ATTACHMENT VII-2

GROUNDWATER SAMPLING AND FIELD ANALYSIS STANDARD OPERATING PROCEDURES

I. INTRODUCTION

A. GENERAL STATEMENT CONCERNING CLEAN HARBORS GRASSY MOUNTAIN (CHGM) MONITORING

Protection of the groundwater under its facilities is a critical environmental concern of CHGM. This procedure shall provide for efficient, accurate, and representative sampling of the groundwater beneath CHGM, and subsequent analysis of those samples. Other non-routine sampling events may also be covered by this document.

Throughout this document, the term "The Laboratory" will be used. "The Laboratory" is expressly stated to mean the Utah Certified Laboratory used for analyses of environmental samples.

B. RESPONSIBILITIES OF KEY PERSONNEL

Management of the groundwater monitoring program is the responsibility of the CHGM General Manager. The CHGM General Manager will coordinate this effort utilizing personnel from any or all the following: CHGM, Clean Harbors (the owner), Clean Harbors Monitoring Group, other divisions or companies of the owner, and consultants. The actual sampling teams may be composed of representatives from any or all these entities. Field team personnel will have completed 40-hour HAZWOPER. There will be a person designated as the Facility Technical Representative to perform specific duties as noted. Individual team members with the appropriate training may hold more than one title and/or be on both the sampling and purging teams as described below.

i. Sampling Team and/or Purging Team:

The sampling and/or purging team(s) are responsible for the actual field activities of the sampling episode. The Facility Technical Representative shall act as the team coordinator. At the beginning of the episode, an Event Coordinator shall be determined. Individual team members shall be appropriately trained. The sampling and purging teams will each have a minimum of two members. A single team can be used for both purging and sampling.

Each team member will have read the Groundwater Sampling and Field Analysis Standard Operating Procedure and passed a written test before sampling is undertaken. A copy of the test and test results shall be included in the sampling event records. Field experience will be gained in stages, with continuing supervision from one of the senior members of the group. The person(s) responsible for various documents relating to field sampling (Document Control Officer) will become familiar with the Standard Operating Procedures (SOP) and receive instruction from the Facility Technical Representative prior to the event.

1. ***Team Leader(s):***

   This person(s) will be the supervisor for each individual purge or sampling team. Specific responsibilities shall include team adherence to protocol, documentation management for their team and assignment of team members to specific tasks.

2. ***Team Member(s):***

   These individuals shall accomplish required tasks as assigned by the team leader.

C. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Detailed Quality Assurance/Quality Control (QA/QC) procedures are a significant part of all aspects of sample collection, sample preservation, sample shipment, analytical procedures, and chain-of-custody control. QA/QC for sample collection, sample shipment, and chain-of-custody control shall be as follows:

1. Sample preservation, sample sizes and holding time requirements shall be updated by the Laboratory prior to each event to make sure the most current method requirements are used. This list, an example of which is Attachment VII-3, Table 4, is provided to the sampling team. A contract Laboratory is responsible for their own QA/QC.
2. Analytical methods are also shown in Attachment VII-3, Table 4.
3. Sample Preservation and Transportation Methods.
    a. The sample shall be protected from damage. The analytical method, and site safety requirements shall provide guidance for the safe handling of samples. All samples shall be handled with extreme care.
        1) The Laboratory ships the sample containers packed to prevent contamination and/or damage.
        2) CHGM shall inventory the sample containers they receive at and ensure they are protected to prevent contamination and/or damage. The sample shipping container can be used to store the sample containers at the site, move the sample containers to the sample site, and to hold and ship the sample containers after sampling.
        3) After the sampling event, all samples shall be packed in bubble wrap and placed on ice in coolers to prevent damage and maintain the appropriate temperature. They shall be shipped to the Laboratory within the required holding times.
        4) Samples generated during the sampling event shall remain under the control of the sampling team or shall be stored in a secure (locked) location. The sampling team will initiate chain-of-custody documentation. Custody shall be transferred to the shipping company, at the time of shipping through use of the shipping documentation. The Laboratory shall document receipt of the samples on the chain-of-custody seal. All sample transfers, except during shipping via an overnight delivery service, shall be documented on a chain-of-custody form that shall be retained by the Laboratory as part of the internal documentation package.
        5) The following information shall be included on chain-of-custody forms:
            (a) Sample location;
            (b) Sample tracking identification;
            (c) Name of samplers;
            (d) Signature of samplers;
            (e) Date of sample collection;
            (f) Time of sample collection;
            (g) Type of sample;
            (h) Number of sample containers;

(i) Analysis requested;
(j) Space for additional chain-of-custody transfer signatures;
(k) Laboratory name and location; and
(l) Additional sample tracking information as deemed necessary.

6) CHGM shall ensure that the Laboratory follows procedures to track sample receipt, maintain log-in procedures, and other documentation, which shall include chain-of-custody records from sample receipt to sample disposal.

b. A primary file containing the original shipping documentation (if used), chain of custody, sample receipt, and Laboratory reports shall be maintained and archived for at least three years.

II. PLANNING THE SAMPLING EVENT

A. PRE-EVENT PREPARATION

1. Scheduling:

The final sampling event schedule shall be prepared by the Facility Technical Representative. The following tasks will be accomplished prior to actual field sampling activities:

a. The Facility Technical Representative will coordinate sample containers with the contracted laboratory.

b. The Facility Technical Representative or assigned team member shall gather all required instrumentation needed for the field analytical data, which generally includes:

- Depth Sounder
- Turbidity meter
- Field pH meter,
- Field conductivity meter,
- Field thermometer,
- Organic Vapor Analyzer

As the field instrumentation is gathered, each instrument shall be confirmed to be clean and operational. Calibration and testing procedures outlined by manufacturers specifications shall be followed. A calibration and testing checklist shall be maintained for each piece of equipment. Any equipment needing repair, recharging or battery replacement shall be evaluated and corrected at this time so all needed equipment shall be operational during the days of sampling. All standards to be used for the sampling episode shall be confirmed to be available and in appropriate condition for use during the sampling event. As much as practical, duplicate instrumentation shall be available at the facility in case of breakage or malfunction.

