EXHIBIT E

State of Utah Department of Natural Resources Division of Oil, Gas and Mining **Coal Regulatory Program Guideline**	Guideline Number: Tech-004 Effective Date: June 27, 2006 Supersedes: Water Monitoring Programs for Coal Mines Directive Dated May 23, 1995, May 14, 1996 and July 1, 1997
Subject: **Water Monitoring Programs for Coal Mines**	
Approved: John R. Baza John Baza, Director, Division of Oil, Gas, and Mining	On: 7/3/06

DISCLAIMER

This guideline is intended as advice provided by the Utah Coal Regulatory Program in the implementation of the Utah Coal Rules. It neither confers rights nor imposes obligations on the Division of Oil, Gas and Mining (the "Division") or any other party. Where a conflict is perceived to exist between this guideline and the Utah Coal Rules, the rules prevail.

ABSTRACT

The Utah Coal Regulatory Program requires all mines to develop water monitoring programs to assess the hydrology of the permit and adjacent areas. These monitoring programs should be sufficient to determine the Probable Hydrologic Consequences of all coal mining and reclamation activity upon the quality and quantity of surface and ground water under seasonal flow conditions for the proposed permit and adjacent areas. This guideline is issued to achieve the goals and objectives of a successful surface and ground water monitoring program. By defining terms, stating objectives, and identifying responsibilities, it is meant to clarify the Division's recommendation of what typically constitutes a successful monitoring program and provides methodology for consistently amending these monitoring programs.

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1. Purpose

The purpose of this guideline is to provide the Division's recommendations for water monitoring programs so as to facilitate permitting, compliance, and decision-making processes for permitting Utah coal mine operations.

Water monitoring requirements are established to identify and assess the hydrologic conditions prior to, during and after mining to ensure protection of the hydrologic balance, and to detect changes to the hydrologic regime, including State-appropriated water, caused by mining activities. According to the R645 Coal Mining Rules, material damage to the hydrologic balance outside of a permit area must be prevented and disturbance to the hydrologic balance within the permit area must be minimized. Furthermore, any State-appropriated water affected by contamination, diminution, or interruption resulting from underground mining must be replaced.

It is the Division's intent to work with mining applicants and permittees to ensure that the monitoring plan provides complete environmental information for analyses.

2. Regulatory Basis

A. Relevant definitions for this guideline from the R645 Coal Mining Rules are as follows:

"Acid Drainage" means water with a pH of less than 6.0 and in which total acidity exceeds total alkalinity discharged from an active, inactive, or abandoned coal mining and reclamation operation, or from an area affected by coal mining and reclamation operations.

"Acid-Forming Materials" means earth materials that contain sulfide minerals or other materials which, if exposed to air, water, or weathering processes, form acids that may create acid drainage.

"Adjacent Area" means the area outside the permit area where a resource or resources, determined according to the context in which adjacent area is used, are or reasonably could be expected to be adversely impacted by proposed coal mining and reclamation operations, including probable impacts from underground workings.

"Affected Area" means any land or water surface area which is used to facilitate, or is physically altered by, coal mining and reclamation operations. The affected area includes the disturbed area; any area upon which coal mining and reclamation operations are conducted; any adjacent lands the use of which is incidental to coal mining and reclamation operations; all areas covered by new or existing roads used to gain access to, or for hauling coal to or from coal mining and reclamation operations; any area covered by surface excavations, workings, impoundments, dams, ventilation shafts, entryways, refuse banks, dumps, stockpiles, overburden piles, spoil banks, culm banks, tailings, holes or depressions, repair areas, storage areas, shipping areas; any areas upon which are sited structures, facilities, or other property material on the surface resulting from, or incident to, coal mining and reclamation operations; and the area located above underground workings.

"Aquifer" means a zone, stratum, or group of strata that can store and transmit water in sufficient quantities for a specific use.

