PRELIMINARY HYDROLOGIC MONITORING PLAN KING II COAL MINE

Submitted to:
GCC ENERGY, LLC

Date:
July 30, 2015

Resource Hydrogeologic Services, Inc.
PO Box 2836
Durango, CO 81302
Tel: (970) 403-3665
Email info@resourcehydrogeologic.com

RESOURCE HYDROGEOLOGIC SERVICES

INTRODUCTION

GCC Energy (GCC) is currently responding to questions and concerns regarding ground water hydrology monitoring raised by numerous parties stemming from expansion efforts at the King II Coal Mine. These groups include:

- Office of Surface Mining Reclamation and Enforcement (OSMRE)
- Colorado Division of Reclamation Mining & Safety (DRMS)
- Bureau of Land Management (BLM)
- La Plata County (LPC)
- Hay Gulch Citizen Advisory Panel (HGCAP)

DRMS and OSMRE are currently reviewing the available hydrologic data for the relevant King II project area in order to determine appropriate measures for expanded ground water monitoring requirements. Resource Hydrogeologic Services, Inc. (RHS) has been retained by GCC to provide technical expertise and assist in development and implementation of the future expanded hydrologic monitoring plan. ***The following preliminary hydrologic monitoring plan to be submitted to LPC is intended to show GCC's full commitment and current progress in development of a final hydrologic monitoring plan following DRMS and OSMRE consensus and subsequent directive to GCC.*** The final hydrologic monitoring plan will include:

- Specific proposed monitoring locations
- Detailed well design and construction methodology
- Sampling and analysis protocol
- Sampling frequency and analytes
- Data evaluation process
- Reporting requirements

GROUND WATER MONITORING WELLS – BEDROCK

No bedrock monitoring wells have previously been installed, monitored or maintained at King II. Bedrock monitoring wells will be installed to further document observations of dry conditions in the overburden (Cliffhouse Sandstone Formation), mined "A" seam and immediate underburden (Menefee Formation). These dry conditions have been documented in exploration borehole drilling and active mining operations, but OSMRE has suggested concern with potential changes over time to water quantity and quality. The most effective way to document any changes over time to ground water quantity or quality is with permanent monitoring wells located in strategic locations. A standard hydrogeologic investigative approach is to monitor water-bearing or potentially water-bearing intervals

above and below the horizon of interest, in this case the "A" coal seam. As such, the current proposal is for monitoring well locations that consist of three wells completed in the three intervals of interest in a tightly spaced "cluster" configuration with surface spacing distance on the order of 20 feet. See the attached **Figure 1** that demonstrates the "cluster" monitoring well concept. A minimum of three "cluster" bedrock monitoring well locations are required to determine a plane that represents the potentiometric surface of each ground water system. That plane determines the ground water gradient and thus flow direction. Location preference has been to the west of King II due to the adjacent landowner concerns for impacts to their bedrock domestic water wells. Due to inherent data quality concerns in attempting to utilize adjacent landowner driller's well reports, new wells would be required to fully document the bedrock ground water conditions in the vicinity of King II. A dry drilling method will be selected in order to eliminate the possibility of drilling fluids masking formation water inflow.

Any overburden wells are expected to be dry based on current knowledge, with the exception of occasional perched water-bearing intervals. These water-bearing intervals can be expected to possibly produce small volumes of water through localized, discontinuous fracture networks and would likely drain quickly. To best document the specific water-bearing intervals, observations are preferred in an open hole monitoring well completion, rather than a traditional cased and screened monitoring well. If the borehole is competent, which is expected based on past borehole exploration drilling, this will allow for follow-up investigation and documentation of the exact water-bearing fractures should water ever manifest in the open hole. The design concept is 40 feet of 8-inch steel surface casing cemented in place with an approximate 6-inch diameter drill-out through the Cliffhouse Formation to the top of the "A" seam. The 6-inch diameter drill-out allows adequate space for later installation of a standard 2-inch PVC monitoring well should that be warranted. Overburden wells, even if dry at completion, present a value to GCC by creating monitoring points for unexpected water intrusion over time that could impact mining operations. This is particularly true in new exploration areas as well as down-gradient locations.