c. The sample containers shall be inventoried at CHGM to assure that they have been received in acceptable condition. Missing or broken containers shall be reordered from the Laboratory.

d. The Facility Technical Representative, or assigned team member, shall assure the other needed equipment is collected:

- Safety equipment including protective gloves, safety glasses, respirators, and chemically resistant coveralls for each team member, when required by the health and safety policy.
- Graduated wastewater buckets, graduated cylinder or beaker, and timing device capable of measuring to the nearest second.
- Appropriate waste container labels.
- Sample containers for field analytical determinations.
- Deionized/distilled water shall be available from the Laboratory or from CHGM for cleaning purposes and the collection of QA/QC blank samples. At least one complete trip blank field blank and equipment blank using this DI water shall be collected for each annual sampling event.
- Well controller for dedicated well pumps. The unit shall be confirmed to be working as per the manufacturer's specifications.
- Tarpaulin, plastic sheets, or other nonporous material (ground cloth) for use as the sampling surface at individual well locations.
- Waste container for purged well water and other water discarded during the sampling event (this water shall be managed in hazardous waste tanks according to Section IV.D.3. of this Permit). If the well is inside the fenced perimeter of the facility, the waste container can be left on the well concrete apron or on a pallet pending placement of the water in the hazardous waste leachate tank. One or more containers can be used for purging water from wells outside the perimeter fence and brought inside the fence for management.
- Appropriate sampling vehicle. It will be confirmed that appropriate vehicles will be available for the sampling episode. It is emphasized that any possible surface upon which a sample could be placed should be clean.

e. Each team shall maintain documentation describing performance of all procedures and tasks. Notes are to be taken during all purging and sampling related activities describing the sequence of events. This documentation shall be maintained in a combination of field notebooks, field data sheets, field forms, and checklists. At a minimum, each team shall maintain a field notebook. Field notebooks are to be constructed of bound, water-resistant, numbered pages. Notes are to be entered using non-erasable ink. Data can be transferred from field notebooks to other required field data sheets and forms. Information may be recorded in more than one location. Data can be entered simultaneously in a field notebook and a data sheet. Duplication of record keeping is encouraged. Information recorded during purging and sampling related activities shall include, but not be limited to, the following:

- Identification of sampling location or monitoring well, condition of well, locked or not, any evidence of tampering, and presence of standing water in the vicinity.
- Meteorological information including temperature, wind direction and velocity, barometric pressure, and general conditions and time of all measurements. These

measurements shall be recorded at least twice daily, once in the morning and once in the afternoon.

- Sample team members and all observers.
- Water-well depth information.
- Well Purging information and calculations.
- Results of all immiscible checks.
- Specific sampling information for each well including turbidity measurements.
- Sample distribution.
- Instrument calibration information will be recorded in the morning. A calibration verification will be performed in the afternoon and the information will be recorded. Deviations from the acceptability range for the instrument being used will require re-calibration and the re-calibration results will be recorded. Variations from this SOP and the reasons for the variations shall be recorded. Documentation of variations from this SOP does not relieve CHGM of any obligations to perform procedures as described in the permit.

A sample of a field data sheet is included as part of this attachment. Revisions to this form can include additional information or reformatting without prior notice to the Division of Waste Management and Radiation Control (Division).

B. DAY OF SAMPLING PREPARATION

1. Field instrumentation:

   Field instrumentation shall be validated for use daily prior to going into the field. Manufacturer specifications will be followed for the calibration and maintenance of all instruments. Calibration verifications shall be performed as necessary and in the afternoon by measuring a known standard. Values that fall outside of the acceptability range for the instrument being used will require that the instrument be re-calibrated. Instrument preparation protocols include the following:

   - pH Meter: The pH meter will be calibrated using a three-buffer system to assure accuracy and precision. The two primary calibration buffers should bracket the range of anticipated values. The third buffer should be used as a calibration check only (unless the meter can be calibrated using all three buffers). Standard buffers shall be available over the range of pH 4 to pH 10. A minimum of two three-buffer calibrations, as explained above, shall be performed daily. The calibration shall be conducted in a location that best reflects ambient temperatures.
   - Conductivity Meter: The conductivity meter shall be capable of measuring specific conductance up to at least 100,000 µmhos/cm. The meter shall be calibrated at least daily using two standards. One standard shall be used to set the calibration while the second standard reading shall be recorded for reference (unless the meter allows a two-standard calibration). These two calibrations shall be performed in a location that best represents ambient temperatures. The two calibration standards shall bracket the range of anticipated field readings based upon previous sample results.

- Depth Sounder: The water depth sounder shall be confirmed to be working as per manufacturer's specifications. An interface probe can also be used as a sounder.

2. Health and Safety:

   Prior to entering the field, each piece of safety equipment shall be checked for appropriate fit and applicability:

   - Other health and safety aspects shall be considered in accordance with the health and safety requirements.
   - Respirators shall be of the appropriate type as designated by safety requirements and/or the CHGM safety representative. Respirators shall be carried by each team member during the sampling and will be worn any time it is required by facility safety rules. Respirators will also be worn at any time when the judgment of a team leader dictates. Field experience based on previous sampling episodes, coupled with analytical results, indicates no immediate hazard exists (such as sulfides). Specific safety precautions shall be addressed by the CHGM safety representative.
   - Gloves shall be worn by all team members participating directly in sample collection and preservation tasks. As a minimum, disposable latex gloves or equivalent shall be worn. Gloves shall be changed as necessary to prevent cross contamination, maintain cleanliness and to assure safety. Gloves shall particularly and specifically be changed between wells, and if they become soiled with any possible contaminant.

