PURGING INFORMATION

Casing Diameter (inches): | Borehole Diameter (inches): | Screened Interval (ft. BGL):

Depth to Water (ft below MP): | Total Depth (ft): | Casing Volume (gal): (gal/ft: 1.5" = 0.092; 2" = 0.163; 4" = 0.653)

Purging Method:

Comments: Monitoring point (MP) is the top of the PVC well casing.

Date/ Time	Vol. Purged (gal)	Depth to Water (feet below MP)	pH	Conductivity (uS @ 25 deg C)	Temp (deg C)	Appearance (color, sediment, etc.)	Comments

Cumulative Volume Purged: (gallons) (casing vol)

WELL SAMPLING INFORMATION

Sampling Equipment:

Comments:

SAMPLING MEASUREMENTS:

Date/ Time	Depth to Water (feet below MP)	Depth Sampled (feet below MP)	pH	Conductivity (uS @ 25 deg C)	Temp (deg C)	Other	Other	Comments

SAMPLE HANDLING:

Date/ Time	Aliquots			Filtered (Y/N)	Preserved (type)	Comments
	Volume (ml)	Bottle Composition	Quantity			

Field QA/QC Samples Collected (type, Sample No.):

Equipment Decontamination:

Waste Disposal:

Signature of Field Personnel:

GCC RIO GRANDE, INC.
Pueblo, CO

GCC	**Creation Date:** 02/18/2020	**Revision Date:** 2/19/2020
	Control Number: PUE.EN.P.003.01	**Page:** 1 of 6

Title: GCC Rio Grande Pueblo Plant Groundwater Monitoring Well Compliance Sampling

1.0 SCOPE

This procedure covers the process for obtaining and submitting groundwater monitoring well samples to an analytical lab as required by the DRMS approved Sampling and Analysis Plan (SAP).

2.0 REFERENCES AND RELATED DOCUMENTS

PUE.SA.P.015 Workplace Examinations
PUE.SA.F.005 Workplace Examination
PUE.EN.D.026 SAP for Groundwater Monitoring

3.0 RESPONSIBILITY

N/A

4.0 TRAINING REQUIREMENTS

Read and understand these procedures. Contact the Environmental Engineer if you have questions regarding these instructions.

5.0 REPORTING AND COMMUNICATION

All groundwater sampling records (field form) are provided to the GCC Environmental Engineer who will store the electronic versions on the Pueblo Environmental Shared Drive.

All analytical will be stored on the Pueblo Environmental Shared Drive upon receipt from the lab.

6.0 DEFINITIONS

N/A

7.0 MATERIALS AND EQUIPMENT

- PPE
- Wellhead lock key(s) or combination number
- Clipboard and groundwater sampling record (field form), multiple indelible ink pens & markers
- Phone/camera/calculator
- Calibrated water quality meter (YSI Pro 1030 or similar) and accessories, calibration fluids
- Graduated cylinder
- Water level indicator
- 1.25” X 36” disposable poly bailer(s), new in factory plastic bag
- Bailer nylon cord/twine, new/unused on roll stored in clean plastic bag
- Peristaltic pump (Geotech Geopump or similar) & power cable accessories
- 0.45 µm filters, approximately 5-foot length of new 3/8” ID silicone, Tygon or other peristaltic pump-appropriate environmental-grade tubing
- 1-gallon new, disposable poly cubitainer(s)
- Sample cooler with “GW-Compliance” bottle sets (bring spares!) and bagged ice
- Ziploc bags for ice and COC
- Clear packing tape

- COC's, custody seals
- Box or bag of disposable nitrile gloves
- Hand sprayers – (1) with Liquinox solution, (1) with distilled water
- Roll of paper towels
- Graduated 3 to 5-gallon bucket