"Coal Mining and Reclamation Operations" means (a) activities conducted on the surface of lands in connection with a surface coal mine or, subject to the requirements of section 40-10-18 of the Act, surface coal mining and reclamation operations and surface impacts incident to an underground coal mine, the products of which enter commerce or the operations of which directly or indirectly affect interstate commerce. Such activities include all activities necessary and incidental to the reclamation of the operations, excavation for the purpose of obtaining coal, including such common methods as contour, strip, auger, mountaintop removal, box cut, open pit, and area mining; the use of explosives and blasting; in-situ distillation; or retorting, leaching, or other chemical or physical processing; and the cleaning, concentrating, or other processing or preparation of coal. Such activities also include the loading of coal for interstate commerce at or near the mine site. Provided, these activities do not include the extraction of coal incidental to the extraction of other minerals, where coal does not exceed 16-2/3 percent of the tonnage of minerals removed for purposes of commercial use or sale, or coal exploration subject to section 40-10-8 of the Act; and, provided further, that excavation for the purpose of obtaining coal includes extraction of coal from coal refuse piles; and (b) the areas upon which the activities described under part (a) of this definition occur or where such activities disturb the natural land surface. These areas will also include any adjacent land the use of which is incidental to any such activities, all lands affected by the construction of new roads or the improvement or use of existing roads to gain access to the site of those activities and for haulage and excavation, workings, impoundments, dams, ventilation shafts, entryways, refuse banks, dumps, stockpiles, overburden piles, spoil banks, culm banks, tailings, holes or depressions, repair areas, storage areas, processing areas, shipping areas, and other areas upon which are sited structures, facilities, or other property or material on the surface, resulting from or incident to those activities.

"Cumulative Impact Area" means the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface and groundwater systems. Anticipated mining will include, at a minimum, the entire projected lives through bond releases of: (a) the proposed operation, (b) all existing operations, (c) any operation for which a permit application has been submitted to the Division, and (d) all operations required to meet diligent development requirements for leased federal coal for which there is actual mine development information available.

"Division" means Utah State Division of Oil, Gas and Mining, the designated state regulatory authority.

"Ephemeral Stream" means a stream which flows only in direct response to precipitation in the immediate watershed, or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table.

"Ground Water" means subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

"Hydrologic Balance" means the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage.

"Hydrologic Regime" means the entire state of water movement in a given area. It is a function of the climate and includes the phenomena by which water first occurs as atmospheric water vapor, passes into a liquid or solid form, falls as precipitation, moves along or into the ground surface and returns to the atmosphere as vapor by means of evaporation and transpiration.

"Intermittent Stream" means (a) a stream, or reach of a stream, that drains a watershed of at least one square mile, or (b) a stream, or reach of a stream, that is below the local water table for at least some part of the year and obtains its flow from both surface runoff and groundwater discharge.

"Perennial Stream" means a stream or part of a stream that flows continuously during all of the calendar year as a result of groundwater discharge or surface runoff. The term does not include intermittent stream or ephemeral stream.

"Permit Area" means the area of land, indicated on the approved map submitted by the operator with his or her application, required to be covered by the operator's performance bond under R645-301-800, and which will include the area of land upon which the operator proposes to conduct coal mining and reclamation operations under the permit, including all disturbed areas, provided that areas adequately bonded under another valid permit may be excluded from the permit area.

"Quarterly sampling" means collecting representative water samples from all designated water monitoring locations at least once per three month period with a minimum of one month between sampling events.

"Recharge Capacity" means the ability of the soils and underlying materials to allow precipitation and runoff to infiltrate and reach the zone of saturation.

"Water Supply" "State-appropriated Water", and "State-appropriated Water Supply" are all synonymous terms and mean, for the purpose of the R645 Rules, state appropriated water rights which are recognized by the Utah Constitution or Utah Code.

B. The regulatory basis for this guideline from the R645 Coal Mining Rules is as follows:

R645-301-723. Sampling and Analysis. All water quality analyses performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to the methodology in the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Water quality sampling performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to either methodology listed above when feasible. "Standard Methods for the Examination of Water and Wastewater" is a joint publication of the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation and is available from the American Public Health Association, 1015 Fifteenth Street, NW, Washington, D. C. 20036.

R645-301-724. Baseline Information. The application will include the following baseline hydrologic, geologic and climatologic information, and any additional information required by the Division.

-724.100. Ground Water Information. The location and ownership for the permit and adjacent areas of existing wells, springs and other ground-water resources, seasonal quality and quantity of ground water, and usage. Water quality descriptions will include, at a minimum, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron and total manganese. Ground-water quantity descriptions will include, at a minimum, approximate rates of discharge or usage and depth to the water in the coal seam, and each water-bearing stratum above and potentially impacted stratum below the coal seam.

-724.200. Surface Water Information. The name, location, ownership and description of all surface-water bodies such as streams, lakes and impoundments, the location of any discharge into any surface-water body in the proposed permit and adjacent areas, and information on surface-water quality and quantity sufficient to demonstrate seasonal variation and water usage. Water quality descriptions will include, at a minimum, baseline information on total suspended solids, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron and total manganese. Baseline acidity and alkalinity information will be provided if there is a potential for acid drainage from the proposed mining operation. Water quantity descriptions will include, at a minimum, baseline information on seasonal flow rates.