3. Sample Containers and Coolers:

   Prior to leaving for the field, sample containers shall be rechecked to assure that there is a full set for each well properly marked and labeled. Ice, or other cooling agents, shall be added to the coolers to aid in preserving the samples. The sample coolers shall be managed in the field to minimize temperature changes. Following sample inventory, and prior to sample shipment, ice or other cooling agents shall be added to the shipping containers to ensure a cool environment during shipping.

4. Documentation Package:

   The following documentation shall be maintained:

   - Field notebook(s)
   - Field data sheets
   - Chain-of-custody forms
   - "Groundwater Sampling Field Data Sheet" and equivalent forms

   Appropriate writing tools shall be included as part of the documentation package.

5. Vehicle Use and Packing

   The designated vehicle to be used for the sampling episode shall be cleaned and loaded so that each item of equipment is readily available at time of use. Vehicle inventory shall include:

   - Sample coolers

- Field analytical instrumentation
- Wastewater bucket for purging
- Depth sounder, probe, or Interface Probe
- Deionized/distilled rinse water for decontamination
- Well pump controller
- Sample containers and glass bottles

III. SAMPLING PLAN (ROUTE AND STRATEGY)

A. SAMPLING ROUTE

The sampling route shall be based on first sampling the wells with the least potential for contamination and proceeding to the wells with the highest potential for contamination. The basic strategy is that background wells are to be monitored prior to down gradient wells, and that wells outside of the controlled area are to be monitored prior to wells inside the controlled area. If leachate sumps are to be sampled, they will be last on the schedule. Wells known to be slow to recover will be purged at an appropriate time to assure timely completion of the sampling event. Based on this strategy, a route plan for the sampling team will be developed. The route shall be confirmed by the Facility Technical Representative and will be kept as part of the sampling SOP documentation. The route may change based upon operational requirements.

In accordance with Permit Condition VII.D.6.a., the Utah Department of Environmental Quality, Division of Waste Management and Radiation Control, shall be notified and invited to observe the sampling event 14 days prior to the start date. The dates proposed for monitoring individual wells are target dates, and final schedules for sampling shall be adjusted to maintain compliance with all CHGM permits and approvals.

B. QA/QC SAMPLES

Sample duplicates, field blanks, equipment blanks, matrix spike/matrix spike duplicates (MS/MSD), and trip blanks shall be collected during sampling events as QA/QC samples. All QA/QC samples shall be collected with the same care and treated as regular samples.

Duplicate samples shall be collected from a minimum of ten percent (10%) of the sampled wells. Each duplicate sample shall be analyzed for the same parameters as the original sample. Duplicates shall be collected by alternating the filling of bottles between the sample and the duplicate sets. Each duplicate will be labeled to disguise the sample location from the Laboratory. The location and identity of each duplicate sample shall be maintained in the field documentation.

A least one complete field blank will be collected during each week of a regularly scheduled sampling event. One Volatile Organic Analysis (VOA) field blank shall be collected daily when VOA samples are being collected. Field blanks shall be collected at a sample location (i.e., wellhead) or in the immediate vicinity CHGM activity (such as near an active cell).

MS/MSDs shall be collected from a minimum of five percent (5%) of the sampled wells. Each MS/MSD sample shall be analyzed for the same parameters as the original sample.

Trip blanks will originate at the Laboratory, shall remain with a shipment container, and shall be submitted to the Laboratory with sample shipments for analysis. At a minimum of one trip blank for every two days of shipping shall be submitted for VOA analysis when VOA samples are being collected.

An equipment VOA blank shall be obtained from the well water level probe at the beginning of each regularly scheduled sampling event.

IV. PURGING AND OTHER SPECIFIED WELL ACTIVITIES

A. WATER-LEVEL READINGS

Water-level readings for each well shall be taken electronically using an electronic depth meter or interface probe. Water levels shall be measured and recorded during each sampling event, or as required by regulations or permit, but at least each quarter. The Facility Technical Representative or assigned team member shall take these measurements. Gloves shall be worn to minimize the potential for contamination. Water-level readings are taken in concert with review of each well using the following order of activities:

1. After arrival at the well, environmental and site information per Section II.A.1.e shall be recorded. Background Organic Vapor Analyzer (OVA) readings shall be obtained and recorded.

2. A team member shall remove the lock and open the steel top. They shall remove the plastic plug in the well cap, taking care that no dirt or foreign matter is dropped into the well. A check of the well head in the breathing area shall be taken with an OVA and recorded for health and safety purposes. A reading greater than 10 ppm in the air space shall invoke the safety consideration identified in the Health and Safety Section II.B.2. A team member shall rinse and wipe the probe of the electronic depth meter with deionized/distilled water. The probe shall be slowly lowered into the well until the meter indicates that water has been reached. The depth at which the water was encountered shall be measured from a surveyed datum and recorded. (The meter shall be read to the nearest 0.01 ft.). The probe shall be raised until it is no longer in the water. Lower the probe again until the meter indicates that water has been reached and enter the value in the field logbook. If the values do not agree within 0.02 ft., the steps shall be repeated as above until the two readings agree within 0.02 ft. (record all values).

3. The probe shall be raised from the well, cleaning the immersed portion of the cable and rinsing the probe thoroughly with deionized/distilled water. Replace the probe and meter in the protective sleeve or other protection.

4. Continue with the Section D purging operation or secure the well and proceed to the next well in the circuit.

B. DEPTH READINGS

Depth readings shall be taken each time a pump is pulled, but they shall also be taken for each well at least biennially. This has been a requirement since 2010.

OVA readings will have been conducted previously as described in IV.A. Well depth readings shall be measured using an electronic depth sounder. The following procedure shall not be performed during the actual sampling event unless a pump must be pulled during the event. The depth readings shall be taken in concert with review of each well, as per the following order of activities:

1. After arrival at the well, the designated team member will document and record all required environmental and site information as required by Section II.A.1.e.