The "A" seam monitoring wells would also be expected to be dry in the vicinity of King II based on current knowledge. Two main issues prompt consideration of "A" seam monitoring wells. First, adjacent landowner wells are documented to be completed in numerous coal seams, with reasonable expectation that the "A" seam may intersected. While it is expected that the "A" seam does not contribute water to these adjacent landowner wells, there is no current documentation by down-gradient discrete interval monitoring wells that it does not. Properly completed "A" seam monitoring wells, particularly down-dip from the King II workings, will provide monitoring capabilities to detect impacts by mining activities to ground water in the "A" seam, should it manifest. As with overburden monitoring wells, possible "A" seam monitoring wells up-dip and north of current King II workings also present value to GCC by creating monitoring points for unexpected water saturation or intrusion over time that could impact mining operations. Secondly, there has been underground water storage that

has occurred in the gob near the King II portal. Concern has been expressed by both OSMRE and DRMS regarding need to monitor the "A" seam down-gradient of the water storage sump for potential leakage migration with a properly constructed monitoring well, despite the now current GCC plan to abandon the underground storage concept in favor of a standard lined pond at surface. Given these two issues, "A" seam monitoring locations can help to provide documentation of potential mining impacts to the bedrock ground water. Due to the long-term instability of coal in an open borehole, the general design concept would be to complete a standard 2-inch PVC monitoring well with silica sand filter pack and screen across the entire "A" seam. A 2-inch PVC monitoring well will allow for routine water level measurement as well as ground water sampling by numerous standard technologies if water ever manifests in the well.

The Menefee Formation below the "A" seam is expected to be saturated in water-bearing intervals at some depth but this has not been documented with recent, defensible data in the vicinity of King II. Past GCC exploration drilling total depth has been approximately 125 feet below the "A" seam, with no water encountered. The stratigraphic sequence below the "A" seam is composed of shale, sandstone, siltstone and coal. GCC exploration borehole data correlation suggests decent lateral continuity in these units. The shale certainly represent low-permeability aquitards that are expected to act as seals that confine ground water to the likely more permeable fractured sandstone, siltstone and coal. The primary goal is to document the depth at which ground water is intercepted in the Menefee and interpret the hydraulic character of the system including confining conditions, gradient and flow direction. Of great importance is also the characterization of any confining units between the "A" seam and the water-bearing interval in order to interpret and project the potential for water or contaminants to migrate vertically. Monitoring wells provide demonstration of any impact to ground water, especially by utilizing at least one up-gradient location north of any current mining activity in order to represent true baseline water quality and level conditions. Monitoring wells completed specifically in the Menefee water-bearing interval near King II will provide important water quality data for comparison with adjacent landowner wells in order to better understand if the systems are in hydraulic communication and potentially on what time scale. The design concept for Menefee Formation monitoring wells would be to drill and cement casing through the base of the "A" coal seam, thus isolating those intervals. The Menefee below the "A" seam would then be drilled out as an isolated interval to the top of the underlying Point Lookout Sandstone Formation to document all water-bearing intervals. Pending results, this drill-out can be further investigated to determine if the Menefee acts as one aquifer or rather contains multiple, hydraulically isolated aquifers. This will determine the final Menefee well completion interval appropriate for long-term monitoring for potential mining impacts. Likely final design will be a 4-inch PVC well in order to accommodate an appropriate ground water sampling and possibly testing pump with the required lift capacity as lower Menefee Formation depth to water is expected to be on the order of 350 to 450 feet below ground surface. Again, as mentioned previously for all monitoring well

designs, it is critical to complete each well in a discrete water-bearing interval in order to not comingle two or more otherwise hydraulically isolated zones. The monitoring well target interval for the lower Menefee monitoring well is the uppermost water-bearing interval.