-724.500. Supplemental Information. If the determination of the PHC required by R645-301-728 indicates that adverse impacts on or off the proposed permit area may occur to the hydrologic balance, or that acid-forming or toxic-forming material is present that may result in the contamination of ground-water or surface-water supplies, then information supplemental to that required under R645-301-724.100 and R645-301-724.200 will be provided to evaluate such probable hydrologic consequences and to plan remedial and reclamation activities. Such supplemental information may be based upon drilling, aquifer tests, hydrogeologic analysis of the water-bearing strata, flood flows, or analysis of other water quality or quantity characteristics.

R645-301-725. Baseline Cumulative Impact Area Information.

-725.100. Hydrologic and geologic information for the cumulative impact area necessary to assess the probable cumulative hydrologic impacts of the proposed coal mining and reclamation operation and all anticipated coal mining and reclamation operations on surface- and ground-water systems as required by R645-301-729 will be provided to the Division if available from appropriate federal or state agencies.

-725.200. If this information is not available from such agencies, then the applicant may gather and submit this information to the Division as part of the permit application.

-725.300. The permit will not be approved until the necessary hydrologic and geologic information is available to the Division.

R645-301-728. Probable Hydrologic Consequences Determination.

-728.100. The permit application will contain a determination of the PHC of the proposed coal mining and reclamation operation upon the quality and quantity of surface and ground water under seasonal flow conditions for the proposed permit and adjacent areas.

-728.200. The PHC determination will be based on baseline hydrologic, geologic and other information collected for the permit application and may include data statistically representative of the site.

-728.300. The PHC determination will include findings on:

-728.310. Whether adverse impacts may occur to the hydrologic balance;

-728.320. Whether acid-forming or toxic-forming materials are present that could result in the contamination of surface- or ground-water supplies;

-728.330. What impact the proposed coal mining and reclamation operation will have on:

-728.331. Sediment yield from the disturbed area;

-728.332. Acidity, total suspended and dissolved solids and other important water quality parameters of local impact;

-728.333. Flooding or streamflow alteration;

-728.334. Ground-water and surface-water availability; and

-728.335. Other characteristics as required by the Division; and

-728.340. Whether the proposed SURFACE COAL MINING AND RECLAMATION ACTIVITY will proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial or other legitimate purpose.

-728.400. An application for a permit revision will be reviewed by the Division to determine whether a new or updated PHC determination will be required.

R645-301-731. General Requirements. The permit application will include a plan, with maps and descriptions, indicating how the relevant requirements of R645-301-730, R645-301-740, R645-301-750 and R645-301-760 will be met. The plan will be specific to the local hydrologic conditions. It will contain the steps to be taken during coal mining and reclamation operations through bond release to minimize disturbance to the hydrologic balance within the permit and adjacent area; to prevent material damage outside the permit area; to support the approved postmining land use in accordance with the terms and conditions of the approved permit and performance standards of R645-301-750; to comply with the Clean Water Act (33USC 1251 et seq); and to meet applicable federal and Utah water quality laws and regulations. The plan will include the measure to be taken to: avoid acid or toxic drainage; prevent to the extends possible using the best technology currently available, additional contribution of suspended solids to stream flow; provide water treatment facilities when needed; and control drainage. For the purposes of SURFACE COAL MINING AND RECLAMATION ACTIVITIES the plan will include measure to be taken to protect or replace water rights and restore approximate premining recharge capacity. The plan will specifically address any potential adverse hydrologic consequences identified in the PHC determination prepared under R645-301-728 and will include preventative and remedial measures. The division may require additional preventative, remedial or monitoring measure to assure that material damage to the hydrologic balance outside the permit area is prevented. Coal mining and reclamation operations that minimize water pollution and change in flow will be used in preference to water treatment.

-731.200. Water Monitoring.

731.210. Ground-Water Monitoring. Ground-water monitoring will be conducted according to the plan approved under R645-301-731.200 and the following:

-731.211. The permit application will include a ground-water monitoring plan based upon the PHC determination required under R645-301-728 and the analysis of all baseline hydrologic, geologic and other information in the permit application. The plan will provide for the monitoring of parameters that relate to the suitability of the ground water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance set forth in R645-301-731. It will identify the quantity and quality parameters to be monitored, sampling frequency and site locations. It will describe how these data may be used to determine the impacts of the operation upon the hydrologic balance. At a minimum, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron, total manganese and water levels will be monitored;

-731.212. Ground-water will be monitored and data will be submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the approved reporting period. When the analysis of any ground-water sample indicates noncompliance with the permit conditions, then the operator will promptly notify the Division and immediately take the actions provided for in R645-300-145 and R645-301-731;