2. The designated team member will proceed as follows:

a. Prior to pulling the pump, carefully rinse and wipe the probe before well measurements are taken. Slowly lower the water depth sounder into the well until it contacts the water, or an immiscible layer is contacted. Record all fluid level readings to the nearest 0.01 feet. Obtain 2 consecutive fluid readings within .02 feet and record. Remove the water depth sounder from the well. Grasping the PVC cap with both hands, lift upwards. Since the pump and tubing are attached to the lid, the pump will be removed as the lid is raised. Carefully coil the tubing and place the lid, coiled tubing, and pump into a large, clean, plastic, disposable bag. Close and seal the top of the disposable bag containing the pump and tubing. Care shall be taken to not let the lid, tubing, or pump touch anything other than the inside of the bag while being placed in the bag.

b. After the pump is removed, lower the oil/water interface probe or water level sounder until it gently touches the bottom of the well. Record the depth when tension in the cable is relieved as the probe touches the bottom of the well. Raise the probe above the bottom and then lower it again to the bottom to take a second reading. The readings taken are recorded to the nearest 0.01 ft. as measured from a surveyed datum.

c. If a water contaminated with petroleum (Light Non-Aqueous Phase Liquid (LNAPL)) or a water that is denser than water or immiscible (Dense Non-Aqueous Phase Liquid (DNAPL)) is encountered, record the occurrence of such phases. Arrangements shall be made to sample the well after notification to the Director of the Division of Waste Management and Radiation Control (Director).

d. Slowly remove the probe from the well, carefully rinse and wipe both the immersed portion of the cable and probe with deionized/distilled water as it is removed, ensure the wire or probe never touches the ground or anything outside of the well. If a LNAPL or DNAPL were encountered the decontamination procedure shall include a detergent rinse followed by deionized/distilled water. In the event these procedures are not effective, then a senior team member shall decide to use an acetone/hexane rinse which will precede the detergent and deionized/distilled water. The acetone/hexane rinse shall not be recommended except in extreme circumstances. These procedures can be performed in the field or upon returning to the shop to decontaminate the cable and probe.

e. Remove the pump from the bag and thoroughly rinse both the pump and the first few feet of tubing with deionized/distilled water. After rinsing, insert the pump and first few feet of tubing back into the well. Prior to reinserting the remaining tubing, they shall be rinsed with deionized/distilled water or wiped with disposable wipes. Gently lower the pump and tubing back into the well. Abrupt actions could separate the components. Securely push the cap back onto the well stem making sure that the cap is flush with the top of the PVC casing. Record the condition of the pump and any other observations on the field data sheet or in the logbook.

f. Minor maintenance and cleaning of the pump can be undertaken while the assembly is accessible on the surface. Extensive maintenance or cleaning can require additional servicing or replacement.

g. Secure the well cap and proceed to the next well in the circuit.

C. WELL-VOLUME CALCULATIONS

The volume of water to be removed from the well for purging can be calculated from the following formula:

Water volume to be purged (gal) = (Casing Length in Ft - Depth to Water in Ft) * X * 3

Where: X = 0.16 for 2-inch wells[1]

X = 0.65 for 4-inch wells[1]

X = 1.47 for 6-inch wells[1]

(Rounded to two decimals, only)

To convert gallons to liters, multiply by 3.785.

Values for additional casing sizes are available and values can change as construction materials vary.

It will be noted on the Groundwater Sampling Field Data Sheet located in Appendix B if there is a significant difference between the current water elevation and/or well volume calculation and the historical value. A table including the most recent well depth measurements shall be made a part of the facility log records. The table shall be updated prior to each regularly scheduled sampling event.

D. WELL PURGING

Wells must be purged prior to obtaining a sample for formal analysis at the Laboratory (see calculations section). Wells should be purged for a minimum of three well volumes. Field parameters should be measured and recorded throughout purging, and purging should continue and until parameters have stabilized: pH +/- 0.1, NTUs <5, specific conductivity +/- 10%, temperature +/- 0.1 degree.

Wells with low rate of recovery shall require special procedures. Wells shall be defined as low recovery when less than 150 ml/minute is obtained during pumping. If a well cannot provide adequate volume for samples after purging, it shall be purged dry and allowed to recover for about 24-hours (or less, if the water level has recovered sufficiently). Following this recharge cycle, samplers shall collect as much sample as possible. The well shall be allowed to recover for an additional 24-hours (or less if the water level has recovered sufficiently) if additional water is needed for sample collection. All wells except low recovery wells shall be sampled the same day that they are purged.

i. Purging Process

For each well, purging shall be performed based on the established total volume to be removed from the well and using the following procedures

1. Field personnel shall wear clean gloves when purging each well.

[1]The volumes/foot values given are nominal values using the assumption that the actual casing diameter is exactly equal to the stated size. Variations between casing types, manufacturers, production runs, temperatures, handling conditions, etc., will make the actual volumes slightly different from those stated. These minor differences will make no effective difference in the quality of samples collected.

2. Open the well. If vapors greater than 10 ppm from the OVA were measured in the breathing area when the water-level readings were taken, follow procedures as found in the Health and Safety Section II.B.2.

3. Each well has a dedicated pump. Specifications, details, and operational procedures are included at the conclusion of this protocol. Using the established total volumes to be removed from the well, the following protocol shall be used to purge each well.

    a. Connect the well pump control unit to each well.

    b. Start the pump and remove as much water from the well as required based on the well-volume calculation. Collect purge water in an appropriate container to validate purge volumes and to minimize any contamination of the ground or well apron by the purged water.

    c. Observe the purge water for evidence of immiscibles (not forming a homogeneous mixture when added together, see Appendix A) and note the results on the field data sheet.

    d. Note the amount removed from the well on the field data sheet.

    e. All purged water shall be placed in a container and managed as hazardous waste. Initial management is limited to labeling containers and handling labeled containers as hazardous waste. It shall then be managed in one of the following ways:

        1) Regardless of previous or current analytical results, it can be solidified and disposed of in RCRA permitted disposal units or disposed of as leachate. This does not include any assignment of hazardous waste codes or imply that any of the Land Disposal Restrictions, regulatory prohibitions or restrictions apply to groundwater.