8.0 PROCEDURE

1) **Prior to day of sampling, obtain necessary equipment and materials (listed below in following section) to sample groundwater monitoring wells per compliance requirements.**
2) **Calibrate YSI Pro 1030 (or similar) water quality meter for pH and specific conductivity per manufacturer's instructions in office or lab setting prior to going to field.**
3) **Complete Workplace Examination, per PUE.SA.P.015, and review with crew.**
4) **Observe and document in official record (Groundwater Sampling Record) any unusual conditions at or near well, especially including potential signs of tampering such as unlocked wellhead, removed cap, damage, etc. Take photo(s) as needed.**
5) **Set up sampling station**
   a) Place water level indicator (WLI) and bailer (still in sealed factory bag) beside well.
   b) Place graduated bucket for purge water collection & volume measurement nearby.
   c) Place cooler containing bags of ice, "GW-Compliance" sample bottle set(s), bag or box of disposable nitrile gloves, sealed new 0.45 µm filter(s), sealed new syringe(s), and bailer cord nearby.
6) **Measure and record well water level and well head stick-up**
   a) Unlock wellhead padlock. Remove wellhead cap or j-plug.
   b) Measure depth to water (DTW) with *clean/decontaminated* WLI to the hundredth of foot from top of casing. Record value on GW Sampling Record.
   c) Measure and record total depth of well (TD) with WLI from top of casing.
   d) Measure and record well head stick-up (SU) from ground surface to top of casing.
   e) Clean/decontaminate probe and tape with Liquinox detergent solution followed by distilled water rinse when done with use at this well.
   f) If no water is present in well when measured, or water level is found to be within 0.25 feet of well TD (the distance between the lowest screen slot and well bottom cap), this monitoring event shall be designated "dry" on the Groundwater Monitoring Record. No collection of water quality field parameters or a sample for lab analysis is possible. Retrieve and decontaminate WLI, secure wellhead and rig down all monitoring equipment.
7) **Calculate three-wellbore volume purge**
   a) Calculate water column height as TD – DTW = WC, where

      TD is total depth (ft) measured from top of casing (TOC)
      DTW is depth to water (ft) measured from top of casing (TOC)
      WC is water column (ft)

b) Calculate volume of WC as WC X 0.163 = 1WBV, where

WC is water column (ft)
0.163 is multiplier for gallons per foot (gal/ft) for a 2" schedule 40 well
1WBV is a single wellbore volume (gal)

c) Calculate purge volume of prior to sampling as 1WBV X 3 = 3WBV, where

1WBV is a single wellbore volume (gal)
3WBV is three wellbore volumes (gal)

d) Record calculated single and triple wellbore volumes on the GW Sampling Record.

8) Bail well & measure water quality parameters

a) With clean disposable nitrile gloves, tear the bailer plastic bag open at the bail end (top) to expose only the bailer cord tie-off location.

b) Securely tie bailer cord to bailer and remove bailer from bag, taking care to not touch the bailer to anything prior to inserting it into the well.

c) Lower bailer into well at a rate that is manageable to keep bailer cord from tangling until it reaches the well water level. Allow the bailer to fill by submerging under its own weight at least the length of the bailer or otherwise until the bailer stops at the bottom of the well in the case of a short WC.

d) Retrieve the bailer by pulling/winding the cord, taking care to not allow the cord to touch any potentially contaminating surfaces. When bailer is at surface it should be full of water, or at least to the level it was submerged. If not, the check valve ball may have not seated properly due to debris. Inspect and rinse with distilled water as necessary. Replace bailer as necessary.

e) Dump bailer water from top of bailer to graduated bucket. The approximate full volume of a 1.25" X 36" bailer is 0.2 gallons.

f) Lower bailer back into well and allow it to submerge completely to fully fill.

g) Repeat steps 7c through 7e to purge well towards target production of 3 WBV.

h) Collect purge water for water quality field parameter measurement with the *calibrated* multi-parameter water quality meter: temperature (T), pH, specific conductance (SC), after at minimum each 20% towards the total 3 WBV target production. For example, if the 3 WBV is 15 gallons, WQ parameter readings should be recorded at approximately 3, 6, 9, 12, and 15 gallons. If the well has only a short water column (limited volume) and is low-yield, a single full bailer volume may exceed 20% of the expected target production. In this case collect and document the specified water quality field parameters with each bailer produced. Record each of these purge WQ measurements on the GW Sampling Record. At these times also measure and record DTW.

i) Monitor the individual water quality field parameters for stabilization over 3 consecutive measurements according to the following:

Temperature (10%)

Specific Conductance (10%)

pH (± 0.2 unit)

No more than 5 well volumes need to be removed prior to sample collection in the event of failure to reach stabilization criteria.