-731.213. If an applicant can demonstrate by the use of the PHC determination and other available information that a particular water-bearing stratum in the proposed permit and adjacent areas is not one which serves as an aquifer which significantly ensures the hydrologic balance within the cumulative impact area, then monitoring of that stratum may be waived by the Division;

-731.214. Ground-water monitoring will proceed through mining and continue during reclamation until bond release. Consistent with the procedures of R645-303-220 through R645-303-228, the Division may modify the monitoring requirements including the parameters covered and the sampling frequency if the operator demonstrates, using the monitoring data obtained under R645-301-731.214 that:

-731.214.1. The coal mining and reclamation operation has minimized disturbance to the prevailing hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses and the SURFACE COAL MINING AND RECLAMATION ACTIVITY has protected or replaced the water rights of other users; or

-731.214.2. Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under R645-301-731.211.

-731.215. Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of ground water on-site and off-

site will be properly installed, maintained and operated and will be removed by the operator when no longer needed.

-731.220. Surface-Water Monitoring. Surface-water monitoring will be conducted according to the plan approved under R645-301-731.220 and the following:

-731.221. The permit application will include a surface-water monitoring plan based upon the PHC determination required under R645-301-728 and the analysis of all baseline hydrologic, geologic and other information in the permit application. The plan will provide for the monitoring of parameters that relate to the suitability of the surface water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance as set forth in R645-301-731 as well as the effluent limitations found in R645-301-751;

-731.222. The plan will identify the surface water quantity and quality parameters to be monitored, sampling frequency and site locations. It will describe how these data may be used to determine the impacts of the operation upon the hydrologic balance:

-731.222.1. At all monitoring locations in streams, lakes and impoundments, that are potentially impacted or into which water will be discharged and at upstream monitoring locations, the total dissolved solids or specific conductance corrected to 25 degrees C, total suspended solids, pH, total iron, total manganese and flow will be monitored; and

-731.222.2. For point-source discharges, monitoring will be conducted in accordance with 40 CFR Parts 122 and 123, R645-301-751 and as required by the Utah Division of Environmental Health for National Pollutant Discharge Elimination System (NPDES) permits;

-731.223. Surface-water monitoring data will be submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the approved reporting period. When the analysis of any surface water sample indicates noncompliance with the permit conditions, the operator will promptly notify the Division and immediately take the actions provided for in R645-300-145 and R645-301-731. The reporting requirements of this paragraph do not exempt the operator from meeting any National Pollutant Discharge Elimination System (NPDES) reporting requirements;

-731.224. Surface-water monitoring will proceed through mining and continue during reclamation until bond release. Consistent with R645-303-220 through R645-303-228, the Division may modify the monitoring requirements, except those required by the Utah Division of Environmental Health, including the parameters covered and sampling frequency if the operator demonstrates, using the monitoring data obtained under R645-301-731.224 that:

-731.224.1. The operator has minimized disturbance to the hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses and the SURFACE COAL MINING AND RECLAMATION ACTIVITY has protected or replaced the water rights of other users; or

-731.224.2. Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under R645-301-731.221.

-731.225. Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of surface water on-site and off-site will be properly installed, maintained and operated and will be removed by the operator when no longer needed.

R645-301-731.530. State-appropriated water supply. The permittee will promptly replace any State-appropriated water supply that is contaminated, diminished or interrupted by UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES conducted after October 24, 1992, if the affected water supply was in existence before the date the Division received the permit application for the activities causing the loss, contamination or interruption. The baseline hydrologic and geologic information required in R645-301-700 will be used to determine the impact of mining activities upon the water supply.

R645-301-731.800. Water Rights and Replacement. Any person who conducts SURFACE COAL MINING AND RECLAMATION ACTIVITIES will replace the water supply of an owner of interest in real property who obtains all or part of his or her supply of water for domestic, agricultural, industrial, or other legitimate use from an underground or surface source, where the water supply has been adversely impacted by contamination, diminution or

interruption proximately resulting from the surface mining activities. Baseline hydrologic information required in R645-301-624.100 through R645-301-624.200, R645-301-625, R645-301-626, R645-301-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-=301-731.210 through R645-301-731.223 will be used to determine the extent of the impact of mining upon ground water and surface water.

R645-301-751. Water Quality Standards and Effluent Limitations. Discharges of water from areas disturbed by coal mining and reclamation operations will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

3. Policy

A. The Utah Department of Environmental Quality (DEQ) is the designated regulatory authority for the State of Utah responsible for administering and enforcing environmental laws including water quality, drinking water, and solid and hazardous waste management. A Memorandum of Understanding (MOU), dated September 1, 1999, was signed between the Division and the DEQ. The intent of the MOU is to coordinate permitting, compliance, and enforcement activities related to mining operations in Utah between the agencies. The MOU helps to ensure that all appropriate controls set forth by State law are incorporated into environmental permits and approvals.