        2) It may be stored until the analytical results are received from the sampling event and if those results show no constituents above the critical level the purge water can be solidified and disposed of in the landfill or mixed with and disposed of as leachate.

    f. If the dedicated pump is non-operational, the well shall be bailed using the procedures, including cleaning, and representative blanks, outlined in Section VII of this Attachment (observation wells and malfunctioning monitoring wells).

    g. If the dedicated pump is non-operational, attempts should be made to return the pump to operation or to secure a replacement pump. If the pump cannot be repaired in a reasonable amount of time or a replacement pump cannon be quickly procured, then the well shall be bailed using the procedures, including cleaning, and representative blanks, outlined in Section VII of this Attachment (observation wells and malfunctioning monitoring wells).

    h. Cap and lock the well and proceed to the next well according to the schedule or proceed with sampling.

V. WELL SAMPLING

Once the wells have been purged, the actual sampling shall occur. All wells except low recovery wells shall be sampled the same day they are purged. Wells with low recharge rates shall be sampled as per

the protocol outlined in Section III. Steps 1 and 4 below do not have to be repeated if sampling is part of a continuous purge and sample event or if the well was purged on the same day.

A. FIELD ANALYTICAL PROTOCOL

1. Note all required environmental and site information per Section II.A.1.e.
2. A team member shall remove the ground cloth from the sampling vehicle and place it at an appropriate place near the well. The location shall be designated by the team coordinator.
3. Start the pump controller and allow the water to fall into the waste bucket. Observe the water in the bucket and in the samples for evidence of immiscibles and note the results on the field data sheet.
4. Separate samples for pH, specific conductance, and turbidity to be collected or these same analysis can be performed from the same sample.
5. pH measurement: Take a sample from the well, place the pH probe into the sample, let the reading stabilize, and record. Wash the probe with deionized/distilled water and discard with purge water. Place the pH meter and probe in the pH meter protective carrying case.
6. Turbidity: Confirm calibration of the instrument per manufacturer's requirements. Take a reading and record the value.
7. Specific conductance: Take a sample from the well and immerse the conductivity probe into the sample. Measure and record the value. Discard sample in the waste container, wash probe with deionized/distilled water and replace the meter and probe in the protective container. In the event of specific conductivity is outside of the calibration range, the specific conductance shall also be analyzed by the Laboratory. All specific conductance readings, field and Laboratory, shall be corrected to 25 degrees Celsius.

B. PROTOCOL OF SAMPLING FOR LABORATORY ANALYSES

1. Sample containers should come pre-labeled and/or pre-preserved from the Laboratory or vendor, identifying the analyses and appropriate preservative. This is to assure proper bottle inventory during sample gathering, shipping, and receiving. If received without labels, all bottles shall be appropriately labeled at the facility prior to entering the field. If bottles are pre-preserved or if preserved at the time of sampling, random pH checks shall be performed to verify proper pH values for preservation.
2. Analytes, if sampled, shall be sampled in the following order and with the following precautions as required by permit conditions:
   a. Group I
      - Volatiles
      - TOX (total organic halides)
      - TOC (total organic carbon)
   b. Group II

- TOC
- Semi-Volatiles
- Pesticides/herbicides/PCBs
- Total Metals
- Dissolved Metals
- General Parameters - Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and Anions
- Phenols
- Ammonia, Hardness
- Total Cyanide
- Total Sulfide

c. NOTES:

1) Group I analytes are flow-sensitive and shall be collected first.

2) Group II analytes are not flow sensitive and shall be collected next.

3) TOC may be collected as either a Group 1 or Group II analyte, which will be determined by the type of the sample container provided by the Laboratory. Note that the collection of this analyte is not flow sensitive.

3. A list of the current requirements for types of containers, holding times, minimum acceptable volumes, and preservation methods for each sample parameter shall be updated by the Laboratory and provided to the sampling team prior to each sampling event based on the analytical methods shown in Attachment VII-3, Table 4. Changes shall be included in the report of the event submitted to the Director.

4. Flow-sensitive Analytes:

a. For volatile analyses the flow rate shall be adjusted to be at least 75 ml/min but shall not exceed 150 ml/min with the top of the sample vial located less than or equal to six (6) centimeters from the exit of the sample tube. The flow shall be timed to demonstrate the flow rate. If the flow rate is adjusted before all flow sensitive samples have been taken, the sampler shall recheck the flow rate before collecting additional flow sensitive samples. Carefully add the water to the first VOA vial. Ensure that there is no air in the sample during collection and after the cap has been placed on the vial. Place the cap on the vial, invert the vial and make sure there is no trapped air in the sample. If there is air in the sample, open the vial and add sample to displace the air. Recheck until there is no trapped air as determined by inspection. Fill the other VOA vials using the same technique. Place the vials in the cooler and continue with the next sample. Sample preservative, if directed by approved method, can be added to the sample bottle during or prior to sample collection.

b. If a TOX sample is taken, the same precautions as for VOA analysis shall be used. Fill the designated bottle. The bottle shall be filled to the top with no air trapped in the bottle. When the bottle is filled, place it in the cooler.