Shall water be encountered, water level and water quality sampling at each completed well shall occur at all of these wells quarterly for a period of no less than 1 year to establish statistical and seasonal variation. The water quality analyte list shall be consistent with the DRMS standard ground water sampling suite applicable to bedrock aquifers with the samples submitted for analysis to an accredited analytical laboratory. Water levels measurements will be obtained quarterly, including dry or "no level" measurements. Results of this investigation will guide the future data collection and reporting frequency for these monitoring wells. Again, the bedrock monitoring wells will be installed per recommendation and final guidance by DRMS in accordance with best management practices.

GROUND WATER MONITORING WELLS – ALLUVIAL

Ground water monitoring is required at King II to assess potential for impact to ground water related to mining. At the present time for King II, GCC maintains two ground water monitoring wells, #1 (Up-gradient) and #2 (Down-gradient). Field and laboratory data is collected quarterly and interpreted and summarized annually in the 'Annual Hydrology Report' to DRMS. Each of these wells are completed in the Hay Gulch Alluvium, the shallow ground water aquifer in the La Plata County Road 120 corridor which is immediately down-gradient of GCC surface operations. As a formality, GCC recently requested of the DRMS to remove the #1 (Up-gradient) well from quarterly monitoring and annual reporting because it is not required in the DRMS permit to mine. RHS has recommended GCC consider withdrawal of this request to DRMS given planned future expansion of mining operations. Continued ongoing monitoring and reporting efforts for #1 (Up-gradient) will provide valuable baseline data up-gradient of King II operations including data comparison to the #2 (Down-gradient) required point of compliance monitoring well.

Attention to potential ground water impacts in the shallow ground water system has been recently expanded by the OSMRE to East Alkali Gulch. This ephemeral drainage runs to the immediate west and northwest of King II with "A" seam outcropping on the side slopes and presenting the absolute limit to mining. Minimum operational setbacks from daylighting are required for underground mining of the "A" seam. Given the non-saturated nature of the "A" seam and water addition during mining limited to misting quantities at the coal face, there can be no foreseeable discharge of water through the "A" seam that would exit at the outcrop and enter East Alkali Gulch. The likelihood of discharge of water from the "A" seam into East Alkali Gulch, should water ever be introduced in flowable quantity, is very unlikely given the south-southwest dip that would preferentially recharge ground water rather than discharge

ground water. The remainder of the exposed Menefee Formation below the "A" seam is likewise dipping south-southwest and represents a potential recharge zone, not a discharge zone.

Regardless, there is no known data regarding the East Alkali Gulch Alluvium water quantity (presence) or quality in the reach adjacent to King II. There are four domestic water wells completed in East Alkali Gulch to the west and southwest of King II, but only one well is clearly documented as completed in the alluvium. These well have apparently been identified by OSMRE as potential for impact and thus cause for study of the East Alkali Gulch Alluvium. Alluvial monitoring wells in East Alkali Gulch could provide useful data for GCC to demonstrate no current mining impacts to this ground water system which would include documentation of unconsolidated alluvial materials during well installation, water level measurements and water quality field and analytical data over time. If well installation is to occur along East Alkali Gulch, it is recommended that one well is installed north of current King II workings to ensure data collection represents true baseline conditions. One well should be placed downstream at the proposed Lease Modification 1 boundary.

MONITORING WELL PERMITTING AND DOCUMENTATION

Pending approval of the monitoring well designs and locations by DRMS, appropriate well permits will be obtained through the Colorado Division of Water Resources (DWR) with the process designated by 2 CCR 402-2, Section 6.2. Furthermore, each completed monitoring well will be properly documented and reported to DWR defined by 2 CCR 402-2, Rule 17. 49. GCC shall document the design, installation and development, of all monitoring wells as well as the measurements, sampling, and analytical devices at such wells. This includes description of where, when and how all wells have been constructed, the sampling/pumping equipment that has been installed. Documentation shall be placed in the operating record and shall be submitted to the DRMS and any local governing body having jurisdiction within 90 days of completion of well development.