9) **If well goes dry before field parameter stabilization or 5 WBV, recap and secure well and allow well to recover for up to 24 hours. Monitor DTW for adequate recovery. If recovered within 24 hours (same or next day), no further purging is required so move to step 10 below. If the well does not recover within 24 hours, this monitoring event shall be designated "dry following purge" on the Groundwater Monitoring Record. No collection of a sample for lab analysis is possible, however the field water quality parameters collected during the purge shall be retained on the Groundwater Monitoring Record. Retrieve and decontaminate WLI, secure wellhead and rig down all monitoring equipment.**

10) **Collect final field parameters and sample**

    a) When stabilization criteria are met or 5 WBV have been purged, log one sample for all default parameters on the multi-parameter water quality meter naming the log for the appropriate monitoring well ID (i.e. MW-6). Download and email the export data file at completion of daily sampling activities to the GCC Environmental Engineer.

    b) There are 3 individual bottles in the "GW-Compliance" bottle set to be filled. Label all sample bottles by completing labels with indelible ink pen or marker prior to filling. Alternatively, the labeling may be made by writing directly on the bottles. Information shall include:

        - Site or project name (GCC Rio Grande)
        - Sample ID
        - Sample collection date and time
        - Sampler's initials

    c) Bail to fill at least ¼ the 1-gallon new, disposable poly cubitainer, which is the sample transfer container to be used for this groundwater bailer sample collection methodology.

    d) Load the 3/8" peristaltic tubing through the peristaltic pump head unit per manufacturer's instructions, keeping both tubing ends from touching any contaminating materials.

    e) Insert one end of the 3/8" peristaltic pump tubing into the cubitainer, keeping this suction end submerged.

    f) Attach the inlet side of the 0.45 µm filter (observe flow arrow on filter) to the other end of the peristaltic pump tubing.

    g) Operate the peristaltic pump per manufacturer's instructions producing water to flush air from the 0.45 µm filter and fill with sample water until the filter is producing water. Confirm there are no visible particulates flowing in the water from the filter outlet.

    h) Fill the 125 ml poly preserved bottle to the bottleneck and cap immediately. There is acid preservative in this container. Do not over-fill or spill the preservative – if this does happen then take a replacement 125 ml poly preserved bottle from a spare bottle set and repeat fill procedure.

    i) Fill the 250 ml poly unpreserved bottle from the 0.45 µm filter outlet to the bottleneck and cap immediately.

    j) Stop the peristaltic pump and remove the tubing from the cubitainer.

k) Fill the 500 ml poly unpreserved bottle to the neck directly from the cubitainer and immediately cap.

l) Label each bottle with actual the sample time, coordinated with the final logged water quality field parameters readings.

m) IF AT ANY POINT A BOTTLE CAP GETS DROPPED ON THE GROUND, RAINED ON, ETC. – simply triple rinse the cap (inside and out) with excess sample water from the bailer to decontaminate. Bail more water if necessary. Confirm no debris is on the cap and then screw it onto the bottle. If the cap is dropped into a known or suspected contaminant, then do not take a chance and simply replace the contaminated cap from a bottle from a spare bottle set.

11) Collect QA/QC field duplicate sample

a) For each quarterly compliance groundwater monitoring event (up to 10 monitoring locations to meet 10% minimum QA/QC standard), one randomly selected, blind duplicate sample shall be collected and submitted for laboratory analysis by the “GW-Compliance” suite.

b) Fill the bottles for the duplicate sample in sequence of the “normal” sample that is being duplicated by using the procedure in step 10. Batching is recommended for efficiency with field-filtered samples.

c) Name the sample MW-99 (to make the sample ID “blind” from the lab) and assign it a sample time of + one hour of the duplicated sample collection time(i.e. 12:00 for standard sample, 13:00 for the duplicate), also to aid in keeping the sample identification blind from the lab.

12) Rig down sampling equipment

a) Reel up WLI and decontaminate probe and tape exposed to water with Liquinox solution spray and spray-rinse with distilled water.

b) Place used bailer and cord, 0.45 µm filter, tubing, cubitainer and miscellaneous consumables into a trash bag for appropriate disposal.

c) Decontaminate multi-parameter water quality meter probes by spraying with Liquinox solution followed by spraying with distilled water until no suds remain. Prepare meter probes for long-term storage per manufacturer’s instructions.