B. The Division of Water Quality (DWQ) at the DEQ administers the Utah Pollutant Discharge Elimination System (UPDES) and Underground Injection Control (UIC) programs as delegated by the U.S. Environmental Protection Agency (EPA). Regulations under these programs govern discharge to surface and ground water from coal mines.

C. The Utah Division of Water Rights (DWRi) is the designated regulatory authority for the State of Utah responsible for the appropriation and distribution of water, dam safety, stream alteration, well drilling, and other water right activities. An MOU, dated November 18, 2005, was signed between the Division and DWRi. The intent of the MOU it to coordinate permitting, compliance, and enforcement activities related to mining operations in Utah between the agencies.

D. Water monitoring should be designed to provide information to determine the probable hydrologic consequences of all mining and reclamation activities to the quantity and quality of surface and groundwater under seasonal variation for the permit area and adjacent areas. Water monitoring programs can be divided into three phases, baseline, operational and post mining.

Baseline monitoring is intended to provide pre-mining water quality and quantity conditions. This baseline information should be used in the development of the Probable Hydrologic Consequences (PHC) document.

Operational water monitoring data should be utilized to demonstrate the validity of the PHC. The data should aid in determining the status of any mining related impacts to the hydrologic balance.

The post mining monitoring continues until bond release to provide information relevant to potential impacts due to the mining and reclamation activity. It should also verify for bond release that the water quality from a reclaimed site is meeting all State and Federal water quality requirements.

E. Monitoring programs should include surface water, springs, underground sources and wells. Table 1: Surface Water Sampling and Table 2: Ground Water Sampling provide recommended sampling procedures for various water sources. These tables are incorporated herein by reference.

F. Sampling and analysis should be adequate to demonstrate compliance with all applicable State and Federal water quality protection regulations and to ensure that the postmining beneficial uses of the water are maintained.

G. Laboratory analysis of water samples should be conducted in accordance with Table 3: Surface Water Baseline, Operational and Postmining Water Quality Parameter List and Table 4: Ground Water Baseline, Operational and Postmining Water Quality Parameter List which are incorporated herein by reference.

H. Appropriate Quality Assurance/Quality Control (QA/QC) should be incorporated into all water monitoring programs for sampling, sample handling and storage and during analytical procedures as required by R645-301-723.

I. Amendments to water monitoring programs are allowed as specified under the R645 rules for permit amendments and more particularly for water monitoring as specified in the Procedures section below.

4. Procedure

A. General Water Monitoring Information

All coal mining operations are required to develop surface- and ground-water monitoring programs as part of their mining and reclamation plan. The surface- and ground-water monitoring plans must be based upon PHC determinations required under R645-301-728, and hydrogeologic information provided in permit applications. Among other requirements specified in R645-301-724 and –731.200, these plans must provide for collection of the following water related information, which will be used to determine the use and objectives for protection.

1. Provide mapped locations, elevations, and coordinates (UTM NAD 27) of all water sources and monitoring locations.

2. Provide adequate information to assess the quality and quantity under seasonal variation.

3. Provide geologic origin and rates of discharge for each source.

4. Provide ownership information, seasonal use and quantity of use for each source.

The plan should provide for the monitoring of parameters that relate to the suitability of the ground water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance and State-appropriated water supplies as set forth in R645-301-731. It will identify the quantity and quality parameters to be monitored, sampling frequency and site locations. It will describe how these data may be used to determine the impacts of the operation upon the hydrologic balance as required by R645-301-728. Water monitoring will continue through mining and continue during reclamation until bond release.

Table 3: Surface-Water Monitoring Baseline, Operational, and Postmining Water Quality Parameter List and Table 4: Ground-Water Monitoring Baseline, Operational and Postmining Water Quality Parameter List provide required and recommended parameter lists for baseline, operational and postmining water quality studies. The minimum required parameters for surface-and ground-water monitoring are specified in R645-301-724.100, -724.200, and –731.211, and –731.222.1. Because the R645 Rules allow for the Division to require additional monitoring measures, extended parameter lists are provided in Tables 3 and 4 for recommended parameters for baseline, operational, and postmining monitoring. The Division may require monitoring of the recommended parameters on a site-specific basis. Unless otherwise approved by the Division, water monitoring is required for each site on a quarterly basis.

B. Baseline Monitoring

Prior to permit issuance adequate baseline information must be collected to satisfy the requirements of R645-301-724.100 and 724.200. Tables 3 and 4 list the minimum required and recommended parameters for baseline studies. It is recommended that baseline information be collected quarterly for a minimum of two years prior to permit issuance. Data will be sufficient to demonstrate seasonal variation in quality and quantity for each source.

C. Operational Monitoring

Ground Water

Ground -water monitoring plans will be based upon the PHC determination required under R645-301-728. The plan will provide for the monitoring of parameters that relate to the suitability of the ground water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance and State-appropriated water supplies as set forth in R645-301-731. Table 4 lists the minimum required and recommended parameters for operational monitoring of ground water sources.

Surface Water

Surface-water monitoring plans will be based upon the PHC determination required under R645-301-728. The plan will provide for the monitoring of parameters that relate to the suitability of the surface water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance and State-appropriated water supplies as set forth in R645-301-731 as well as the effluent limitations found in R645-301-751;

For point-source discharges, monitoring will be conducted in accordance with 40 CFR Parts 122 and 123, R645-301-751 and as required by the Utah Division of Environmental Health for Utah Pollutant Discharge Elimination System (UPDES) permits;

Table 3 provides the minimum required and recommended parameters for operational monitoring of surface water sources.

D. Post-Mining Monitoring

Water monitoring will continue through the life of the mine, and reclamation until bond release. Tables 3 and 4 include the required and recommended parameters for postmining monitoring. Water monitoring information will be used to determine that all State and Federal water quality laws are being met and that the reclaimed areas are not contributing additional contributions of Suspended Solids to stream flow outside the permit area. The Division may formulate a bond release directive which would include the water monitoring requirements for bond release.

E. Amendments to Water Monitoring Programs

Amendments to water monitoring programs may be submitted by the permittee and will be approved according to the Division's permit amendment process and as specifically outlined for water monitoring below.

Amendments to monitoring programs will be approved on a site specific basis. Quarterly sampling is required at each surface and ground water monitoring location. Tables 3 and 4 list the required and recommended parameters to be analyzed. Inaccessibility will not be considered an excuse to forego the sampling requirements.

1. Sites above and below a mine's disturbed area and discharge points, public drinking water sources, and other high priority sources should be monitored quarterly in accordance with Tables 1 through 4.

2. Before reducing monitoring parameters for sites not included in the above group, the following criteria should be considered:

a. If the water source is included in a water right, then the surface landowner or water right holder should be notified of the proposed change and be given an opportunity to respond.

b. Appropriate historical quality data has been collected to show that a good cation/anion balance exists with these data.

c. Historical data can be used in a regression analysis to demonstrate that conductivity correlates to the specific water quality of that site. A good description of this type of analysis is given on pages 66-69 of Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd edition, USGS Water Supply Paper 2254, 1992.

d. The site is not critical to the ongoing PHC determination.

e. Criteria identified in R645-301-731.214 and 731.224.

f. Subsidence monitoring information may be used to indicate that further subsidence is not likely and that future mining will not occur in adjacent areas which could affect this water source.

The Division may require additional monitoring in accordance with R645-301-724.500, R645-301-731, as required by Division Orders or to address citizen's complaints.

F. The Division has created a hydrologic work group consisting of Division technical staff members involved in hydrology issues. This working group meets at least quarterly to discuss hydrologic related issues and concerns. Its members are listed in Section 9 below.

5. Delegated Responsibilities

TECH-004.GUI

A. Initiation of amendments to water monitoring programs: Coal Mine Permittee

B. Review water monitoring program amendments: Division Hydrologists

6. Reporting Requirements

In accordance with R645-301-130, R645-301-731.212 and 731.223, analytical results of all samples collected for each monitoring location will be submitted to the Division at least every three months.

7. References

United States Geological Survey, Study and Interpretation of the Chemical Characteristics of Natural Waters, Water Supply Paper 2254, 1992.

8. Effect on Other Documents

Supersedes Monitoring Programs for Coal Mines directive dated May 6, 1996 and July 1, 1997.

9. Division Contact/Work Group

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10. Tables

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Table 1: Surface-Water Sampling
Recommended Procedures