All completed ground water monitoring wells will have associated and properly constructed borehole and well construction diagrams that include:

- A hydrogeologist's description of the subsurface materials encountered
- A copy of the driller's log
- A copy of the well permit
- Boring log with well construction details
- Description of materials used
- Survey results including
    - Surface elevation
    - Top of casing elevation

MONITORING WELL CONSTRUCTION

Well bore holes will be drilled to a minimum 6" diameter using a truck or track mounted drilling rig, as appropriate, with the oversight of a qualified hydrogeologist. The drill cuttings will be continuously logged by the hydrogeologist to ensure that all subsurface water-bearing zones, material types and characteristics (e.g. grain size, moisture content, color) have been identified and documented. Bore holes will be drilled in order to properly install the ground water monitoring well so that it will monitor the targeted intervals for monitoring as interpreted onsite by the qualified hydrogeologist.

Monitoring wells will be designed and constructed per protocols established in Colorado Regulations 2 CCR 402-2, Rules and Regulations for Water Well Construction, Pump Installation as pursuant to State of Colorado Statute Title 37, Article 91-104 (Cistern Installation, Monitoring and Observation Hole/Well Construction) and US EPA Handbook of Suggested Practice for the Design and Installation of Ground water Monitoring Wells including:

- Proper borehole size to well casing size ratio for effective filter pack installation and function (i.e. minimum 6" for 2" well).
- Proper SCH40 PVC machine-cut screen slot size selection and saturated depth placement based on conditions encountered in the field interpreted by the qualified hydrogeologist. This will be in the saturated portion of the identified aquifer, with preference to always remain submerged.
- Inert (PVC or Stainless Steel) bow-spring centralizers will be utilized on the 2" casing/screen just above the bottom well cap and spaced every ten feet above to surface to ensure uniform annular spacing for filter pack and seal materials. Blank (solid) SCH40 PVC will be installed from the appropriate depth above the screen section to 2.75' above ground surface.
- Appropriate annular filter pack material, grain size and placement will be based on conditions encountered in the field interpreted by the qualified hydrogeologist. Filter pack will be installed 2-5 feet above the screen top.
- Appropriate well seal and annular seal materials and placement will be completed. Coated bentonite pellets will be installed a minimum of two feet above the filter pack material and bentonite/cement grout will installed to a maximum of four feet below ground surface per 2 CCR 402-2, Section 14.3.5.
- Proper surface well completion will consist of cement placed above the well seal up to surface.
- A locking steel wellhead protector will be set a minimum of three feet into the cement (below grade), with a surface stick-up of three feet.
- An adequate cement apron will be constructed around the locking steel wellhead protector.
- A minimum of three 4" steel guard posts shall be installed to a depth of three feet and cemented in place, spaced uniformly around the well, at approximately five feet distance.

The exception to this standard monitoring design is the overburden Cliffhouse Formation wells that are proposed as open hole completion. Open hole completion in competent unsaturated bedrock allows for detailed identification of water-bearing fractures should they be intersected. Additionally, per standard protocol in environmental monitor well construction, well installation procedures will be conducted in a manner to minimize ground water or soils cross-contamination from outside sources (i.e. hydrocarbons, solvents, non-potable water, contaminated subsurface drill equipment, etc.).

GROUND WATER SAMPLING AND ANALYSIS

This section describes the preliminary ground water sampling and analysis plan for King II, to be conducted in accordance with appropriate DRMS Regulations of the Colorado Mined Land Reclamation Board for Coal Mining, section 4.05.13.

Baseline Sampling

True baseline ground water quality monitoring for the bedrock ground water system and East Alkali Gulch Alluvium is not feasible, as operations have been ongoing since the year 2007, and may have influenced ground water quality since operations began. However, baseline ground water quality can be evaluated from up-gradient monitoring wells that are located at sufficient distance from operations.

Sampling and Analysis Protocol

Ground water sample collection will be carried out after the well has been developed and a sufficient period of time has passed (typically 24 hours) to allow formation disturbances from well development to subside. All field equipment will be calibrated and the calibration data will be recorded in a field notebook. Any equipment that will be used in the ground water sampling program will be decontaminated between locations to ensure no cross-contamination occurs during sample collection. Where possible, low-flow sampling methodology will be followed in order to collect the most representative fluid samples as reasonably possible with minimal physical or chemical alterations related to or caused by the sampling itself. This methodology is designed to minimize the hydraulic stress at the well screen that can otherwise be induced by high fluid velocities, turbulent flow conditions and large drawdowns. General sampling procedures are outlined in the U.S. EPA Region 1 document titled "Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground water Samples from Monitoring Wells" (2010).