13) Prep sample for submittal to analytical lab

a) Note laboratory analysis holding times for “GW-Compliance” suite, specifically nitrite/nitrate analysis which requires samples to be received by lab within 48 hours of the sample collection time. **This requires each sample to be shipped by overnight service by the conclusion of the day it was collected!**

b) Place all 3 filled and labeled sample bottles into the original lab-provided bottle set bag or otherwise a gallon-size Ziploc bag and place in cooler under ice. Label bag with the same information on the individual bottle labeling in indelible ink. Ice should be in multiple gallon-size Ziploc bags. Package so that all bottles are secure to prevent movement during shipping. It is very important that these samples get under ice as soon as possible after collection and arrive to the lab between 0°C - 4°C. NEVER DUAL-PURPOSE THE SAMPLE COOLER FOR FOOD OR DRINKS!

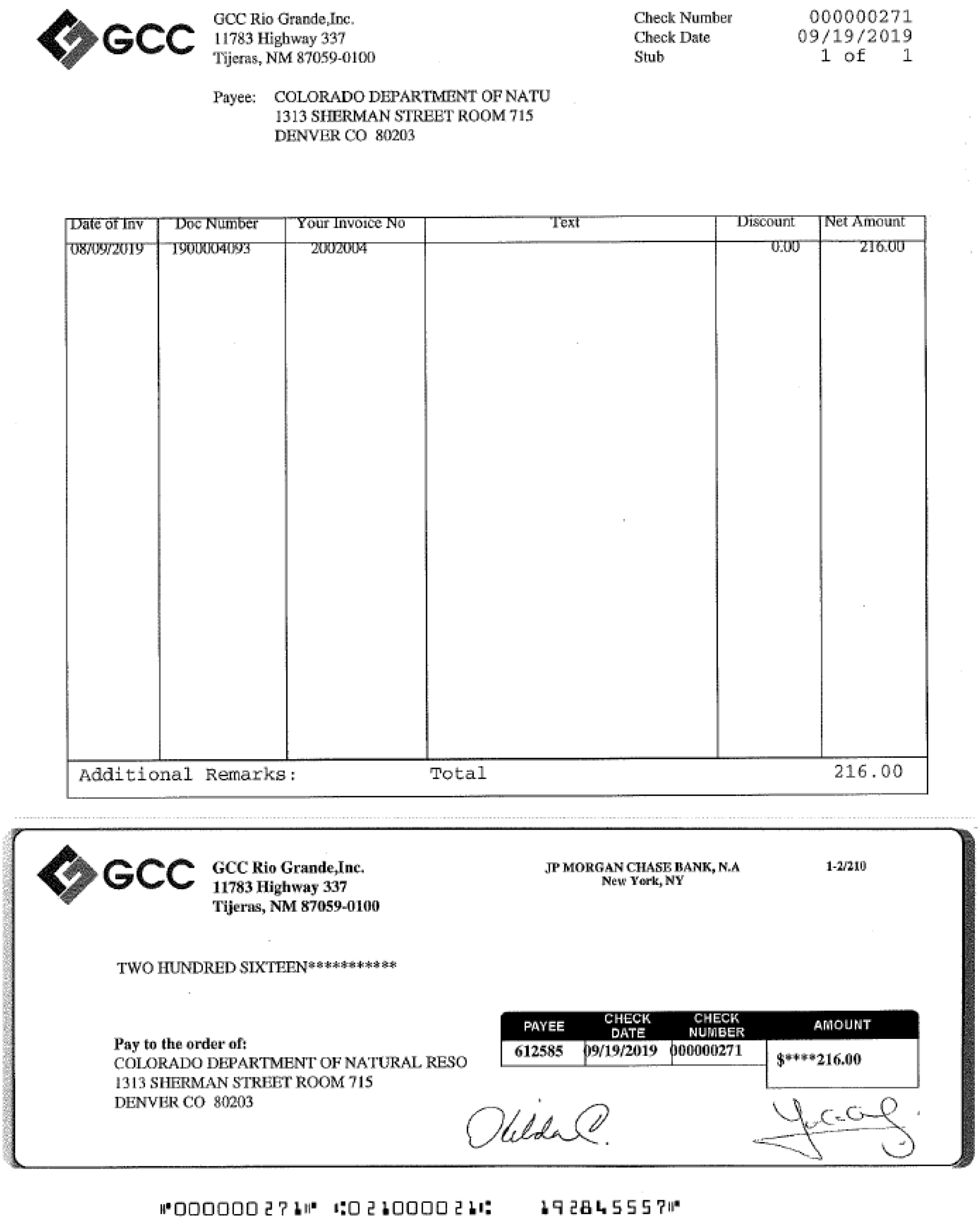
c) Complete the Chain of Custody (COC) for the lab using the official sample ID, the sample date and time, the matrix “Groundwater” checked, the number of containers (3). Enter