5. Analytes that are not flow sensitive:

    a. The volume of sample collected for semi-volatile organics shall be specified by the method. Fill the bottle to the level specified by the most recent method, cap and place it in the cooler. Separate sample bottles, one liter (or one quart) or larger, can be used for pesticides/herbicides/PCBs. Fill each bottle to the neck or the level specified by the most recent method, cap and place it in the cooler as above.

    b. The sample for total metals shall be taken by filling the sample container to provide sufficient sample for analysis (leaving sufficient headspace for preservative) and, if the bottle is not pre-preserved, adding nitric acid preservative, to a pH of less than 2. Close the container and place it in the cooler. If a sample for dissolved metals is desired, filtering shall be performed in the field prior to preservation using a 0.45-micron filter.

    c. The container for general parameters not requiring a preservative such as anions, TSS, and TDS, is filled to provide sufficient sample volume, capped, and placed in the cooler.

    d. If a sample for total phenol is to be taken, the bottle shall be filled to the appropriate level (leaving sufficient headspace for preservative) and add sulfuric acid preservative until a pH of less than 2 is achieved. Cap the bottle and place the sample in the cooler.

    e. If a sample for ammonia and hardness is to be taken, the container shall be filled to the appropriate level (leaving sufficient headspace for preservative) and add sulfuric acid preservative to a pH less than 2. Cap the bottle and return it to the cooler.

    f. If a sample for total cyanide is to be taken, the container shall be filled to the appropriate level (leaving sufficient headspace for preservative) and shall be preserved with NaOH to a pH of greater than 12. Cap the bottle and return it to the cooler.

    g. If a sample for total sulfide is to be taken, the container shall be filled to the appropriate level (leaving sufficient headspace for preservative) and NaOH/zinc acetate preservative shall be added to the sample to a pH greater than 9. Cap the bottle and return it to the sample cooler.

C. ENDING THE INDIVIDUAL WELL SAMPLING

When the final sample has been taken at the well site, the following procedure shall be used to secure the site and prepare the team to move to the next sampling location:

a. Remove the pump controller hose from the well pump.

b. Secure the well by replacing the cap and putting the lock in place. Make sure any protective covers or caps have been put in place and secured.

c. Repack the sampling vehicle, so that the analytical instrumentation and pump controller are readily accessible for the next well sampling.

d. Clean the surface of the ground cloth and place in sampling vehicle or carefully dispose.

e. Secure all excess groundwater and rinses in a waste container for disposal.

f. Dispose of gloves used at the well site.

g. Proceed to the next sampling site on the established circuit.

D. ENDING THE SAMPLING EPISODE

1. The following protocol shall be used to complete the documentation and send the samples to the Laboratory for analyses:

   a. A sampling team member shall check each cooler to make sure that all samples have been collected and are packed securely. Packaged ice, "blue ice" or other cold preservative is acceptable as a coolant. Coolers filled during the day may be left in a secure (locked) area until the end of the day.

   b. An assigned sampling team member shall verify the transfer of all field analytical data to report sheets. The report sheets shall be sent to the Laboratory with the samples in the courier pouch to be included in the documentation report.

   c. The bottles to be sent shall be compared with the chain-of-custody forms. A sampling team member shall confirm that all bottles are present and sign the chain-of-custody forms for each set of samples.

   d. A sampling team member shall review and sign the chain-of-custody forms and make sure they are placed in the courier pouch. The courier pouch shall be placed in the cooler. If an independent carrier is used, each cooler shall be sealed with "chain-of-custody" tape.

   e. The bill of lading and documentation shall be prepared to send the samples to the Laboratory. If necessary, an overnight delivery service shall be used to ensure that the samples will arrive at the Laboratory the next day. As an option, the samples can be escorted to the Laboratory where samples with short hold times can be analyzed and if necessary, the other associated samples sent to a more distant lab when hold times are not a concern.

   f. An assigned team member shall remove the field analytical instrumentation, calibration standards and other standards and other analytical equipment from the sampling vehicle and stores in the appropriate place.

   g. All team members shall be responsible for removal and storage of personal safety equipment used during the sampling episode. Disposal of disposable clothing shall be done in an appropriate manner according to the facility policy.

   h. The sampling team as a group shall review the documentation package generated during the sampling day, making sure it is complete and transferred to the master log. The assigned person shall complete any necessary information.

   i. A team member shall remove all additional equipment from the sampling vehicle and place it in the appropriate storage area.

E. WELL RESAMPLING

During sampling handling, shipments, and analysis sampling bottles may be broken. In addition, sample holding times can be exceeded. As a result, additional well resampling will be required to obtain new

samples. Usually, this additional sampling will require a limited number of samples to be collected for analysis.

If resampling is required, the resampling will normally be scheduled for within 14 days of discovery for missing analyses; however, if the date of discovery is within 45 days of the next regularly scheduled groundwater sampling event, the resampling may be delayed until the next event. All of the procedures presented in this document will apply, including well purging and sampling. All resampling efforts will follow all applicable documentation guidelines

VI. DOCUMENTATION AND DOCUMENT CONTROL

Management of the documentation package is a critical aspect of the sampling, as it provides assurance that all requirements of the operational permit in relation to facility groundwater sampling and analysis are being followed, as well as providing a complete record of activities prior to and during the event. Documentation shall be processed completely and accurately.

A. SAMPLE CONTAINER CONTROL AND DOCUMENTATION

Quality assurance of the containers used for sampling at the facilities is to assure that they meet the analytical and sampling protocols. The Laboratory shall provide the following information, if requested.

- Date of bottle preparation and analyst preparing the bottles.
- An inventory of the bottles including vendors name, catalog number, lot number, and bottle description.
- Statement by technician preparing bottles as to cleaning protocol used, if applicable. Most bottles are brand new. However, certain bottles will require additional cleaning based on the analytical test methods used.
- Date of shipment to the facility including carrier and handling bill number.
- All the above data shall be kept by the Laboratory Manager, or designee, in a bound notebook which is available, if needed, at the Laboratory.

B. FACILITY PREPAREDNESS

The following information is to be maintained by the Facility Technical Representative to confirm that the facility is ready for the sampling event. The documentation will be maintained with the other sampling documentation and be available for review and a check-off system shall be put in place to confirm that all is ready for the sampling event. Signatures of responsible personnel shall be included.