No more than 5 well volumes need to be removed prior to sample collection in the event of failure to reach stabilization criteria. Sample collection shall be conducted directly from the pump tubing by disconnecting the tubing immediately upstream from the flow-through cell. In the case of low- and very

low-yielding wells, purge requirements differ from the method described above. In low-yielding wells where recharge occurs within three hours, the well will be pumped dry and field parameter measurements recorded. Once the well has recovered, final field parameter measurements will be recorded and sample collection will begin. In very low-yielding wells where recharge occurs after three hours but within twenty-four hours, field parameter measurements will be recorded and sample collection will begin. These requirements are consistent with industry standards. Samples will be filtered, preserved, and and/or chilled according to the laboratory requirements for the analytes to be identified by DRMS. Laboratory analytical methods will follow approved DRMS and U.S. EPA protocols.

Water level measurements will be recorded at each sampled well at King II. Water level and water quality results will provide a better understanding of the occurrence of ground water and extent of ground water contamination, if any. A plan for the statistical analysis of ground water quality data will be developed prior to the commencement of the baseline sampling program and, upon approval by DRMS, will be applied to the hydrologic monitoring plan. The proper statistical analysis methodology will be determined after ground water quality data collection has been initiated and data is available for review.

Sampling Frequency

Ground water monitoring will be conducted quarterly (four times each calendar year) to provide water level and water quality data over a variety of seasonal changes. After one year the number of wells sampled during subsequent events may be reduced based on the results of the first year of quarterly monitoring (i.e., no ground water analyte exceedances, dry wells). This potential reduction in sampling frequency or number of sampling locations will require written approval from DRMS.

Analytes

DRMS will provide a list of the required analytes to be included in the ground water monitoring program, and generally include field parameters, cations, anions and inorganic constituents (metals). The analyte list is currently expected to be consistent with what is currently required for the existing Hay Gulch Alluvial wells #1 and #2. Laboratory data will be reviewed following each quarterly sampling event and individual chemical constituents will be evaluated for relevance to the ground water quality in the vicinity of King II. If a single constituent or group of constituents is proven to not participate in the geochemical processes of ground water system, those constituents may be removed from the analyte list upon approval from DRMS.

Recordkeeping and Reporting

All field notes and forms, as well as laboratory data obtained as part of this monitoring program will be maintained by the to-be-determined ground water monitoring contractor in both hard-copy and electronically in a Microsoft Excel or Access database, and will be provided to DRMS upon request. Copies of field notes, forms, and laboratory data shall also be placed in the Facility Operating Record. Should the ground water monitoring program identify constituents of potential concern (through statistical analyses), a written notification will be incorporated into the ground water monitoring plan. Results of the quarterly monitoring will be evaluated and summarized in an annual hydrology report to the DRMS. Ground water quality data, statistical analyses, and all supporting documentation will be provided as attachments to the annual report.

GROUND WATER MONITORING METHODOLOGY

The following section describes the methodology used to collect and process ground water samples, properly document samples and sampling procedures, and ensure that sample quality has been maintained.

Ground water Sample Collection

The low flow sampling methodology, where applicable, is conducted by first measuring and documenting the static fluid level in the well. The static water level shall be measured to 0.01-foot using a water level meter. Depths to water will be measured from the top of the PVC well casing, unless otherwise noted. Water level information will be recorded on either a ground water sampling record or water level monitoring record.

Next, the pump and peripheral equipment or peristaltic pump tubing is installed into the well to the appropriate depth and the static fluid level is recorded again. The monitoring well will be purged prior to sample collection, and measurements of temperature, pH, specific conductance, oxygen reduction potential (ORP) dissolved oxygen (DO) and turbidity will measured through an appropriate flow-through cell and be recorded in the field notebook or sampling field form. A cumulative production total will be documented. The pumping rate shall be kept as low as possible so that fluid production is occurring but drawdown is minimized as observed by measurements as needed. Stabilization of field parameter measurements is considered to be achieved when three consecutive readings are within the following limits:

Temperature (10%)

Turbidity (10% for values greater than 5 NTU; if three turbidity values are less than 5 NUT, consider the values stabilized)

Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three dissolved oxygen values are less than 0.5 mg/L, consider the values as stabilized)

Specific Conductance (10%)

pH (± 0.2 unit)

Oxygen Reduction Potential (± 10 mV)

Purging will be performed using one of the following: 1) Peristaltic pump and tubing, or 2) a disposable, polyethylene hand bailer, or 3) an electric submersible pump and tubing. If ground water is not present or is not in sufficient quantities to be collected, the well may not be sampled. Sample collection shall be conducted directly from the pump tubing by disconnecting the tubing immediately upstream from the flow-through cell.

Sample Handling and Custody Requirements

Sample bottles provided by the laboratory will be pre-preserved (i.e., HNO_3, etc.), as appropriate. The sample containers will be labeled in the field with the following information:

- Company name (GCC Energy, LLC).
- Project Name (King II).
- Sample identification.
- Sample date and time (24-hour clock).
- Preservative type (e.g., HNO_3), if applicable
- Sample type (i.e., filtered or unfiltered).

Once a sample has been collected and properly labeled, field personnel will place the sample in an ice-filled cooler for storage and transport to the laboratory. All samples transmitted to the laboratory will be accompanied by a Chain-of-Custody, following appropriate custody procedures. All samples will be filtered by the Laboratory.

Quality Control Requirements

Ground water sampling procedures will be conducted in a manner that assures samples and field data are representative, and that the resultant data can be duplicated for comparison to subsequent sampling events. Additionally, consumable ground water sampling equipment (i.e. hand bailers, tubing, filters, gloves) will be disposable to limit the potential for cross contamination between different well

samples and sampling events. Non-consumable ground water sampling equipment will be properly decontaminated per industry standards between different well samples and sampling events.

A duplicate sample will be collected during each event to further enhance the quality control. A duplicate sample requires the collection of two samples from a specified location (i.e., MW-1W). Both aliquots are sampled and processed using the same equipment and sent to the laboratory for analysis. Analyte variations between each sample provide evidence that field sampling techniques and/or laboratory procedures may be influencing sample concentrations. Generally, variations in aqueous samples less than or equal to 20% are considered acceptable by EPA guidance (U.S.EPA, 2004).

Similarly, an equipment rinsate blank sample (ERB) will be collected during each sampling event. An ERB requires the use of distilled water provided by the laboratory to come in contact with all sample equipment (i.e., hand bailer, tubing, filter) using the same procedures as a normal sample. The distilled water is then processed into appropriate sample containers and sent to the laboratory for analysis. If an analyte is detected in the ERB, potential contamination of the detected analyte may have occurred during sampling activities.

DATA EVALUATION

Analytical data will be evaluated for each ground water monitoring event by performing a quality assurance/quality control (QA/QC) check and performing a water quality assessment and statistical analysis.

QA/QC VERIFICATION

The QA/QC verification procedure utilizes the guidelines presented in the *U.S.EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA, 2004). The data quality will be assessed using the "Blank" and "Duplicate Sample Analysis" sections of the EPA document. Duplicate analyses will be compared to identify constituents that exceed a relative percent difference (RPD) of 20%. The RPD between the primary sample and duplicate sample is determined based on the following equation:

$$RPD = \frac{S - D}{\left(\frac{S + D}{2}\right)} \times 100$$

Where,
RPD = Relative Percent Difference

S = Sample Result (original)
D = Duplicate Result

If an exceedance greater than 20% is noted, potential qualification may be required for the specified analyte in all samples.

Results of the ERB sample will be assessed by identifying any analyte detections reported by the laboratory. If an analyte is reported in the ERB, similar analytes in other wells less than ten (10) times the reported concentration may be qualified as undetected, or "U". For example, if zinc is reported in the ERB at 1 mg/L, zinc concentrations in other wells less than 10 mg/L may be qualified as undetected. Further evaluation, including potential re-analysis of detected constituent in the ERB, may be required to evaluate if qualification is required.

Should any equipment rinsate blank sample result in the necessity to qualify a sample as undetected "U", the constituent will be re-sampled within 90 days of the "U" qualification. Equipment decontamination procedures will be reviewed and adjusted to assure future cross-contamination does not occur.

WATER QUALITY ASSESSMENT

A water quality assessment based on statistically significant increases above background will be performed after all water quality data has been validated for all detection monitoring. The analytes to be identified by DRMS will be standard for coal mines.

REPORTING SUMMARY

An annual hydrologic report will be submitted after all water samples have been analyzed for that year. The annual report will include the following:

- Background information for the facility
- Summary of hydrology and geology for the facility
- Site map with ground water monitoring well locations
- Historic and current ground water levels from the monitoring wells
- Summary tables of ground water sample laboratory results
- Statistical analysis results and methodology documentation
- Original laboratory results
- Copies of field notes

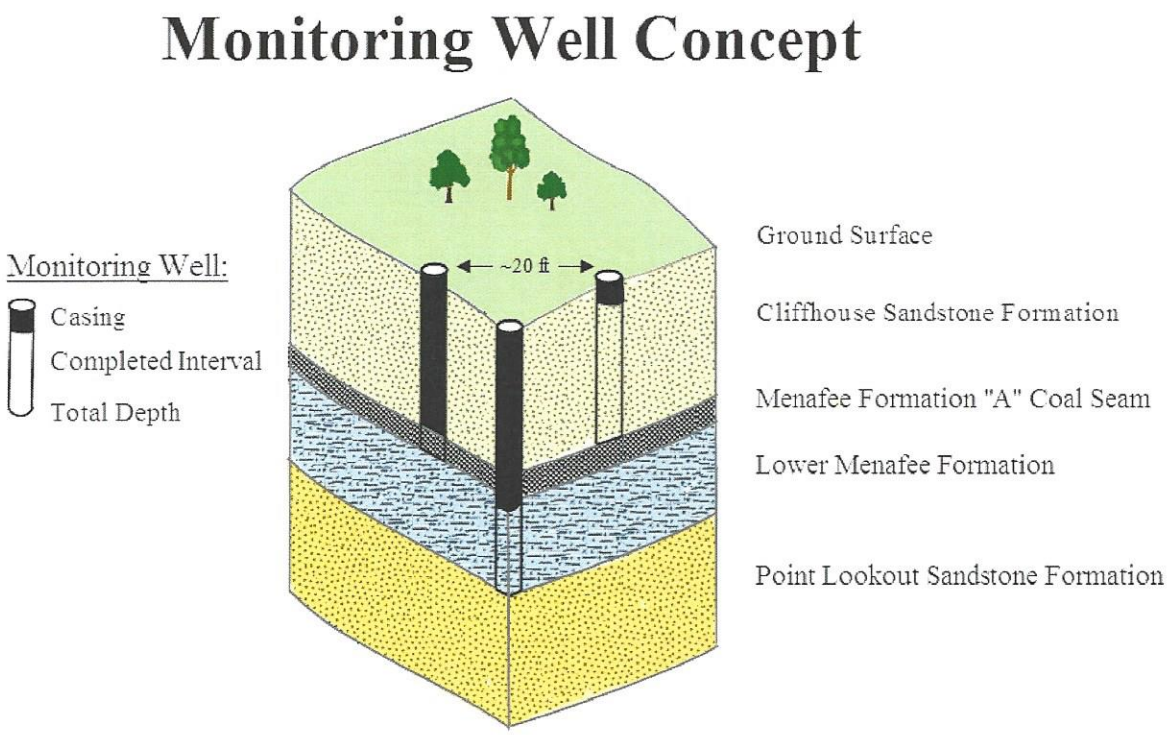

Figure 1. Bedrock Ground Water Cluster Monitoring Well Concept