"GW-Compliance" for analysis request and check the box. Complete all header information using GCC Rio Grande site contact information with project contact person as the GCC Environmental Engineer. Sign "Relinquished By" and date/time and retain the carbon copy (yellow) for your records. If no carbon copy exists, make a photocopy for your records. Place the COC inside a sealed 1-gallon Ziploc bag inside the cooler at the top of the contents. Complete custody seal by signing and dating and adhering across the cooler lid to cooler body. Using clear packing tape, secure lid closed, also covering and securing the custody seal.

d) Ship cooler to lab via overnight service by GCC-approved commercial courier (i.e. UPS) utilizing tracking with email copies to sampler, the lab project manager and GCC Environmental Engineer.

ATTACHMENT 1

Check for Application Fee



GCC Rio Grande,Inc.
11783 Highway 337
Tijeras, NM 87059-0100

Check Number	000000271
Check Date	09/19/2019
Stub	1 of 1

Payee: COLORADO DEPARTMENT OF NATU
1313 SHERMAN STREET ROOM 715
DENVER CO 80203

Date of Inv	Doc Number	Your Invoice No	Text	Discount	Net Amount
08/09/2019	1900004093	2002004		0.00	216.00
Additional Remarks:			Total		216.00

GCC Rio Grande,Inc.
11783 Highway 337
Tijeras, NM 87059-0100

JP MORGAN CHASE BANK, N.A
New York, NY

1-2/210

TWO HUNDRED SIXTEEN***********

Pay to the order of:
COLORADO DEPARTMENT OF NATURAL RESO
1313 SHERMAN STREET ROOM 715
DENVER CO 80203

PAYEE	CHECK DATE	CHECK NUMBER	AMOUNT
612585	09/19/2019	000000271	$****216.00

⑈000000271⑈ ⑆021000021⑆ 192845557⑈

GCC	**Creation Date:** 02/18/2020	**Revision Date:** 2/19/2020
	Control Number: PUE.EN.P.003.01	**Page:** 1 of 6

Title: **GCC Rio Grande Pueblo Plant Groundwater Monitoring Well Compliance Sampling**

1.0 SCOPE

This procedure covers the process for obtaining and submitting groundwater monitoring well samples to an analytical lab as required by the DRMS approved Sampling and Analysis Plan (SAP).

2.0 REFERENCES AND RELATED DOCUMENTS

PUE.SA.P.015 Workplace Examinations
PUE.SA.F.005 Workplace Examination
PUE.EN.D.026 SAP for Groundwater Monitoring

3.0 RESPONSIBILITY

N/A

4.0 TRAINING REQUIREMENTS

Read and understand these procedures. Contact the Environmental Engineer if you have questions regarding these instructions.

5.0 REPORTING AND COMMUNICATION

All groundwater sampling records (field form) are provided to the GCC Environmental Engineer who will store the electronic versions on the Pueblo Environmental Shared Drive.

All analytical will be stored on the Pueblo Environmental Shared Drive upon receipt from the lab.

6.0 DEFINITIONS

N/A

7.0 MATERIALS AND EQUIPMENT

- PPE
- Wellhead lock key(s) or combination number
- Clipboard and groundwater sampling record (field form), multiple indelible ink pens & markers
- Phone/camera/calculator
- Calibrated water quality meter (YSI Pro 1030 or similar) and accessories, calibration fluids
- Graduated cylinder
- Water level indicator
- 1.25” X 36” disposable poly bailer(s), new in factory plastic bag
- Bailer nylon cord/twine, new/unused on roll stored in clean plastic bag
- Peristaltic pump (Geotech Geopump or similar) & power cable accessories
- 0.45 µm filters, approximately 5-foot length of new 3/8” ID silicone, Tygon or other peristaltic pump-appropriate environmental-grade tubing
- 1-gallon new, disposable poly cubitainer(s)
- Sample cooler with “GW-Compliance” bottle sets (bring spares!) and bagged ice
- Ziploc bags for ice and COC
- Clear packing tape

- COC's, custody seals
- Box or bag of disposable nitrile gloves
- Hand sprayers – (1) with Liquinox solution, (1) with distilled water
- Roll of paper towels
- Graduated 3 to 5-gallon bucket

8.0 PROCEDURE

1) **Prior to day of sampling, obtain necessary equipment and materials (listed below in following section) to sample groundwater monitoring wells per compliance requirements.**

2) **Calibrate YSI Pro 1030 (or similar) water quality meter for pH and specific conductivity per manufacturer's instructions in office or lab setting prior to going to field.**

3) **Complete Workplace Examination, per PUE.SA.P.015, and review with crew.**

4) **Observe and document in official record (Groundwater Sampling Record) any unusual conditions at or near well, especially including potential signs of tampering such as unlocked wellhead, removed cap, damage, etc. Take photo(s) as needed.**

5) **Set up sampling station**

    a) Place water level indicator (WLI) and bailer (still in sealed factory bag) beside well.

    b) Place graduated bucket for purge water collection & volume measurement nearby.

    c) Place cooler containing bags of ice, "GW-Compliance" sample bottle set(s), bag or box of disposable nitrile gloves, sealed new 0.45 µm filter(s), sealed new syringe(s), and bailer cord nearby.

6) **Measure and record well water level and well head stick-up**

    a) Unlock wellhead padlock. Remove wellhead cap or j-plug.

    b) Measure depth to water (DTW) with *clean/decontaminated* WLI to the hundredth of foot from top of casing. Record value on GW Sampling Record.

    c) Measure and record total depth of well (TD) with WLI from top of casing.

    d) Measure and record well head stick-up (SU) from ground surface to top of casing.

    e) Clean/decontaminate probe and tape with Liquinox detergent solution followed by distilled water rinse when done with use at this well.

    f) If no water is present in well when measured, or water level is found to be within 0.25 feet of well TD (the distance between the lowest screen slot and well bottom cap), this monitoring event shall be designated "dry" on the Groundwater Monitoring Record. No collection of water quality field parameters or a sample for lab analysis is possible. Retrieve and decontaminate WLI, secure wellhead and rig down all monitoring equipment.

7) **Calculate three-wellbore volume purge**

    a) Calculate water column height as TD – DTW = WC, where

        TD is total depth (ft) measured from top of casing (TOC)
        DTW is depth to water (ft) measured from top of casing (TOC)
        WC is water column (ft)

b) Calculate volume of WC as WC X 0.163 = 1WBV, where

WC is water column (ft)
0.163 is multiplier for gallons per foot (gal/ft) for a 2” schedule 40 well
1WBV is a single wellbore volume (gal)

c) Calculate purge volume of prior to sampling as 1WBV X 3 = 3WBV, where

1WBV is a single wellbore volume (gal)
3WBV is three wellbore volumes (gal)

d) Record calculated single and triple wellbore volumes on the GW Sampling Record.

8) Bail well & measure water quality parameters

a) With clean disposable nitrile gloves, tear the bailer plastic bag open at the bail end (top) to expose only the bailer cord tie-off location.

b) Securely tie bailer cord to bailer and remove bailer from bag, taking care to not touch the bailer to anything prior to inserting it into the well.

c) Lower bailer into well at a rate that is manageable to keep bailer cord from tangling until it reaches the well water level. Allow the bailer to fill by submerging under its own weight at least the length of the bailer or otherwise until the bailer stops at the bottom of the well in the case of a short WC.

d) Retrieve the bailer by pulling/winding the cord, taking care to not allow the cord to touch any potentially contaminating surfaces. When bailer is at surface it should be full of water, or at least to the level it was submerged. If not, the check valve ball may have not seated properly due to debris. Inspect and rinse with distilled water as necessary. Replace bailer as necessary.

e) Dump bailer water from top of bailer to graduated bucket. The approximate full volume of a 1.25” X 36” bailer is 0.2 gallons.

f) Lower bailer back into well and allow it to submerge completely to fully fill.

g) Repeat steps 7c through 7e to purge well towards target production of 3 WBV.

h) Collect purge water for water quality field parameter measurement with the *calibrated* multi-parameter water quality meter: temperature (T), pH, specific conductance (SC), after at minimum each 20% towards the total 3 WBV target production. For example, if the 3 WBV is 15 gallons, WQ parameter readings should be recorded at approximately 3, 6, 9, 12, and 15 gallons. If the well has only a short water column (limited volume) and is low-yield, a single full bailer volume may exceed 20% of the expected target production. In this case collect and document the specified water quality field parameters with each bailer produced. Record each of these purge WQ measurements on the GW Sampling Record. At these times also measure and record DTW.

i) Monitor the individual water quality field parameters for stabilization over 3 consecutive measurements according to the following:

Temperature (10%)

Specific Conductance (10%)

pH (± 0.2 unit)

No more than 5 well volumes need to be removed prior to sample collection in the event of failure to reach stabilization criteria.

9) **If well goes dry before field parameter stabilization or 5 WBV, recap and secure well and allow well to recover for up to 24 hours. Monitor DTW for adequate recovery. If recovered within 24 hours (same or next day), no further purging is required so move to step 10 below. If the well does not recover within 24 hours, this monitoring event shall be designated "dry following purge" on the Groundwater Monitoring Record. No collection of a sample for lab analysis is possible, however the field water quality parameters collected during the purge shall be retained on the Groundwater Monitoring Record. Retrieve and decontaminate WLI, secure wellhead and rig down all monitoring equipment.**

10) **Collect final field parameters and sample**

   a) When stabilization criteria are met or 5 WBV have been purged, log one sample for all default parameters on the multi-parameter water quality meter naming the log for the appropriate monitoring well ID (i.e. MW-6). Download and email the export data file at completion of daily sampling activities to the GCC Environmental Engineer.

   b) There are 3 individual bottles in the "GW-Compliance" bottle set to be filled. Label all sample bottles by completing labels with indelible ink pen or marker prior to filling. Alternatively, the labeling may be made by writing directly on the bottles. Information shall include:

      - Site or project name (GCC Rio Grande)
      - Sample ID
      - Sample collection date and time
      - Sampler's initials

   c) Bail to fill at least ¼ the 1-gallon new, disposable poly cubitainer, which is the sample transfer container to be used for this groundwater bailer sample collection methodology.

   d) Load the 3/8" peristaltic tubing through the peristaltic pump head unit per manufacturer's instructions, keeping both tubing ends from touching any contaminating materials.

   e) Insert one end of the 3/8" peristaltic pump tubing into the cubitainer, keeping this suction end submerged.

   f) Attach the inlet side of the 0.45 µm filter (observe flow arrow on filter) to the other end of the peristaltic pump tubing.

   g) Operate the peristaltic pump per manufacturer's instructions producing water to flush air from the 0.45 µm filter and fill with sample water until the filter is producing water. Confirm there are no visible particulates flowing in the water from the filter outlet.

   h) Fill the 125 ml poly preserved bottle to the bottleneck and cap immediately. There is acid preservative in this container. Do not over-fill or spill the preservative – if this does happen then take a replacement 125 ml poly preserved bottle from a spare bottle set and repeat fill procedure.

   i) Fill the 250 ml poly unpreserved bottle from the 0.45 µm filter outlet to the bottleneck and cap immediately.

   j) Stop the peristaltic pump and remove the tubing from the cubitainer.

k) Fill the 500 ml poly unpreserved bottle to the neck directly from the cubitainer and immediately cap.

l) Label each bottle with actual the sample time, coordinated with the final logged water quality field parameters readings.

m) IF AT ANY POINT A BOTTLE CAP GETS DROPPED ON THE GROUND, RAINED ON, ETC. – simply triple rinse the cap (inside and out) with excess sample water from the bailer to decontaminate. Bail more water if necessary. Confirm no debris is on the cap and then screw it onto the bottle. If the cap is dropped into a known or suspected contaminant, then do not take a chance and simply replace the contaminated cap from a bottle from a spare bottle set.

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