1. Information includes:

    a. Confirmation of field instrumentation operation including calibration data. If any equipment needs repair or replacement, the Facility Technical Representative shall evaluate and notify the appropriate facility personnel to evaluate the impact of this shortcoming on the scheduled sampling event.

    b. Confirmation that all field analytical standards are ready for use during the pre-event calibration (to be handled in concert with the above) and at the time of the actual sampling event.

c. Confirmation that all required safety equipment shall be available for all team members at the time of the sampling event. If equipment needs to be ordered, the Facility General Manager shall be notified and be given confirmation that the equipment is on order. It will be the Facility General Manager's responsibility to determine if the lack of required safety equipment shall impact the schedule of the sampling event.

d. Confirmation that all the other required sampling equipment has been gathered and is in proper order ready for the sampling event.

e. Confirmation that the bottles have been received from the Laboratory, are in suitable condition, assure that the sealing tape on each cooler is unbroken, and have been received with any necessary paperwork.

C. EQUIPMENT PROBLEMS

If an equipment malfunction occurs such that adequate samples cannot be taken, sampling will cease while the equipment undergoes repair or is replaced. Upon completion of repairs/replacement of equipment, sampling shall immediately resume where terminated. If equipment cannot be repaired or replaced the same day, the remaining samples will be taken using a Teflon bailer, or sampling on the down well will be terminated and the well will be resampled in its entirety upon repair or replacement in accordance with permit condition VII.D.2.e.

D. CERTIFICATION OF COMPLETION

The Facility Technical Representative or assigned team member shall be responsible for seeing that a commentary is written after the conclusion of the event which describes the sampling event, including any problems or variations from the SOP that may have occurred. The Facility General Manager shall be notified when the sampling event is completed and if there were any problems or variances from the SOP.

VII. OBSERVATION WELLS OR MALFUNCTIONING MONITORING WELLS

Observation wells may be included in the monitoring of groundwater, although they are not constructed as monitoring wells and do not have dedicated pumps. These wells shall be managed and monitored as per the established methods and procedures found in the following attachments and appendices of this document. Conversely, wells with dedicated pumps may sometimes need to be sampled with a bailer.

1. Procedures are as follows:

   a. Wells can be sampled with a Teflon bailer rather than dedicated pumps. Each well will normally have its own dedicated bailer or will use a previously cleaned bailer using the steps identified in the procedure describing the cleaning of a contaminated bailer. If the bailer has been cleaned and is to be reused, deionized/distilled water shall be placed in the bailer and an equipment blank shall be collected for VOA and total metals as a minimum. An alternate method is to use a disposable Teflon bailer. A blank can also be collected from the disposable bailer prior to use, but it is not required.

   b. Purging and sampling shall be conducted by carefully lowering the bailer down the well until it fully immerses in fluid and then returning it to the surface. Discard the water into a

waste container, if it is being purged, or into the appropriate sample container, if the well is ready to be sampled. The bailer may be manipulated by hand or a power winch, using a monofilament rope, Teflon coated wire, or single strand stainless steel wire. Extreme care shall be exercised, if a power winch is used, so the coated wireline does not contact any oiled or greased mechanical parts of the winch.

c. During purging and sampling the bailer and associated sampling cord shall not be allowed to touch the ground or any potentially contaminated surface. Should this happen, the bailer and/or cord shall be decontaminated or replaced prior to use.

d. Bailers shall be kept wrapped in clean foil or suitable material and stored in a clean plastic bag, when not in use.

e. If a bailer becomes contaminated, the following procedure shall be used to clean it:

   1) If the bailer is heavily contaminated, the bailer shall be thoroughly washed with a strong laboratory soap such as Alconox or Hexane/Acetone. Hexane/Acetone shall not be used for rinsing. Mechanical action with a cloth or brush may be needed to remove stubborn contamination. Care shall be taken when using mechanical action to avoid scratching the Teflon surface of the bailer.

   2) The bailer shall be thoroughly rinsed with tap water.

   3) The bailer shall then be triple rinsed with deionized/distilled water.

   4) The bailer is allowed to air dry or wiped dry using a clean and dry laboratory grade disposable wipe such as a Kimwipe or equivalent.

   5) After the bailer has dried, it shall be wrapped in clean aluminum foil and placed in a clean plastic bag. It is now ready for use again in the field.

   6) The same cleaning procedures shall be followed for the cord utilized in the activity. As an alternative, the cord may be disposed.

VIII. PUMP REMOVAL, CERTIFICATION AND REPLACEMENT

It may be required from time to time to take pumps out of the system and replace them with new ones. Dedicated pumps shall be removed and placed in a new well only if they can be certified to be clean and operational. A dedicated pump needing maintenance may later be placed back in the same well without the cleaning described below. The following procedures are required to remove the pump and to certify that it is clean and fully operational:

A. PUMP REMOVAL

1. Pumps shall be removed from the old well casing as per the instructions found in Section IV-E. (Total depth measurements)

2. After the pump and tubing have been removed and placed in the plastic bag, it shall be securely packaged in a shipping carton or clean plastic bag and taken to a controlled environment for repair, or it can be sent to the laboratory or manufacturer. The dedicated

pump may be repaired and cleaned at the facility if it will be placed in the well from which it was retrieved.

B. PUMP CLEANING

1. After receipt, the pump will be disassembled according to the manufacturer's instructions and using protective gloves.
2. After disassembly, all parts that contact groundwater will be washed according to the following protocol:
   a. Wash with a strong laboratory soap such as Alconox (preferred) or Hexane/Acetone (however, the use of these solvents should be avoided unless absolutely necessary). These solvents shall not be used for rinsing.
   b. Rinse with tap water.
   c. Triple rinsed with deionized/distilled water.

C. REASSEMBLY

1. The pump shall be carefully reassembled while it is still wet.
2. Clean vinyl (or nitrile or latex) gloves shall be worn from this point forward, whenever the pump is handled.
3. Any parts that appear to be worn shall be replaced with original manufacturer's parts.
4. Tubing shall be washed according to the specifications for the pump or discarded.