	Baseline	Operational	Postmining
Type of Sampling Site	Surface Water Bodies in the permit and adjacent area: Streams and tributaries; Stockwatering ponds; Impoundments; Discharge points (UPDES, other).	Surface Water Bodies: Those baseline and operational stations determined necessary for operational phase monitoring.	Surface Water Bodies: Those baseline, operational and reclamation stations determined necessary to meet bond release criteria.
Field Measurements and Parameters (See Table 3)	Performed during water level/flow measurements. According to Table 3.	Performed during water level/flow measurements. According to permit application and Table 3.	Performed during water level/flow measurements. According to permit application and Table 3.
Sample Frequency	Quarterly for lakes, reservoirs and impoundments. Monthly flow measurements for perennial streams. Quarterly water quality measurements for perennial streams, with one sample at low flow and one at high flow. Monthly water quality and flow measurements during period of flow for intermittent streams. Water quality and flow measurements schedules will be based on proximity to downstream water uses and potential for impacts.	Quarterly water quality for lakes, reservoirs and impoundments (water level and quality). Quarterly water quality and flow measurements for perennial streams, with one sample at low flow and one at high flow. Quarterly water quality flow measurements during period of flow for intermittent streams, with a minimum of one water quality and flow measurement during period of flow. Water quality and flow measurements schedules will be based on proximity to downstream water uses and potential for impacts.	Quarterly for perennial streams (high & low flow); Two water quality and flow measurements per annum during snowmelt and rainfall for intermittent streams. Water quality and flow measurements schedules will be based on the requirements for bond release.
Sampling Duration	Two years (one complete year of data before submission of permit application. Adequate to describe seasonal variation.	Every year until two years after surface reclamation activities have ceased.	Every year until termination of bonding
Reporting	Quarterly water monitoring data should be submitted in an electronic format through the Division's Electronic Data Input web site, http://linux1.ogm.utah.gov/cgi-bin/appx-ogm.cgi. Supporting documentation should be kept at the mine site for review upon inspection by the Division. This includes: Copies of DMR's Lab reports with: Results of analysis Method of analysis Date of analysis Date sampled Date sample received Precipitation data where applicable.	Quarterly reports same as baseline. Annually report as required by the Division.	Quarterly reports same as baseline. Prior to Bond release -adequate to assist the Division in determining. Phase I: Whether pollution of surface and subsurface water is occurring, the probability of future occurrence, and estimated cost of abatement. Phase II: After revegetation has been established and contributing suspended solids to stream flow or runoff outside the permit area is not excess of the requirements set by UCA 40-10-17(j) of the Act and by R645-301-751.

	Baseline	Operational	Postmining
			Phase III: Until reclamation requirements of the Act and the permit are fully met.
Comments	All field measurements performed concurrently with level/flow measurements. Stations used as comparative tools for PHC should be monitored on the same days.	All field measurements should be performed concurrently with level/flow measurements. Every fifth year (midterm), one sample at low flow or one at high flow. Each should be taken for baseline water quality parameters. An additional construction monitoring program may be required	

Table 2: Ground-Water Sampling
Recommended Procedures

	Baseline Monitoring	Operational Monitoring	Postmining Monitoring
Type of Sampling site	Springs, In-Mine Flows, Boreholes, Observation Wells.	Spring, In-Mine Flows, Boreholes, Observation Wells.	Springs, Observation Wells, Mine discharge points.
Field Measurements and Parameters (See Table 4)	Water levels and/or flow and water quality. According to Table 4.	Water levels and/or flow and water quality. According to permit application and Table 4.	Water levels and/or flow and water quality. According to permit application and Table 4.
Sample Frequency	Quarterly for all; Adequate to describe seasonal variation. Monthly recommended for more accurate description of seasonal variation.	Quarterly samples for springs and wells. In-mine flows greater than 5 gallons per minute (gpm) at initial interception, quarterly after 1st 30 days until diminished. From sumps and/or mine discharge points quarterly or as required by UPDES.	Quarterly based on potential impact; or once per annum (spring sampling at low flow).
Sampling Duration	Two years (one complete year of data before submission of permit application).	Every year until two years after surface reclamation activities have ceased.	Until termination of bonding.
Reporting	Wells and Boreholes- Water quality, water level or flow logs, collar elevation; ground elevations; screened interval; formation where completed; depth. Springs - Water quality, location, and flow. Quarterly water monitoring data should be submitted in an electronic format through the Division's Electronic Data Input web site, http://linux1.ogm.utah.gov/cgi-bin/appx-ogm.cgi. Supporting documentation should be kept at the mine site for review upon inspection by the Division. This includes: Copies of DMR's Lab reports with: Results of analysis Method of analysis Date of analysis Date sampled Date sample received Precipitation data where applicable.	Quarterly reports same as baseline. Annually report as required by the Division.	Quarterly reports same as baseline. Prior to Bond release -adequate to assist the Division in determining. Phase I: Whether pollution of surface and subsurface water is occurring, the probability of future occurrence, and estimated cost of abatement. Phase II: After revegetation has been established and contributing suspended solids to streamflow or runoff outside the permit area is not excess of the requirements set by UCA 40-10-17(j) of the Act and by R645-301-751. Phase III: Until reclamation requirements of the Act and the permit are fully met.
Comments	Springs and seeps should be measured from source at high	During the year preceding re-permitting: Springs, one water quality	

	Baseline Monitoring	Operational Monitoring	Postmining Monitoring
	and low flow periods.	sample at low flow for baseline parameters; Other sites, one sample for baseline parameter.	

Table 3: Surface-Water Monitoring Parameters

Minimum Requirements and Recommendations
Baseline, Operational, and Postmining

			FIELD MEASUREMENTS	REPORTED AS
+	*	-	Water level or Flow	Depth, Flow
+	*	-	pH	Standard units
+	*	-	Specific Conductivity	umhos/cm @ 25° C
	*	-	Dissolved Oxygen	mg/l
	*	-	Temperature	°C

			LABORATORY MEASUREMENTS	REPORTED AS
+	*	-	Total Dissolved Solids	mg/l
	*	-	Total Settleable Solids	(UPDES)
+	*	-	Total Suspended Solids	mg/l
	*	-	Total Hardness ($CaCO_3$)	mg/l
+'	*	-	Total Alkalinity	mg/l
+'		-	Acidity	mg/l
		-	Aluminum (Dissolved)	mg/l
		-	Arsenic (Dissolved)	mg/l
		-	Boron (Dissolved)	mg/l
+'	*	-	Carbonate	mg/l
+'	*	-	Bicarbonate	mg/l
		-	Cadmium (Dissolved)	mg/l
	*	-	Calcium (Dissolved)	mg/l
	*	-	Chloride	mg/l
		-	Copper (Dissolved)	mg/l
	*	-	Iron (Dissolved)	mg/l
+	*	-	Iron (Total)	mg/l
		-	Lead (Dissolved)	mg/l
	*	-	Magnesium (Dissolved)	mg/l
	*	-	Manganese (Dissolved)	mg/l
+	*	-	Manganese (Total)	mg/l
		-	Molybdenum (Dissolved)	mg/l
		-	Ammonia	mg/l
		-	Nitrates	mg/l
		-	Nitrites	mg/l
	*	-	Potassium (Dissolved)	mg/l
		-	Phosphates(Ortho)	mg/l
		-	Selenium (Dissolved)	mg/l
	*	-	Sodium (Dissolved)	mg/l
	*	-	Sulfate	mg/l
		-	Zinc (Dissolved)	mg/l
	*	-	Oil & Grease	mg/l
	*	-	Cations	meq/l
	*	-	Anions	meq/l

+ Parameters required for Baseline monitoring.
+' Parameters required for Baseline monitoring if there is a potential for acid drainage.
- Parameters recommended for Baseline monitoring.
* Parameters recommended for Operational and Postmining monitoring

Table 4: Ground-Water Monitoring Parameters
Minimum Requirements and Recommendations
Baseline, Operational, and Postmining

			FIELD MEASUREMENTS	REPORTED AS
+	*	-	Water level or Flow	Depth, Flow
+	*	-	pH	Standard units
+	*	-	Specific Conductivity	umhos/cm @ 25° C
	*	-	Temperature	°C

			LABORATORY MEASUREMENTS	REPORTED AS
+	*	-	Total Dissolved Solids	mg/l
	*	-	Total Hardness ($CaCO_3$)	mg/l
	*	-	Total Alkalinity	mg/l
		-	Acidity	mg/l
		-	Aluminum (Dissolved)	mg/l
		-	Arsenic (Dissolved)	mg/l
		-	Boron (Dissolved)	mg/l
	*	-	Carbonate	mg/l
	*	-	Bicarbonate	mg/l
		-	Cadmium (Dissolved)	mg/l
	*	-	Calcium (Dissolved)	mg/l
	*	-	Chloride	mg/l
		-	Copper (Dissolved)	mg/l
	*	-	Iron (Dissolved)	mg/l
+	*	-	Iron (Total)	mg/l
		-	Lead (Dissolved)	mg/l
	*	-	Magnesium (Dissolved)	mg/l
	*	-	Manganese (Dissolved)	mg/l
+	*	-	Manganese (Total)	mg/l
		-	Molybdenum (Dissolved)	mg/l
		-	Ammonia	mg/l
		-	Nitrates	mg/l
		-	Nitrites	mg/l
	*	-	Potassium (Dissolved)	mg/l
		-	Phosphate (Ortho)	mg/l
		-	Selenium (Dissolved)	mg/l
	*	-	Sodium (Dissolved)	mg/l
	*	-	Sulfate	mg/l
		-	Zinc (Dissolved)	mg/l
	*	-	Cations	meq/l
	*	-	Anions	meq/l

\+ Parameters required for Baseline monitoring.
\- Parameters recommended for Baseline monitoring.
* Parameters recommended for Operational and Postmining monitoring