D. CERTIFICATION

1. The pump shall be certified to perform according to original manufacturer's specifications by placing the pump in a tub of deionized/distilled water and starting the pump controller. The pump shall meet or exceed the volume flow specification as per the manufacturer. If the pump does not pass, the appropriate parts shall be replaced. The testing shall be repeated until the flow requirements are met or the pump will be discarded.
2. The purchase of new pump(s) meeting the above operational criteria shall be confirmed contaminate free and certified by the manufacturer. Pump(s) shall come shipped in clean packaging so that no surface is exposed.
3. When the operational criteria have been met, the pump shall be certified to be "contamination free" by allowing a minimum of ten gallons of the deionized/distilled water to flow through the tubing and pumping mechanism. After the ten gallons have passed through the pump, a series of samples shall be collected as per the sampling and analysis plan Section V-B. Concurrent with the pump samples, a set of samples from the feed water will also be taken. Certification will occur if all parameters in the pump samples are equal to or less than those of the feed water or show positive parameter values no greater than twice the analytical detection limit of that analyte. The detection limit is generally less than the PQL. Therefore, the above leeway is stated to assure that no residual contamination causes unnecessary additional work. If any

analyses are detected above the established control limits, the pump will be disassembled, and the cleaning process will be repeated.

4. Tubing: To be reused, tubing shall also be certified as above.
5. Packaging: Following the sampling for certification, the pump (and tubing) shall be carefully wrapped in clean aluminum foil. Extreme care in wrapping the tubing and pump parts shall be taken so that no surfaces remain exposed. After wrapping in aluminum foil, the pump shall be placed in a clean plastic bag and held until the completion of the certification analysis.
6. Pump Return: Following acceptable completion of the certification process, the wrapped, bagged pump (and tubing) shall be carefully placed in a shipping carton and sent back to the facility for installation.
7. Installation: The pump shall then be installed in the well casing following the manufacturer's recommendations and following the methods as found in Section IV-E. A minimum of ten liters of well water shall be flushed through the pump before any samples for analysis are taken.

APPENDIX A

IMMISCIBLES

I. Introduction

The technique used to detect immiscibles in a groundwater monitoring system shall be a gross visual method and can be used to evaluate significantly high concentrations (exceeding water solubility limits) of lighter-than and heavier-than-water contaminants in the system. Modern analytical techniques have the potential ability to detect potential immiscible contaminants long before they can be observed through this visual method.

Sampling wells during a well purge cycle (three full well volumes removed or well purged to dryness) can effectively detect both lighter and denser than water immiscibles.

II. Ranges and Types of Immiscibles

There is a broad range of essentially non-water-soluble liquid chemicals. This range of chemicals can be materials as non-toxic as vegetable oil to highly toxic chlorinated solvents. These compounds can range in true solubilities from less than a part per million to percentage ranges. These compounds can come from natural sources such as crude oils, but normally have an anthropogenic source.

A small generic list of lighter and denser compounds is as follows:

Lighter than water (less dense)	
Compound	Solubility at 20^{o} C (distilled water)
Hexane (component of gasoline)	9.5 PPM
Benzene	1780 PPM
Toluene	515 PPM
Xylene	175 PPM
Ethylether	69,000 PPM

Heavier than water (denser)	
Compound	Solubility at 20^{o} C (distilled water)
Chloroform	8,000 PPM
Methylene chloride	20,000 PPM
Tetrachloroethylene	150 PPM
Carbon Tetrachloride	1,160 PPM

III. Problems and Limitations

The primary limitation for the visual evaluation of immiscibles is the need to have the pump screen set so that water can be withdrawn from both the top and the bottom of the water column. The screen shall be set significantly above the bottom of the well, denser immiscibles cannot be observed and if the water column cannot be drawn down faster than the well recharges so that the top of the water column moves into the screened part of the casing less dense immiscibles cannot be detected.

A second problem is the need for visual observation. If very low concentrations of immiscibles are present the ability to detect them separate from the water may be very difficult for the person responsible for this observation.

IV. Alternatives to Immiscible Evaluation

The primary problem with using immiscible analysis for the identification of groundwater contamination is the overall gross aspect of the technique. As seen in the table on the previous page, concentrations will need to be at least five orders of magnitude greater than environmental concern to be detected. Current screening techniques such as TOC (total organic carbon) has a detection limit of approximately one part per million and may be able to detect hydrocarbon contamination long before it can be visually detected. TOX (total organic halides) can detect compounds at a level of 0.01 ppm, a level significantly below any chlorinated compounds solubility. Both techniques may be well suited for general water quality evaluation. Even lower detection limits for target analyses can be achieved by either gas chromatography or mass spectrometry analysis using purge-and-trap concentration technology.

APPENDIX B

GRASSY MOUNTAIN GROUNDWATER SAMPLING FIELD DATA SHEET

(Subject to additions and reformatting without prior notice)

Monitor Well _____Casing Length _____ ft.

Purge

Personnel _____

Date ___ Time ___/____ Apron - Wet/Dry

Dedicated Pump - Y/N Locks - Y/N Tamper - Y/N Odor - Y/N _____

Temp___°F Wind____mph Baro.___millibars General____Time _____

Water Levels: 1. ___ft @___ ft Well Dia.___inch

2.___ft Vol. Mult. (liters only): 2.47 (4 inch) / 0.617 (2 inch)

One Volume = _____ Liters Three Volumes = ____Liters

Actual Purge Vol. = _____Liters Turbidity (NTU) _____

Immiscibles Detected: _____ Y/N

Sample

Personnel _____

Date _____Time ____/_____ Apron - Wet/Dry

Temp____°F Wind____mph Baro._____Millibars General____Time _____

__ __ VOC Flow Rate (ml/min) Turbidity (NTU) _____

__ __ __Immiscibles Detected: _ Y/N

Temp (°C)	pH	Cond

Sp. Cond. Sent to Lab: Y/N

Samples:

Well Check

Change in pumping Rate Y/N (Yes, Check Pump and Trap)

Sand or Silt Y/N (Yes, Check Trap)

Casing Cracked or Broken Y/N (Yes, Notify DEQ/DSHW)

QA/QC Samples:

Sample Splits: